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Willingness to Pay For Environmental Service Functions of Mangrove Forest In Uzere, Delta State, Nigeria

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Abstract
This study was carried out to estimate the value of the environmental service functions of Uzere mangrove forest using the Willingness to pay method. Structured questionnaires were used to obtain information on the willingness to pay (WTP) for environmental service functions of Uzere mangrove forest. Contingent valuation approach was used to elicit information on WTP and the socio-economic variables that influence the WTP. Data were obtained from a systematically sampled 300 residents within the three communities in Uzere. The data were subjected to descriptive statistics, F and student's t-tests, analysis of variance (ANOVA), correlation and multiple regression analyses using Statistical Package for Social Sciences (SPSS 20). The results show that 21.7% of the respondents were willing to pay (WTP) various amounts ranging from ₦50 (US$0.33) - ₦5000 (US$33.33) monthly, ₦50 (US$0.33) being the modal value. The mean monthly WTP value is ₦36.8 (US$0.25). This gave an aggregate estimated value of between ₦147, 835.62 (US$985.57) and ₦681, 097.19 (US$4540.65) (US$1= ₦150) for the environmental service functions of the 2,004.2hectares of Uzere mangrove forest. The semi-log regression equation revealed that the years of residence and occupation are the only socio-economic variables that significantly influenced WTP. The results of this study indicate that the forest is of high value and therefore, there is a need for concerted efforts for sustainable management of the mangrove forest.
Keywords: Willingness to pay (WTP), ecological services, socio-economic factors, mangrove forest, Uzere

Introduction

The Niger Delta Area of Nigeria has an extensive mangrove forest cover, which supports the largest area of mangrove occurrence in Africa (Abere and Ekeke, 2011). Mangrove ecosystems provide a range of non-market as well as marketed goods and services both on and off-site (Frank and Pieter, 1997). Some of these goods and services are sold in markets where they have observable prices, others are not marketed. They may be thought to have little or no value or their market value is difficult to quantify.

Mangrove forests provide a wide range of ecological services like protection of shorelines and riverbanks from erosion, flood regulation, violent storms and hurricanes, maintenance of biodiversity (Patrik, 1999; Mantra, 1986). They play important roles climate change mitigation; and they afford protection for coastal areas from tidal waves, cyclones and are the most carbon-rich forest in the tropics (Cornforth *et al.*, 2013). They support nutrient and organic-matter processing and offer sediment control for other inshore habitats (Giri *et al*., 2011).

Mangroves sequester up to 25.5 million tonnes of carbon per year and contribute more than 10% of essential organic carbon to the world's oceans (Diltmar *et al.*, 2006). Mangroves serve as habitat for commercially valuable marine species (Walters *et al*., 2008). Quarto (2001), in a quarterly report of mangrove action project showed statistically that three-quaters of the tropical world's fisheries depends upon mangrove forest. Mangroves also serve as fish nurseries and breeding grounds for finfish, crabs, shrimps, mollusks, and other sea life. Vast quantities of fallen leaf and branch detritus provide food for countless tiny marine creatures at the bottom of the global ocean food chain. They are also essential habitats for many endangered species such as manatees, dark headed cuckoo, hippopotamus and crocodiles which are found in Uzere. They constitute prime nesting sites for multitudes of shore birds, rare and migratory birds, crab-eating raccoons, proboscis monkeys, fishing cats, and jaguars. Monitor lizards and mudskipper fish also utilise mangrove wetlands as habitat and source of food. Again, Chan (1984) in the study of Human habitation and traditional uses of the mangrove ecosystem reported that mangroves maintain water quality being that they are effective at filtering inshore pollutants and protecting fresh water sources from salt water intrusion.

The full value of mangrove services and products to the local people is not easily recognised, and is, therefore, often neglected in development planning (Frank and Pieter, 1997). As a result, it is often concluded that mangrove forests should be converted to large scale development activities, such as agriculture, aquaculture, salt extraction and infrastructure which generate directly marketable products (Barbier, 1994 and Polidoro *et al*., 2010).

