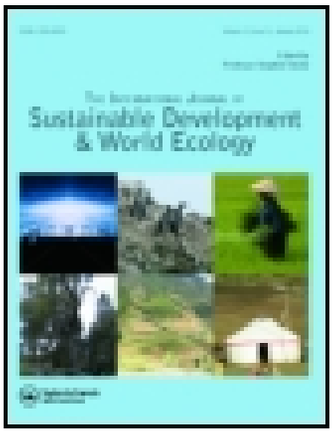

International Journal of Sustainable Development & World Ecology

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/tsdw20

Willingness to pay for rehabilitation of Ibadan urban environment through reforestation projects

Labode Popoola [a] & Ope Ajewole [a]

[a] Department of Forest Resources Management , University of Ibadan , Ibadan, Nigeria

Published online: 11 Oct 2010.

To cite this article: Labode Popoola & Ope Ajewole (2002) Willingness to pay for rehabilitation of Ibadan urban environment through reforestation projects, International Journal of Sustainable Development & World Ecology, 9:3, 256-268, DOI: 10.1080/13504500209470121

To link to this article: http://dx.doi.org/10.1080/13504500209470121

Int. J. Sustain. Dev. World Ecol. **9** (2002) 256–268

Willingness to pay for rehabilitation of Ibadan urban environment through reforestation projects

Labode Popoola and Ope Ajewole

Department of Forest Resources Management, University of Ibadan, Ibadan, Nigeria

Key words: Willingness to pay, environmental rehabilitation, urban environment, reforestation, socio-economic factors, Ibadan

SUMMARY

This study was carried out to determine the estimated value of the environmental service functions of the forests of the Ibadan metropolis. It employed the payment card format – Contingent Valuation approach – to elicit willingness to pay (WTP) for environmental rehabilitation of the Ibadan metropolis through reforestation projects, and to investigate the extent to which socio-economic factors influence the WTP. Data were obtained from a multi-stage randomly sampled 370 residents within the five local government areas of the metropolis. The results show that 77% of the respondents were willing to pay various amounts ranging from ₦50–₦500 monthly, ₦100 being the modal value, having recorded a 52% response. The mean monthly WTP value is ₦161, resulting in an aggregate estimated value of Ibadan urban forests' environmental service functions, ranging between ₦185 468 586 and ₦240 868 294 (US$1 = ₦100). The reduced model of the double log regression equation revealed the respondents' employment status and proximity to the urban forest reserves as the only socio-economic variables that significantly influenced WTP. The differences in the mean WTP values within each independent socio-economic variable were not significant ($p > 0.05$). The results of this study show that there is a need for social valuation of forestry and non-forestry projects that have to do with conversion of forest lands, as a panacea for uncontrolled deforestation.

INTRODUCTION

The nature of the urban environment and the diverse needs of man, place heavy responsibilities on trees and forests as important components of a conducive living urban environment. This makes the role of urban forestry in environmental conservation and rehabilitation crucially important. Trees (forests) by virtue of their anatomical structures and physiological functions serve as natural purifiers of the environment. Also, because of their size, shape, colour and seasonal variations, they become the most visible natural living element that engender serenity and harmony within the urban environment. Forests can equally be used as excellent indicators of the quality of urban environment, since they integrate both positive and negative factors to present a defined urban physiognomy. To say then that the quality of life in an urban area is

Correspondence: L. Popoola, Department of Forest Resources and Management, University of Ibadan, Ibadan, Nigeria. e-mail: labopopoola@skannet.com

greatly influenced by the amount and quality of green spaces or forests within or close to it cannot be an overstatement.

Many of the environmental functions of forests are well documented in literature. These include: enhancement of watershed management, maintenance of soil fertility and stabilization, mitigation of global warming, reduction in air pollution and improvement of microclimate (Ogigirigi, 1986; Olembo and de Rham, 1987; Mbakwe, 1992; Laverne and Lewis, 1996; Freer-Smith and Broadmeadow, 1996; Gusmailina, 1996; Mcpherson *et al.*, 1997; Xie *et al.*, 1998). However, the role of economics and of economic analysis in the use and management of these environ-mental resources has been a subject of great controversy. In this regard, the public good nature of these environmental resources as often typified by their 'non-excludability' and 'non-rivalry' characteristics, has inadvertently resulted in the failure of the market to fully reflect their social and environmental values. Lack of adequate data on production functions, lack of adequate agreement on 'value trade-off criteria' against which values have to be measured, and lack of resources to apply many of the time consuming and complex methods developed, have also been reported as the origin of these inadequate valuation problems (FAO, 1995). Furthermore, individuals' environmental attitudes have also been identified by Mather and Chapman (1995) as being significantly contributory to these improper valuation problems. In this case, the biocentrists/ecocentrists believe that nature has an intrinsic value which is independent of human needs and wishes, and which therefore, cannot be meaningfully expressed in economic terms. Obviously, the forests as major environmental resources suffer greatly from these problems. Hence, Popoola (1995) considered the rich biodiversity of the tropical forests which subsequently elicits different value systems being ascribed to one single resource by different people within and between communities adjoining such forests as a serious limitation on proper valuation of any particular forest resources.