Although the environmental service functions of the mangrove forests are not priced, they are still valuable. Frank and Pieter (1997), stated that economic valuation methods offer a more comprehensive assessment of the many goods and services provided by mangrove ecosystems, and hence may contribute to more informed decision-making. Mather and Chapman (1995), argue that the object of valuation is not the environment itself, but rather the peoples' preferences for changes in the state of their environment, and their preferences for changes in the level of risk to their lives. They opined that importance is measured by preference which in turn is measured by the summation of many individuals' willingness to pay for the environmental services of the forest. Hence, in environmental context, economic valuation measures the preference of people for good environment or against bad environment. In essence the true value of the forest must include not only its productive value as a commodity timber, but also its non-timber use values; which include the indirect use of the forests' environmental service functions and relevant existence values (Ajewole, 2000). Popoola, (1995), observed that appropriate pricing and or valuing of forest will take adequate care of the basic conservation themes which include resources scarcity, ecological balance, quality of life and wasteful and destructive use of the forests.

Mangrove ecosystems are complex, diverse and important (Samina, 1999). Their complexity and importance pertain not only to their role in the biosphere, but also to the broader sphere of human-mangrove interactions. Understanding their environmental and economic values is therefore of great importance in the search for strategies to protect them. Economic valuation methods offer a more comprehensive assessment of the many goods and services provided by mangrove ecosystems, and hence may contribute to more informed decision-making that will help to conserve and sustain the mangroves. Therefore, valuating the environmental service functions of the mangrove forest is essential in order to establish the true value of the forest This will promote the ability of the forest ecosystem to withstand the competition from alternative land uses, particularly agriculture, which is very rampant in the area. Therefore, the main objective of this study is to value the environmental service functions of the Uzere mangrove forest with a view to highlighting its ecological significance; thereby garnering supports for its sustainable management. In order to achieve this, the followings were carried out: assessment of willingness to pay (WTP) for the environmental service functions; investigation of the socio-economic factors that influence WTP for the environmental service functions; and estimation of the value of the environmental service functions of Uzere Mangrove Forest.

Study Area

Uzere Kingdom is in Isoko South Local Government Area of Delta State, Nigeria. It comprises three communities including: Ezede, Uheri and Uweye. The three communities jointly have a projected population of 18,493 based on the 1996 National Population Census. Uzere lies between latitude $5^o\ 33^I$ and $5^o\ 37^I$ North and longitude $6^o\ 20^I$ and $6^o\ 26^I$East, with a total land area of $20.042km^2$. It is a rain forest zone with a minimum and maximum temperature of 21^oc and 35^oC and an average mean temperature of 30^oC and an annual rainfall of 1800-2000mm. The area experiences double peak period of rainfall between June/July and September/October. Figure 1 shows the map of the study area.

The area is flooded yearly from July to October. The water transports the fishes and the aquatic organisms from the mangrove to the creek where they are caught by fishermen. The water is also used by loggers as a means for transporting logs from the mangrove forest to the road side. Harvesting of farm produce is done at this period and the produce is transported from the forest to the road side by boats. The farm produce are harvested before maturity in order to avoid losses to flood. Planting of crops is done when the flood recedes between November and December and harvesting starts with the onset of the flood from July to October. The communities around the forest engage in hunting, artisan fishing and subsistence cultivation of vegetables, cassava, yam and maize. Fishing is done using small nets. Shrimp farming is also practiced and it involves clearing/cutting down the available mangrove forest or aquatic fauna for ponds. Other activities include logging and fuel wood harvesting.

Uzere Mangrove Forest is rich in both flora and fauna. Facultative halophytes which comprise of trees, shrubs, ferns and palm are found in the mangrove forest. Tree species such as *Rhizophora racemos*a, *Rhizophora harrisonii, Rhizophora mangle*, *Avicennia africana, Laganculariа racemosa* and *Conocarpus erectus* are also found in the mangrove forest. The fish species found in Uzere mangrove forest include African catfish (*Clarias gariepinus*), Tilapia fish (*Oreochromis niloticus*), Bonga (*Ethmalosa fimbrata*), Snapper (*Lutjanius spp*), Sole (*Cynoglossus* spp), Shinny nose (*Claria* spp), Ray (*Dasyalis margarite),* Grunter (*Pomadasys* spp). Commercial shrimps and prawns found include Pink shrimp (*Penacus duorarum*), salt water prawns (*Newmatopalaema spp*), crab (*Carcinus maenas*), mudskipper fish (Periophthalmus barbarus) among others. Mammals such as African manatees (*Trichechus senegalensis*), Crocodile (*Crocodylus niloticus*), hippopotamus (*Hippopotamus amphibious*), proboscis monkeys (*Nasalis larvatus*), Alligators (*Alligator mississipensis*), Monitor lizards (*Varanus albigularis*), dark headed cuckoo (*Coracina melanoptera*) and fishing cats (*Prionailurus viverrinus*).