Nevertheless, Barbier *et al.* (1992) and Mather and Chapman (1995), reported the evolution of some economic techniques that have the potential to overcome some of these difficulties. These include: environmental accounting, environmental cost–benefit analysis and discounting the future. Useful as these techniques are in solving part of these inadequate valuation problems, they all suffer one major setback, in that none of them can be used to ascribe monetary values to resources (such as the social and environmental service functions of the forests) for which there is no market or which have intrinsic values. Monetization of forests' environmental services plays a major role in the sustainable management of forest resources, in particular, and in environmental management in general. Since it increases the available knowledge about the broad range of values (direct use values, indirect use values, option use values, bequest use values and existence values) associated with forests, it provides decision makers with useful information for making choices among alternative uses of the forests' land and land that meet the needs of various user groups. It also reveals in monetary terms the degree of peoples' concern for their environment, as observed in the estimation of their WTP functions, and since everyone who is involved in policy formulation as well as in management and uses of the forest is favourably disposed and readily used to the meaning of gains and losses expressed in money terms, such 'estimate values' if sufficiently large can then offer supportive argument for the invaluable roles the forests play in maintaining environmental quality. (Pearce *et al.*, 1989).

Monetization of forest environmental benefits can also provide useful information for the allocation of environmental protection funds, since it enhances comparison with other benefits that can arise from alternative use of funds expended on environmental rehabilitating projects, as well as making comparison between competitive and disparate goods and services of the forest possible.

THE STUDY AREA

Ibadan, the capital of Oyo State, is in the southwestern part of Nigeria. The metropolis comprising five Local Government Areas, namely, Ibadan North, Ibadan Northwest, Ibadan Northeast, Ibadan Southwest and Ibadan

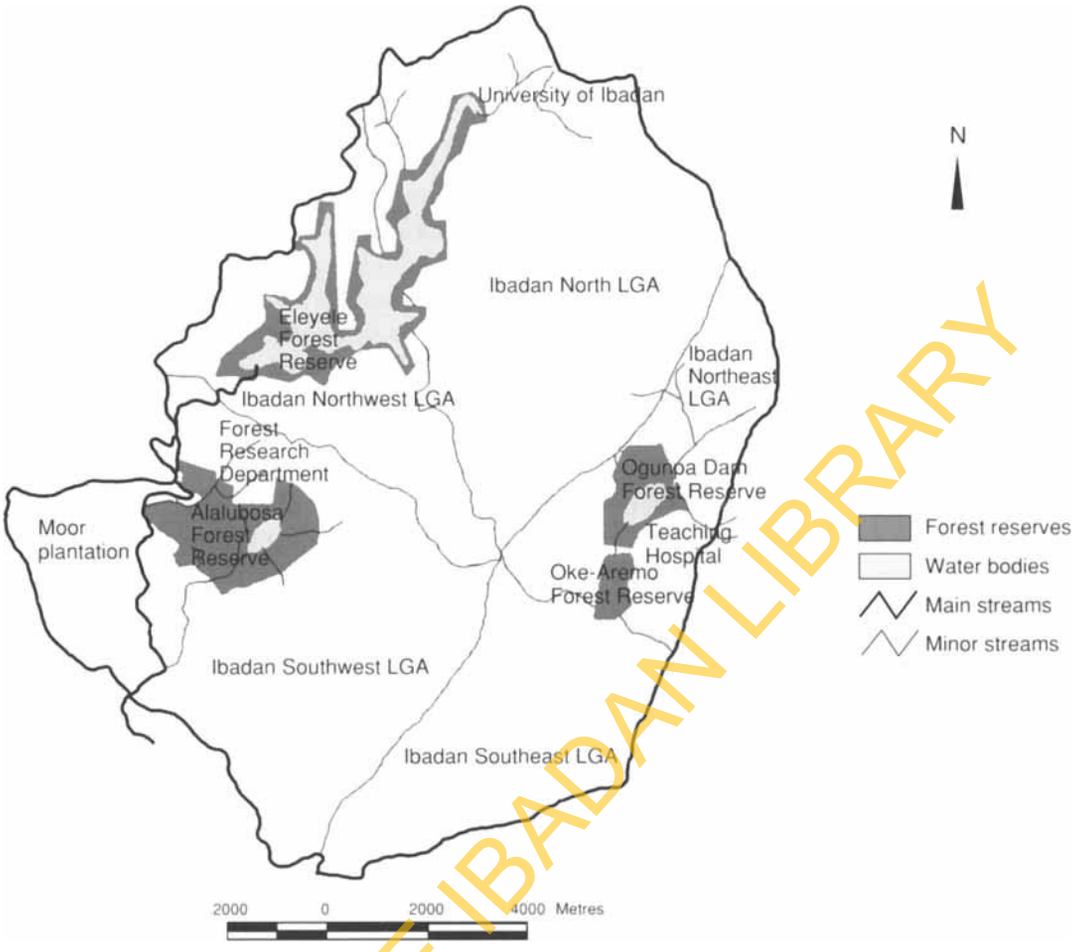

Figure 1 Map of Ibadan Metropolis showing the five local Government Areas (LGAs) and the Forest Reserves