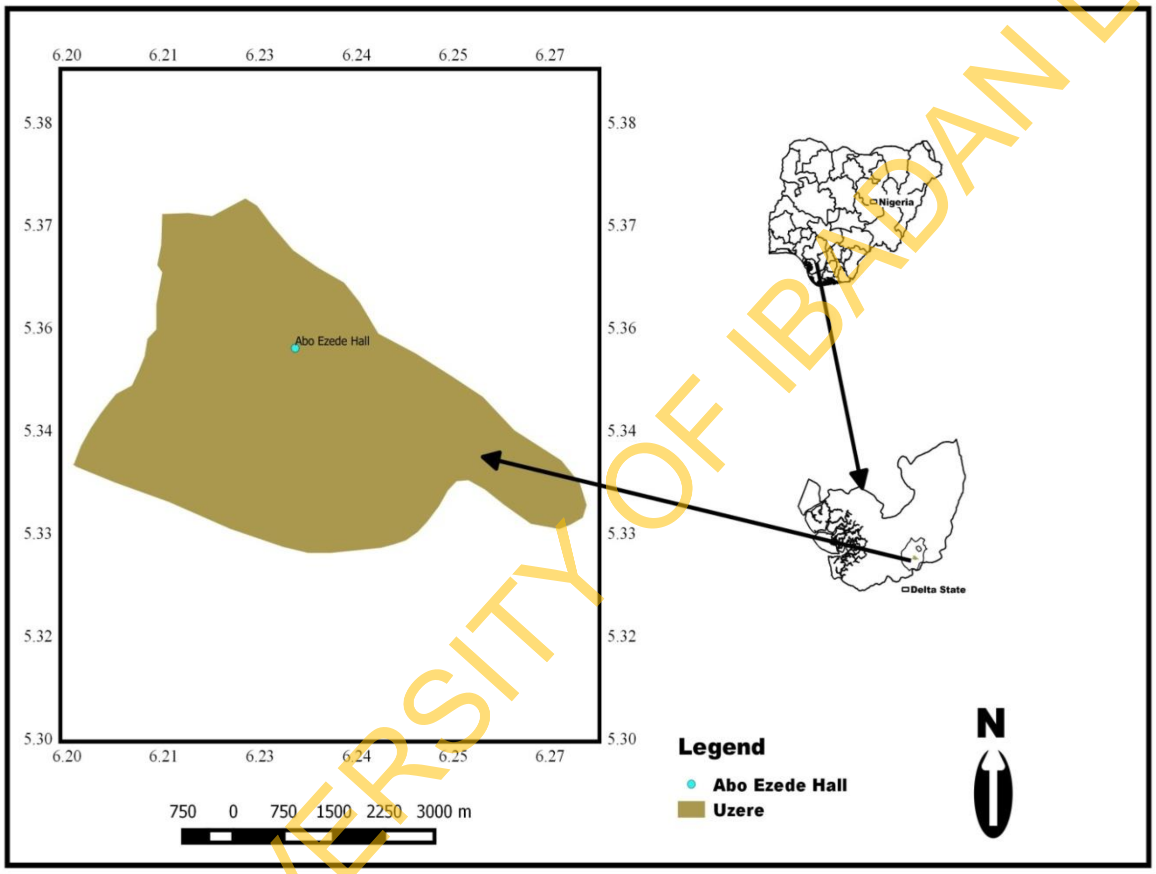

Figure 1: Map of Delta State Showing the Study Area.

Method of Data Collection

Systematic sampling was adopted to collect the primary data. Thus, every 5^{th} household was selected and questionnaires were administered to each of the selected households. Data was obtained using questionnaire survey of 300 residents in the three communities. In addition, Focus Group Discussions were held with the rural populace. The questionnaire was designed to elicit information on respondents' willingness to pay for environmental service functions of mangrove forest in Uzere. Data were also collected on respondents' socio-economic background. The 300 questionnaires were successfully retrieved.