Southeast, has a population of 1 228 663 from the 1991 National Population Census, and a projected estimate population of 1 497 844 for 1998. Ibadan is located on longitude 3° 54'E and latitude 7° 23'N, with total land area of 130 km^2. It is 750 m above sea level (asl) and has two distinctive seasons: the rainy season being from March to October, while the dry season runs through November to February.

Ibadan metropolis was blessed with four forest reserves, namely Oke-Aremo, Ogunpa Dam, Eleyele and Alalubosa reserves which served various needs of the people and provided watershed protection for the Ogunpa dam, Alalubosa lake and Eleyele dam.

However, Alalubosa forest reserve was destroyed and converted to residential quarters and 'Alesinloye' market in the early 1990s, while the remaining three reserves are presently under various degrees of degradation. As a result of the environmental sensitivity of the topographical locations of these reserves, catastrophic environmental hazards like siltation of lakes and ponds, large-scale erosion and massive flooding have been partly associated with the destruction of these urban forest reserves. (Oguntala, 1993). Figure 1 shows the locations of these reserves within the metropolis.

Oke Aremo and Ogunpa dam forest reserves are grouped together under one working plan by the Oyo State Forestry Department. They are located on a range of hills running north–south through the middle of the town. Oke Aremo is situated on Aremo hill, while Ogunpa is on the top of the eastern slopes of the Tank hill. These two hills are divided by a gap made by the Ogunpa stream. Ogunpa dam forest reserve, with an area of 81.27 ha, was constituted in 1931 to protect the reservoir catchment area of Ogunpa dam. It was declared a game reserve in 1952. While Oke-

Aremo forest reserve was constituted in 1935 over an area of 57.67 ha to serve as a source of fuelwood and poles for the inhabitants of Ibadan (Alison, 1956). Similarly Eleleye forest reserve was constituted in 1956, over an area of 325.2 ha. Situated at about 4.6 km from the centre of the city in the northwest of Ibadan, it occupies the land bordering the Ibadan major reservoir, thereby protecting the Eleyele dam, as well as providing fuelwood and building poles for Ibadan residents (Lamb, 1941). Similarly, Alalubosa forest reserve, which was situated adjacent to the railway station in the western outskirts of Ibadan, was constituted in 1916 over an area of 308.53 ha to protect the water catchment area of Alalubosa lake which formed the former railway reservoir. It was considered for amenity value in 1929 (William, 1932), and eventually became a popular resort for public holidays, especially on Easter Mondays.

Today, substantial portions of these urban forest reserves have given way to urbanization pressure. Apart from Agodi gardens which is still under protection, what is left of Ogunpa dam and Oke Aremo reserves, are just small remnants of degraded forests. Also, not less than 40% of Eleyele forest reserve has been dereserved.

CONCEPTUAL FRAMEWORK AND PREVIOUS WORK

Willingness to pay (WTP) for particular goods and services is a technique employed under the Contingent Valuation Method (CVM), to elicit monetary value for conventionally non-priced goods and services (Ajewole, 2000). In situations where markets for environmental goods and services do not exist or are not well developed, or where there are no alternative markets or market prices that can be satisfactorily used as proxies or direct measures of value, it may not be possible to value environmental effects or services of a particular project or resource, by using the direct or indirect market pricing techniques. In such instances it is possible to question people directly about how they would react to a given situation and, based on their answers, the value of a good or service to each person can be determined and then extrapolated to determine the aggregate value of the goods or services under consideration.

This valuation can be achieved by the use of surveys, designed to estimate the respondents' willingness to pay for particular goods and services. Pearce *et al.* (1989) described CVM as a method that uses a direct approach in asking the people what they are willing to pay for a benefit or what they are willing to accept as a way of compensation to tolerate a cost. Portney (1994) described CVM as a method that involves the use of sample surveys to elicit the willingness of respondents to pay for generally hypothetical projects or programmes. Furthermore, Cooksey and Howard (1995) described CVM as a method that uses survey questions to elicit people's preferences for environmental benefits by means of a hypothetical market. Bowers (1997) considered CVM as the most widely used method for obtaining monetary values of environmental problems, while Loomis (1996) reaffirmed it as the only method generally recognised as being able to capture the general public's total WTP for forest preservation. The CVM approach requires postulating a change in environmental attributes such that it is believable to the individual, and accurately depicts a potential change. This change must be fully understandable to him/her, in at least most, if not all, of its ramifications. The individual must also believe that the change might occur and that his contingent value or behavioural changes will affect both the possibility and magnitude of change in the environmental attribute or quality. Standard Contingent Valuation (CV) survey must contain well defined elements encompassing:

(1) Description of policy impacts which gives the respondents information about the issues at hand;

(2) The payment vehicle which is the means by which the costs or savings arising from a policy are passed to the affected members of the public;

(3) The method of provision or the way in which the policy change is implemented;

(4) Elicitation of information on socio-economic characteristics of the respondents; and

(5) Value elicitation procedure (Hoehn, 1992; Hanemann, 1994). Methods of eliciting values in CV survey include Bidding games

(single and iterative), Referendum format or Dichotomous choice, Trade-off games, Costless choice, Delphi technique and Payment card format (Dixon *et al.*, 1994; Kramer *et al.*, 1996). Payment Card Format CVM involves each respondent being presented an array of different amounts, starting with zero, and asked to circle the amount closest to his or her WTP value. Mean WTP value is then calculated from simple average of the circled amounts.

Because CVM does not analyse actual behaviour, some have argued about its accuracy in simulating the conditions of the real world. Hence Schulze *et al.* (1981), Pearce *et al.* (1989), Dixon and Sherman (1991), Dixon *et al.* (1994) and Bowers (1997) identified major sources of bias as information, instrument or payment vehicle, hypothetical, strategic and starting point bias. These limitations notwithstanding, CVM still has major advantages over the indirect methods that employ market transactions. Properly conducted surveys can often provide estimates of value that cannot be obtained by other means (Dixon *et al.*, 1994). It also offers a way to trace the demand curve for a public good that could not otherwise be gleaned from market data. More so that indirect methods using market transaction cannot always be counted upon to provide complete measures of the non-market use value which CVM can capture. More importantly, CVM can be the only way to ascertain how the public values something (Hanemann, 1994).

The CVM may also at times be the best way to measure the effects of changes to the environment on social welfare, and it can also be useful in validating estimates of consumer surplus obtained by more conventional methods (Dixon *et al.*, 1994). Moreover, CVM possesses a highly flexible framework for the valuation of almost all environmental benefits, being universally applicable for the valuation of the various environmental services of the forest and being easily adaptable for use in developing countries. This corroborates Chokor and Obadan's (1991) suggestion of the use of CVM to establish cost of environmental damage in Nigeria, due to inadequacy of data on socio-economic and environmental characteristics that might be needed by other techniques in sufficient quantity. Hanemann (1994) recommended that, in order to avoid or minimise problems associated with bias in CVM studies, description of hypothetical situations must be as specific as possible, with the alternative being clearly outlined. Enough information must be given to allow the respondent to visualise the alternatives without undue effort.

The CVM has been employed at various levels for the preservation and management of natural and environmental resources. Lockwood *et al.* (1993), in estimating the value of planning public forest lands off limits to logging in national parks, recorded a median WTP value of $52 per household through a dichotomous choice CVM, to preserve about 100 000 ha of old growth wet and dry *Eucalyptus* forests on Errinundra Plateau in Victoria and in New South Wales, Australia. Also, Cooksey and Howard (1995), in a study of WTP to protect forest benefits with conservation easement, recorded a mean WTP value of $31.23 annually and an aggregate WTP value of all Coos County (New Hampshire, USA) residents of $228 416–$1 000 000 each year. Similarly, Kramer *et al.* (1996), in their study of WTP to protect tropical rainforest, employed the combination of both referendum and payment card format CVM, to obtain close WTP estimates of $24 and $31 per household, respectively, giving rise to a total of $2.2 billion and $2.8 billion from the two methods. Kramer and Mercer (1997) also employed CVM to assess the value that US residents place on tropical rainforest protection. They discovered that respondents were prepared to make a one-time payment of between $21 and $31 per household to protect an additional 5% of tropical forest. Echeverria *et al.* (1995), working on the prevention of Agricultural Conversion of the Montverde Nature preserve estimated mean one-time WTP of $137 for residents and $118 for foreigners to help protect the preserve.

Moreover, CVM has also been used in some instances to investigate ways in which the policy and management of parks can be improved. Dixon *et al.* (1994), in a contingent valuation survey conducted in 1991 to get an inference of visitors general perception of and WTP user fees for the Bonaire Marine Park, realised that 92% agreed that the user fee system is reasonable, and that they would be willing to pay the proposed rate of $10 per diver per year. Approximately 80% said that they would be

willing to pay at least $20 per diver per year, yielding an average WTP value of $27.40. This survey encouraged the management of the park to set an additional fee that captured part of the WTP. In another study to determine appropriate entrance fees to Poas and Manual Antonio parks of Costa Rica, Schultz *et al.* (1998) found that both the foreign and resident visitors to the parks have been grossly undercharged. Mean WTP values of $11 and $13, an amount representing nearly 900% of the actual entrance fees charged to Costa Rica residents, were recorded for future visits to hypothetically improved Poas Volcano national park and Manual Antonio, respectively. In the case of foreign visitors, a mean WTP value of $23 or 80% higher than the current fee charged were equally recorded for Poas and Manual Antonio. These results revealed an excessive consumer surplus, indicating that improved infrastructure and services in the parks could very likely bring about increased revenues through increased charged entrance fees.