The data obtained was subjected to descriptive statistics, F and student's t- distribution, analysis of variance (ANOVA) as well as correlation and multiple regression analyses
The population of the study area in 2014 was projected from the 1996 National Census figures using the following equation:

$P_x = P_o\,(1+r)^n$ …………………………………………………………………………….. Eqn. (1)
Where, P_x= projected population estimate, P_o= Population of the study area in 1996, r = population growth rate and n= number of years in between.

Ordinary Least Square (OLS) single equation regression model was employed to find the relationship between the elicited WTP values (dependent variable) and the socio-economic factors (independent variables). The model was specified in the general form as:
$W_d = f(X_d..... X_k)$... Eqn .(2)

Where
W_d = individuals' WTP for the environmental service functions of Uzere Mangrove Forest.
X_d= individual's gender, age, marital status, education, origin, years of residence, occupation, household size, income and awareness of the environmental services of the mangrove forest
X_k= 1,2 …. 10. (Being number of parameters considered).

Three functional forms were tried in order to choose the one with the best performance. They are:
Linear: $Y= b_0+ X_1+b_1X_1+b_2X_2+ \ldots + b_nX_n + e$ ………………………...…....... Eqn .. (3)
Semi-log: $WTP = Lnb_0+ b_1LnX_1 + b_2LnX_2 \ldots bnLnXn + e$ .... Eqn . (4)
Double-log: $Ln\ WTP = Lnb_0 + LnX_1 + Lnb_2\ LnX_2 \ldots Lnbn\ LnXn + e$ .... Eqn . . (5)
Where, Y = the dependent or predictor variable
b_0 = constant
$X_1, X_2 \ldots X_n$= the independent or explanatory variables
Ln = natural logarithm
$b_1b_2 \ldots bn$ = regression coefficient for WTP
e = error term

The following criteria were used in choosing the best equation for the regression model:

Coefficient of multiple determination (R^2):
The first criterion that was used in choosing the best equation for the regression model was the magnitude of multiple determination. It is also referred to as the goodness of fit (R^2). The coefficient explains the proportion of the variation in the dependent variables that is jointly explained by the independent variables. The higher the R^2, the greater the percentage of the variation explained by the variables, and the closer R^2 to zero, the worse the fit.

$$R^2 = \frac{RSS}{TSS} \quad \ldots \text{Eqn. (6)}$$

Where, RSS = Regression sum of squares
TSS= Total sum of squares
R^2 is adjusted with its degree of freedom. The adjusted R^2 is expressed as follows:

$$R^2 = 1-(1-R^2)\frac{n-1}{n-k} \quad \ldots \text{Eqn. (7)}$$

Where, R^2= adjusted R^2
n= number of observations in the sample
k= number of parameters or variables

Furthermore, the statistical significance of coefficient of multiple determination (R^2), was tested for with the F-distribution:

$$F_{(k-1)(n-k)} = \frac{R^2/k-1}{(1-R^2)/n-k} \quad \ldots \text{Eqn. (8)}$$

The magnitude of sum of squares of errors:
The magnitude of sum of squares of errors in different regression equations serves as a good criterion for choice of appropriate functional form for the study. The number of parameters used was equal in the equations being compared, and the dependent variables were also defined in the same way (unit of measurements) in the equation. However the independent variable was defined differently. The null hypothesis that the sum of squares of errors in any two equations are statistically equal, if they are found to be statistically different, the equation with the smaller sum of squares of errors was chosen as the better functional form. Thus, the test statistics below was used:

$$d = n/_2 \ \log \frac{\sum e^2_{1t}}{\sum e^2_{2t}} \quad \ldots \text{Eqn. (9)}$$

Where, $\sum e^2_{1t}$ = sum of squares of errors in one equation
$\sum e^2_{2t}$ = sum of squares of errors in another equation
d = satisfies the student t distribution with one degree of freedom
n = sample size

Test for significance of regression equations:
The overall significance of all the regression coefficients was obtained using the F distribution as follows.

$$F= \frac{RSS/k-1}{ESS/n-k} \quad \ldots \text{Eqn. (10)}$$

Where, RSS = Regression sum of squares
ESS = Error sum of squares
k = Number of Parameters
n = Sample size

Standard error test (t-test):
Having established that at least one independent variable contributed significantly to the regression equation, t-test was used to identify which of the independent variables are responsible for the change in the dependent variable as stated below:

$$t\alpha/2, n\text{-}k = \frac{b_k}{SE} \quad \text{Eqn. (11)}$$

Where, $t\alpha/2$ = two tailed significant level or confidence interval
n-k= degree of freedom
b_k = regression coefficients (b_1, b_2……b_9)
SE = standard error

Magnitude of *beta* (β) coefficients:

The Magnitude of *Beta Coefficient* was used to establish the degree of influence of each of the explanatory variables on the dependent variable. *Beta* coefficient is a standardised regression coefficient which measures the typical change in the dependent variable, arising from a typical change in the explanatory variable.

$$\beta_k = \frac{b_k \; Sx_k}{S_w} \quad \text{Eqn. (12)}$$

Where, β_k = *beta* coefficient
b_k = regression coefficient
Sx_k = standard deviation of X_k independent variables
S_w = standard deviation of the dependent variable

Data Presentation and Discussion of Findings

Awareness of the Environmental Service Functions (Non-Market Value) of Uzere Mangrove Forest

From Table 1, the result shows that all the respondents are aware and believe that the mangrove contributes to maintaining biodiversity, protecting the environment and improving soil fertility. Majority of the respondents (59%), believe that the forest maintains biodiversity and protects the environment from climate change, flood and erosion. About 17.3%of the respondents believed the mangrove contributes to environmental protection; 15.7% says it contributes to maintenance of biodiversity, 4.3% response for environmental protection and soil fertility improvement. Also, there was 2% response in support of soil fertility improvement and 1.7% for maintenance of biodiversity, environmental protection and soil fertility improvement.

This suggests that the respondents are appreciative of the environmental service functions of the mangrove forest. This might be due to the high degree of environmental hazards such as annual flooding experienced in the area, air pollution from flared gas, atmospheric heat; and the activities of the forestry extension agents who disseminate information on the importance of the forest/trees. This finding is similar to that of Popoola and Ajewole (2002) in Willingness to pay for rehabilitation of Ibadan urban environment through reforestation projects that. the public support urban reforestation; have high preference for green urban environment and support protection of urban forests in Ibadan, Nigeria.

Table 1: Percentage Distribution of Respondents on the Environmental Services of the Mangrove Forest.

Environmental services	Frequency	Percentage (%)
Maintenance of biodiversity	47	15.7
Maintenance of biodiversity and environmental protection	177	59.0
Maintenance of biodiversity, environmental protection and soil fertility improvement	5	1.7
Environmental protection	52	17.3
Environmental protection and soil fertility improvement	13	4.3
Soil fertility improvement	6	2.0
Total	300	100

Source: Field Survey, 2014

Willingness to Pay (WTP) for the Environmental Services Functions of the Mangrove Forest

Table 2 shows that 21.7% of the respondents are willing to pay for the environmental services function(s) of Uzere Mangrove Forest.

Dixon *et al*. (1994) in a contingent valuation survey carried out in 1991 to get an inference of visitors general perception on WTP user fees for Bonaire Marine Park, reported that 92% agreed that the user fee system is reasonable, and they were willing to pay the proposed rate of $10 per driver per year. Approximately 8% are willing to pay at least $20 per diver per year, yielding an average WTP value of $27.40. Popoola and Ajewole (2002) in willingness to pay for rehabilitation of Ibadan urban environment through reforestation projects recorded 77% as the percentage of respondents that were willing to pay for the environmental services functions of the urban forests in Ibadan with amounts ranging from ₦50- ₦500. Adekunle *et al*. (2006)'s result on WTP for environmental services of forest trees by corporate organizations in Federal University of Agriculture, Abeokuta (FUNAAB) ,Nigeria urban forest also revealed that 77% of the respondents were willing to pay for the environmental services functions of the forest with amounts ranging from ₦5- ₦1000. Adekunle and Agbaje (2011) in public willingness to pay for ecosystem service functions of a peri-urban forest in Abeokuta, Nigeria observed that 46% of the respondents were willing to pay for the environmental services functions of the forest with amounts ranging from ₦100- ₦1000 in the study area.