DATA COLLECTION AND ANALYSIS

Data and sampling procedure

The data used in this study were obtained between July–December, 1998, from a questionnaire survey of 400 residents of the Ibadan metropolis, using the payment card format contingent valuation method. The questionnaire which was designed in line with Hoehn (1992) and Hanemann (1994) elicited the respondents' willingness to pay for reforestation of the Ibadan metropolis and its degraded forest reserves. It also collected data on respondents', socio-economic background. In all, 382 questionnaires were successfully retrieved, of which 12 were discarded for inconsistency, leaving 370 (92.5%) that were used for the analysis. Multi-stage random sampling was adopted to collect the primary data needed. The metropolis was thus stratified into two zones: (i) neighbourhood; comprising the inhabitants that live within 1-km radius of adjoining areas surrounding the urban forest reserves, and (ii) non-neighbourhood which, on the other hand, comprised inhabitants living outside 1-km radius of the adjoining areas surrounding the forest reserves, but within the five local government areas that make up the metropolis.

Zone 1 was further stratified into four cells, each cell in this case comprising residents living within 1-km radius of adjoining areas surrounding the four studied urban forest reserves, namely Ogunpa dam, Oke Aremo, Eleyele and Alalubosa sites. While zone II was further stratified to five cells, each cell in this case comprised the residents living outside 1-km radius of the adjoining areas surrounding the urban forest reserves, but within the five local government areas that constitute the metropolis, namely: Ibadan Northwest, Ibadan Northeast, Ibadan North, Ibadan Southwest and Ibadan Southeast. Names of major streets in each of the nine cells were collected from the metropolitan planning authority. Using a table of random numbers, two streets were picked from each of the nine cells.

Thereafter, through purposive sampling, 25 respondents were surveyed from each of the selected streets in each of the four cells in the neighbourhood zone (1) while 20 respondents were surveyed from each of the selected streets in each of the five cells in the non-neighbourhood zone (ii). This gave rise to 200 respondents, each from both the forests' neighbourhood and non-neighbourhood zones.

Analytical techniques

The data were subjected to descriptive statistics, Student's *t* test, analysis of variance (ANOVA) as well as correlation and multiple regression analyses.

The Model

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 vanables). The model was specified in the general form as:

$$W_d = f(X_d \ldots X_k) \quad (1)$$

Where

W_d = individuals' WTP for urban environment rehabilitation

X_d = Individual's income, age, level of formal education, household size, duration of residence in the study area, environmental awareness, gender, marital status, residence proximity to forest reserves, employment status, town of origin and prior knowledge of forest reserve existence.

X_k = 1, 2, ... 12, (being number of parameters considered).

Three functional forms were tried in order to choose the one with best performance, viz:

Linear: $W_d = b_o + b_1X_1 + b_2X_2 + ... B_{12}X_{12} + Ed$ (2)

Semi log: $W_d = Lnb_o + b_1LnX_1 + b_2LnX_2 + ... B_{12}LnX_{12} + LnEd$ (3)

Double-log: $LnW_d = Lnb_o + b_1LnX_1 + b_2LnX_2 + ... B_{12}LnX_{12} + LnEd$ (4)

Where b_o = constant
$b_1, b_2 ... b_{12}$ = regression coefficient
Ed = residual or error term
Ln = natural logarithm

RESULTS AND DISCUSSION

Percentage distribution of elicited values of WTP

Our investigation found that 77.3% of the respondents are willing to pay or, in other words, willing to make a financial contribution to the Ibadan reforestation project (Figure 2). These values from both the forest reserves' neighbours and non-neighbours follow a similar trend, with ₦100 being the modal value in both classes, having recorded 46% and 60.3%, respectively. However, a greater proportion (88%) of the forests' neighbours are willing to pay, compared to the 64.7% recorded for the non-neighbours. Moreover, a greater percentage (31.7%) of the neighbours are also willing to pay higher values ranging from ₦300–₦500, compared to 13.2% of the reserves' non-neighbours. The above trend suggests that the forest neighbours show greater interest in the reforestation of the metropolis and in the rehabilitation and preservation of its degraded forests. Furthermore, 52% of the pooled respondents are willing to pay ₦100; 21% would contribute ₦200, and 12% would pay ₦500, subsequently making ₦100 to be the pooled modal value. The pooled mean elicited WTP value is ₦161.