The percentage of WTP user fees 92% and 8% respectively recorded by Dixon *et al*. (1994), the percentage of respondents willing to pay for the environmental service functions of the forest recorded by Popoola and Ajewole (2002) and Adekunle *et al*. (2006) both 77% respectively and Adekunle and Agbaje (2011) 46% are higher than the 22% recorded in this study. This may be attributed to differences in study locations. Their studies were carried out in urban centers where there are more elites with income above average and who are willing to pay for the environmental service functions of the forest compared to this work which was carried out in rural communities comprising of rural poor with income below average. Though they appreciate the service functions of the mangrove forest, majority are not willing to pay for the service functions of the mangrove forest probably due to their scale of preference and low level of income.

Table 2: Percentage distribution of willingness to pay (WTP) for environmental service functions of the mangrove forest.

	Willing to pay	Not willing to pay	Total
Frequency	65	235	300
Percentage	21.7	78.3	100

Source: Field Survey, 2014

Distribution of Elicited Values of Individuals' WTP for Environmental Service Functions of the Mangrove Forest

From Table 3, it is observed that Uzere residents were willing to pay amounts ranging from ₦50 (US$0.33) - ₦5000 (US$33.33) for the environmental service functions of the mangrove forest. Eleven percent (11%) of the respondents were willing to pay ₦50 (US$0.33) for the environmental service functions of the mangrove forest, 17% were willing to pay ₦100 (US$0.67), 0.7% were willing to pay ₦150 (US$1), 3.7% were willing to pay ₦200 (US$1.33), 0.3% were willing to pay ₦500 (US$3.33) and ₦5000 (US$33.33) respectively.

Table 3: Percentage Distribution of Elicited Values (₦) of WTP for Environmental Service Functions of the Mangrove Forest.

	0	50	100	150	200	500	5000	Total
Frequency	235	33	17	2	11	1	1	300
Percentage (%)	78.3	11.0	5.7	0.7	3.7	0.3	0.3	100

Source: Field Survey, 2014
NOTE: US$1= 150

Comparison of WTP values within each Independent Socio-economic Variable
From Table 4, Binary independent variables were separated and comparisons were made using descriptive statistics and t-tests. The results of analysis of variance of independent variables revealed that the differences in the mean WTP values amongst the five educational level (no formal education, primary, secondary, tertiary and post graduate), four categories of household size (1-5, 6-10, 11-15, 16 and above), thirteen occupation classes (fishing, farming, trading, livestock rearing, fish farming, hunting, carpentry, logging, palm wine taping, civil servant, students, applicants and driving) and years of residence of the respondents are significant at 5% (p = 0.05) while the mean values for gender, origin, age, marital status and income of the respondents are not significant at 5% (p = 0.05) level of significance.

Correlations between Independent Variables
From Table 4, the significant correlations between independent variables and WTP for the environmental service functions of the mangrove forest revealed that gender and environmental services (r = 0.16) have a positive significant relationship, that means gender has influence on awareness of the environmental service functions of the mangrove forest.

There is also a positive significant relationship between household size and awareness of environmental services of the mangrove forest (r = 0.13). Gender and WTP for environmental service functions of the mangrove forest (r = 0.16), marital status and WTP (r = 0.14) have a positive correlation and Years of residence and WTP (r = 0.24) have a positive significant relationship. The longer a person stays in an area the more he/she shows concern for his/her environment and the more he/she is willing to conserve the environment. Occupation and WTP (r = 0.23) also have a positive significant relationship, when a person is employed, he/she is expected to earn income and with this he/she is willing to pay to conserve his/her environment. Education and WTP (r = -0.29) have a negative significant relationship because the more learned a person is, the more he/she is expected to be conscious of his/her surroundings, the resource that make his/her environment conducive for living and be willing to pay to conserve the resource but this is not always the case. Although they are educated but they may not be willing to pay for the environmental service functions of the mangrove forest because they do not derive direct benefit from the mangrove forest.

Table 4: Correlation Matrix for Independent Variables

	Gender	Age	Marriage	Education	Origin	Years of residence	Occupation	Household size	Income	Environmental services	WTP
Gender	1										
Age	0.71	1									
Marriage	0.25	0.58**	1								
Education	-0.27	-0.20**	-0.22**	1							
Origin	-0.04	0.06	-0.01	0.06	1						
Years of residence	0.03	0.46**	0.39*	-0.27**	-0.44**	1					
Occupation	-0.14	0.07	0.07	0.32**	0.03	0.06	1				
Household size	0.17	0.42**	0.29**	-0.10	-0.11	0.13**	0.02	1			
Income	0.10	0.17*	0.09	0.21*	0.10	0.07	0.24**	0.18*	1		
Environmental services	0.16**	-0.11	0.04	-0.03	-0.12	0.09	-0.04	0.13*	0.06		
WTP	0.16**	-0.03	0.14**	-0.29**	0.00	0.24**	0.23**	0.05	-0.05	-0.05	1

Source: Field Survey, 2014

** Correlation is significant at p = 0.01 level
*Correlation is significant at p = 0.05 level

Regression Analysis
From Table 5, all the three forms of single equation ordinary least square regression models employed were significant at (p< 0.05). This implies that at least one of the tested independent socio-economic variables (individual's gender, age, marital status, education, origin, years of residence, occupation, household size and income) has influence on the dependent variable (WTP) in each of the regression equations. However, semi-log function has the best performance having recorded the highest coefficient of determination R^2 (0.27), highest F-value (5.018) and the highest *beta* coefficient (431.478). Hence, it is chosen as the best equation for the regression model. Although this finding is in line with Adekunle *et al.* (2006) which recorded the semi-log function as the model with the best performance for WTP for environmental service of forest trees by cooperate organisations, they recorded higher values for coefficient of determination R^2 (0.953) and F-value (35.97). This may be due to fact that they recorded higher estimated value for the environmental service of forest trees because of the high percentage (77%) of respondents willing to pay for the environmental service of forest trees.

Table 5: Summary of Regression Models' Performance

Criteria	Linear	Semi-log	Double-log
R^2	0.243	0.267	0.243
Adjusted R^2	0.188	0.214	0.188
Standard Error	0.298	0.189	0.130
Beta coefficient	407.867	431.478	0.155
F-calculated	4.429**	5.018**	4.422**
$F_{10, 138}$ tabulated	3.91	3.91	3.91
$F_{10, 138}$ tabulated p= 0.05	2.54	2.54	2.54

**Significant at P= 0.01
*Significant at P= 0.05

The Full Regression Model
From Table 6, the full regression model treated the log of mean elicited WTP values as dependent variable and the log of all socio-economic variables as the independent variable. The coefficient of determination value (R^2) of 0.27 indicates that the independent socio-economic variables account for only 27% of the variation in the dependent variable. Though several independent variables were insignificant in explaining WTP response, the full semi-log regression model has an F-value of 5.018, indicating a significant relationship between independent and dependent variables at P= 0.01. The student's t-test indicates that only two independent socio-economic variables are significant and influence WTP. At 99% level, years of residence has a positive significant influence on WTP. As expected, those whom have stayed long in the study area are likely to be concerned about the environment and appreciate the mangrove forest and its environmental service functions. Likewise, the variable occupation is found to be significant at 99% level, with positive influence on WTP for the environmental service functions of Uzere mangrove. When a person is employed, he/she is expected to earn income and with this he/she is willing to pay to conserve the resource that makes his/her environment conducive for living.

Popoola and Ajewole (2002) in willingness to pay for rehabilitation of Ibadan urban environment through reforestation projects recorded employment and proximity to reserves as the socio-economic variables that influenced WTP for the environmental service functions of forests in Ibadan Metropolis. Adekunle *et al*. (2006) recorded income, sources of income and years of existence as the factors that significantly influence WTP for environmental service of forest trees by cooperate organisations.

Table 6: Summary of the Full Regression Model

Socio-economic Variables	B(Regression Coefficient)	Standard Error	*BETA* Coefficient	t-Calculated
Constant	66.969	18.234		3.673
Log X_1: Gender	22.143	24.699	0.073	0.897
Log X2: Age	-18.195	27.275	-0.063	0.897
Log X3: Marital status	-13.321	31.652	-0.39	-0.421
Log X4: Education	-18.103	22.710	-0.063	-0.797
Log X5: Origin	101.247	54.423	0.153	1.860
Log X6: Years of residence	88.742	16.288	0.452	5.448**
Log X7: Occupation	40.991	10.782	0.297	3.802**
Log X8: Household size	9.645	22.394	-0.035	-0.431
Log X9: Income	5.728	22.420	-0.020	0.255
Log X10 Environmental Service(s) awareness	0.111	16.004	0.001	0.007