The high modal WTP value of ₦100 compared to the smaller WTP value option such as ₦50, available in the payment card, as well as the 77% of the respondents that were willing to pay a specific amount for urban reforestation of the study area are noteworthy. These are indications of public support for urban reforestation, and also high preference for green urban environment. Decision makers and forest managers can use these observations as additional input in assessing public support for environmental conservation and rehabilitation through a reforestation programme, or in assessing their support for protection of the urban forests of Ibadan. These WTP responses can also be a reliable indicator or predictor of future

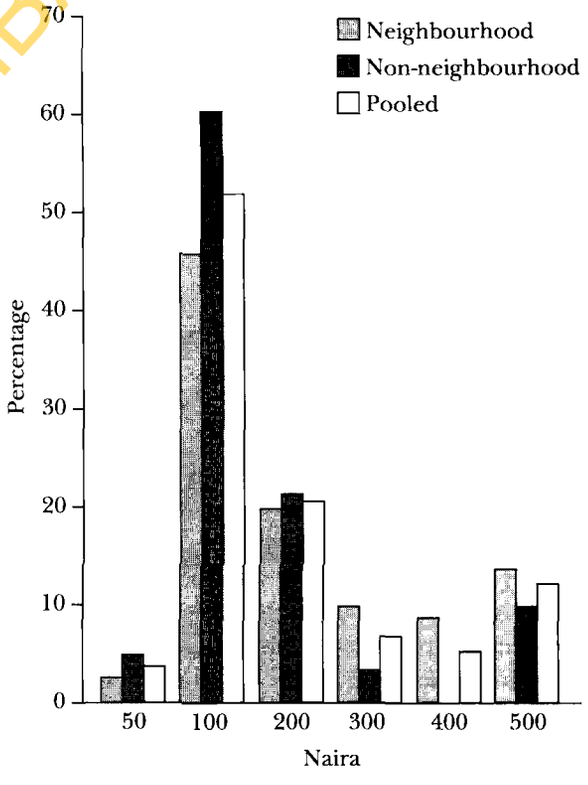

Figure 2 Percentage distribution of elicited values of WTP for environment rehabilitating reforestation project US$1.00 = ₦100.00

behaviour if a protection or conservation fund were actually initiated.

Aggregation of WTP values

Multiplying the mean WTP value of ₦161 by 1 153 340 (77% of the total population of Ibadan metropolis) equals ₦185 687 740 being the lower bound of the range of aggregate values that all Ibadan metropolitan residents would pay to reforest the metropolis (US $1 = ₦100). Multiplying the mean WTP value by the total number of people in the metropolis: 1 497 844 (projected to 1998, from 1991 census) equals ₦241 152 880, being the upper bound of the range. Mather and Chapman (1995) submitted that the object of valuation is not the environment *per se*, but rather the peoples' preference for changes in the state of their environment, and their preferences for changes in the level of risk to their lives. Hence, importance is measured by preference, which in turn is measured by the summation of many individuals' willingness to pay. Therefore, in the environmental context, economic valuation measures the preference of people for environmental good or against environmental bad. Nonetheless, this range of amount can be thought of as a revolving fund that will be used for the greening of Ibadan metropolitan environments. Further, investigations concerning who should handle such funds and projects revealed that the Department of Forest Resources Management, University of Ibadan, and environmental Non-Governmental Organisations (ENGOs) are most favoured among the respondents, recording close scores of 33% and 31%, respectively. Reasons for this preference are basically premised on the technical know-how, professional competence and public trust for credibility and good accountability, in the handling of such funds.

Even though, 21% of the respondents favoured government handling of such funds and projects on the premise that government is already used to and in fact most suitable to handle public fund and projects, yet a substantially greater proportion of the respondents are quite sceptical about government's competence in handling such projects. Bureaucratic bottlenecks, none or bad accountability and fund misappropriation or mismanagement on the part of government were cited as possible potential dangers to such a laudable project if handled by the government.

Dependent variable

The dependent variable comprised the various elicited amounts that the residents are willing to pay for the reforestation of Ibadan urban environment. In all, 282 (77%) respondents were willing to pay various values ranging from ₦50–₦500 monthly for this project.

Comparison of WTP values within each independent socio-economic variable

Binary independent variables were separated and comparisons were made using descriptive statistics and *t*-tests. The variables were specified as follows: gender indicates yes for male respondents, marriage indicates yes for married respondents, native indicates yes for indigenes of Ibadan, employment indicates yes for employed respondents, and prior knowledge indicates yes for respondents that have prior knowledge of the existence of forest reserves within the metropolis. The mean elicited WTP value for 'yes' responses were not significantly different ($p > 0.05$) from the mean elicited WTP values for 'no' responses. Even though almost all of them, with the exception of gender, manifest conspicuous visible differences. Also, the results of analysis of variance (ANOVA) of non-binary independent socio-economic variables revealed that the differences in the mean WTP values amongst the four educational level classes (primary, secondary, tertiary and post graduate), six age bracket classes (15–24, 25–34, 35–44, 45–54, 55–64, 65 and above) and three-monthly income levels (low: ₦1000–₦10 000, ₦10 001–₦20 000, above ₦20 000) were not significant.