R^2 $_{(138, 10)}$ = 0 .27**
**: Significant at p= 0.01

Degree of Independent Variables' Influence on WTP
Though, place of origin of respondents was shown to be statistically insignificant, it was expected that it would have significant influence on WTP. Its insignificance might be due to the fact that people within the study area irrespective of their place of origin benefit from the services of the mangrove forest, therefore, they are willing to pay for the environmental service functions of the mangrove. Gender, age, marital status, education, household size, income and awareness of the environmental service functions of the mangrove forest have no significant influence on WTP to conserve and protect the mangrove forest.

Aggregate Estimate Value of Uzere Mangrove Forest Environmental Service Functions
Multiplying the mean WTP value of ₦36.83 by 4,014 (21.7%) of the total population of Uzere) equals ₦147, 835.62 (US$985.57) being the lower bound of the range of aggregate values that all Uzere residents would pay for the environmental service functions of Uzere Mangrove Forest (U$$I = ₦150). Multiplying the mean WTP value of ₦36.83 by 18,493 (projected population in 2014) equals ₦681,097.19 (US$4,540.65) being the upper bound of the range of aggregate values that all Uzere residents would pay for the environmental service functions of Uzere mangrove forest.

Cooksey and Howard (1995), recorded in a study of WTP to protect forest benefits with conservation easement in New Hampshire, USA, an aggregate WTP value of $228,416- $1,000,000 each year. Also, Kramer *et al*. (1996), in WTP to protect tropical rainforest, employed the combination of both referendum and payment card format (contingent valuation method) estimated a total of $2.2billion and $2.8billion from the two methods. Popoola and Ajewole (2002) in willingness to pay for rehabilitation of Ibadan urban environment through reforestation projects recorded ₦183,468,586 and ₦240,868,294 (US$I=₦100) as the minimum and maximum aggregate value of Ibadan urban forests' environmental service functions. Adekunle *et al*. (2006) in willingness to pay for environmental service of forest trees by cooperate organizations stated ₦7, 800 (US$I=₦140) as the aggregate estimate value for the environmental service functions of the forest. Adekunle and Agbaje (2011) in public willingness to pay for ecosystem service functions of a peri-urban forest in Abeokuta recorded ₦15, 301,245.59 and ₦33, 263,577.38 (US$I=₦140) minimum and maximum values respectively in the study area.

Conclusion
The economic valuation of environmental service functions of natural environment is of great importance. It is essential to place a monetary value on ecological services generated by mangrove forests for the forests to continue to provide goods and services on sustainable basis.

It is revealed from the study that the mangrove forest maintains environmental quality and the Uzere populace are aware and knowledgeable of the worth of the mangrove forest and has revealed in monetary terms the degree of the peoples' concern for the environment, as observed in their willingness to pay specific amounts for the environmental service functions of the mangrove forest. About 22% of the respondents are willing to pay various amounts ranging from ₦50 (US$0.33) - ₦5000 (US$33.33) monthly, ₦50 (US$0.33) being the modal value. The mean monthly WTP value is ₦36.8 (US$0.25), resulting to aggregate estimated value of between ₦147, 835.62 (US$985.57) and ₦681, 097.19

(US$4540.65) (US$1= ₦150) for the environmental service functions of the 2,004.2hectares of Uzere mangrove forest. The semi-log regression equation revealed that the years of residence and occupation are the only socio-economic variables that significantly influenced WTP for the environmental service functions of the mangrove forest in Uzere.

The WTP response can be seen as the values that the rural populace of Uzere place on the environmental service functions of the mangrove forest. It is also observed that the public have reasons for conservation and decision makers can use this in making choices among alternative uses of the mangrove forest land that meet the needs of the populace and as an additional input in assessing the public support for environmental conservation programme. The monetization of the forest benefits in this study can also provide useful information for the allocation of the forest conservation and protection funds.

Finally, The WTP response can be used as a predictor or indicator of future behaviour if conservation or protection fee is initiated. Policy makers and forest managers can also use the information as a guide in assessing public support for conservation of the mangrove forest, or as a measure of unwillingness and displeasure against the conversion of the mangrove forest to other uses and as a supportive argument for the invaluable roles the forests play in maintaining environmental quality.

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