Correlations between independent variables

The significant correlations between independent variables were between age and employment, age and marital status, age and period of residence in the study area, age and prior

knowledge of forest reserves existence in the study area, age and household size, income and employment, marriage and employment, educational level and environmental awareness, town of origin and period of residence, as well as prior knowledge of forest reserves existence and period of residence (Table 1). All of these relationships are expected and intuitive. However, the correlation of respondents' income and years of formal education ($r = 0.29$), although it is reasonably expected, is not always the case. The negative relationship between-household size and age ($r = -0.108$) is equally intuitive because at older age, the household size becomes smaller, since most of the children and other dependants would have gone to school or left home to settle on their own.

Regression analysis

All of the three functional forms of tested regression equations were significant ($p < 0.05$). This implies that at least one of the tested independent socio-economic variables has influence on the dependent variable (WTP) in each of the regression equations.

However, the double log function, was chosen as the best equation for the regression model. It has the highest coefficient of determination ($R^2 = 0.27$), minimum standard error (0.6884) and highest F value (5.758).

The full model

The full regression model treats the log of mean elicited WTP values as the dependent variable and the log of all socio-economic variables as independent variables. Although several independent variables were not significant in explaining the WTP response (Table 2), the full regression model has a F value of 5.758, indicating a highly significant relationship between dependent and independent variables ($p < 0.01$). The Student's t-test indicates that only two independent socio-economic variables influence WTP values. Thus, employment status and residents' proximity to forest reserves are both highly significant ($p < 0.01$) and have positive influence on WTP for the environment rehabilitating reforestation project in Ibadan metropolis. 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.

Degree of influence of independent variables on WTP

Even though income was shown to be insignificant as a socio-economic variable, it was highly expected that it would have a significant influence on WTP. Its insignificance might, however, be due to the fact that many people in the sample population have low incomes. Hence, when confronted with resource allocation decisions, they may choose to fund more urgent and basic needs, rather than paying for what may be seen as public good. Furthermore, factors like prior knowledge of the existence of forest reserves, environmental awareness, town of origin and educational level are also expected to have significant influence on WTP for environmental rehabilitation. However, their insignificance is consistent with the findings of Cooksey and Howard (1995).

SUMMARY

This study has succeeded in establishing the preference of Ibadan inhabitants for a green environment, through the elicitation of their WTP for reforestation of the metropolis and its degraded forest reserves. Not less than 77% of the respondents expressed their WTP various amounts for this project, out of which 52% are willing to pay ₦100; which represents the modal WTP value, while ₦161 was found to be the mean WTP value. The Department of Forest Resources Management, University of Ibadan and Environmental Non-Governmental-Organisations (ENGOs) were most favoured to handle this reforestation project, with 33% and 31% response in favour of each, respectively. The sampled males and females were willing to pay an average of ₦188 and ₦182, respectively, while the married respondents were willing to pay an average of ₦261, compared to the singles who were willing to pay ₦174 on average. The surveyed indigenes were also willing to pay an average of ₦195, as against the non-indigenes

Table 1 Correlation matrix for the independent variables

		Gender	*Age*	*Employment*	*Income*	*Marriage*	*Household*	*Education*	*Town*	*Residence period*	*Knowledge*	*Environmental awareness*	*Proximity*
X_1	Gender	1											
X_2	Age	–0.07	1										
X_3	Employment	0.03	0.14**	1									
X_4	Income	–0.05	0.32**	0.31**									
X_5	Marriage	–0.15**	0.71**	0.35**	0.39**	1							
X_6	Household	0.03	–0.11*	–0.18**	–0.13*	–0.16**	1						
X_7	Education	0.03	0.06	0.16**	0.27**	0.11*	–0.16**	1					
X_8	Town	0.02	–0.06	–0.10	–0.08	–0.1	0.08	–0.07	1				
X_9	Residence period	–0.05	0.47**	–0.01	0.06	0.31**	0.03	0.10**	0.29**	1			
X_{10}	Knowledge	0.02	0.12**	0.08	–0.08	0.08	0.03	0.07	0.03	0.21**	1		
X_{11}	Environmental awareness	–0.08	–0.69	0.02	–0.11	0.04	0.12*	0.01	0.02	–0.04	0.12**	1	
X_{12}	Proximity	0.05	–0.20**	–0.20**	–0.35**	–0.15**	0.17**	–0.27**	0.00	–0.16**	0.05	–0.07	1

**Significant ($p < 0.01$)
*Significant ($p < 0.05$)

Table 2 Summary of the full regression model

Socio-economic variables	*B (regression coefficients)*	*Standard error*	*BETA coefficients*	*Calculated t*
Constant	1.214	0.881		1.379
Proximity to forest reserve	0.670	0.126	0.429	5.315**
Employment	0.538	0.167	0.301	3.232**
Income	–0.108	0.067	–0.177	–1.616
Prior knowledge	0.349	0.188	0.125	1.855
Environmental awareness	–0.277	0.161	0.123	–1.728
Town of origin	0.117	0.112	0.072	1.042
Marital status	–0.105	0.162	0.067	–0.651
Educational level	0.164	0.336	0.033	0.489
Gender	–1.9E-02	0.106	0.012	–0.178
Age	5.6E-02	0.646	0.010	0.087
Household size	1.9E-02	0.289	0.005	0.065
Period of residence	5.3E-03	0.164	0.002	0.033

Tabulated t 2.326
R^2: 0.27
** significant at $p < 0.01$

who were willing to pay an average of ₦180. Furthermore the employed respondents were willing to pay ₦169 on average while the unemployed were willing to pay ₦139. Respondents who had primary, secondary, tertiary and post-graduate education were willing to pay N152, ₦178, ₦209 and ₦143, respectively. Low, medium and high income earners in the study area were equally willing to pay ₦188, ₦128 and ₦225 respectively. Also respondents within the age bracket classes: 15–24, 25–34, 35–44, 45–54, 55–64, 65 and above, were willing to pay an average of ₦199, ₦164, ₦218, ₦213, ₦183 and ₦150, respectively. However, there is no significant differences in the mean WTP values ($p > 0.05$) within any of these socio-economic variables. Interestingly, regression analysis revealed that respondents' employment status, and their residence proximity to at least one of the forest reserves, have highly significant influence ($p < 0.01$) on the amount the respondents are willing to pay for this reforestation project.

CONCLUSION

The need to place proper values on the services provided by the natural environment cannot be over emphasized. Total economic valuation of forest resources will no doubt take adequate care of the basic conservation themes which include resource scarcity, ecological balance, quality of life and wasteful and destructive use of our forests. Almost all resource problems can be traced to discrepancies between private and social valuation of resource commodities and resource stocks. Rapid deforestation and slow reforestation, even in a securely-owned forest land, is partly due to the failure of the market to price forest products to capture the externalities and indirect use value of the forests' non-market environmental services such as watershed and wildlife protection, etc. Hence, the over-exploitation, inefficient utilization, inadequate conservation and lack of investment in regeneration of natural resources can be attributed to under-valuation of resources, arising from failure of either the market or the government to efficiently price natural resources according to their social scarcity.

The social value of the urban forests of Ibadan, exceeds by far the value that government officials who canvassed and spear-headed the degradation and conversion placed on these forests. Such officials could only consider the short-term benefits of forests conversion, but were obviously oblivious of the long-term costs of such action. As a result, too much conversion takes place in areas where no conversion should have been permitted. Apparently, an *ex ante* social valuation of these urban forests prior to their past conver-

sion would have prevented such conversion and subsequently engender continued preservation of these forests till today.

The results of this study have brought into focus the peoples' readiness to concertedly rectify their degraded environment as observed from their willingness to pay for reforestation of their urban environment. This favourable participatory disposition becomes very imperative and of great importance in view of the fact that public funds available for projects (in Nigeria) are dwindling every day. Subsequently, it is incumbent on the people themselves to be actively involved in the management of their environment.

REFERENCES

Ajewole, O.I. (2000). Economic valuation of environmental service functions of forests in Ibadan Metropolis, Nigeria. M.Phil dissertation, Department of Forest Resources Management, University of Ibadan, Nigeria. 165 pp.

Alison, P.A. (1956). Oke Aremo and Ogunpa forest reserves working plan. Vol. 1, Ministry of Agriculture and Natural Resources, Forestry Division. Ibadan

Barbier, E. (1991). Tropical deforestation. In Pearce, D. (ed.) *Blueprint 2: Greening the World Economy.* pp. 138–66

Barbier, E., Bishop, J., Aylward, B. and Burgers, J. (1992). Economic policy and sustainable natural resource management. In Holmberg, J. (ed.), *Policies for a small planet.* pp. 65–88. (London: Earthscan Publica-tions Limited)

Bowers, J. (1997). *Sustainability and environmental economics: An alternative text.* pp. 148–55 (London: Addison Wesley Longman Publications)

Chokor, B.A. and Obadan, M.I. (1991). Environment and economics in Nigeria: Towards a more effective resource pricing and conservation. In Ojo, J.A.I. (ed.), *Proceedings of Mobilising Finance for Natural Resources Conservation.* pp. 47–67

Cooksey, R.A. and Howard, T.E. (1995). *Willingness to pay to protect forest benefits with conservation easements.* An invited paper, IUFRO XX World Congress August, 1995

Dixon, J.A. and Sherman, P.B. (1991). *Economics of protected areas: A new look at benefits and costs.* pp. 24–48 (London: Earthscan Publications Limited)

Dixon, J.A., Scura, L.F., Carpenter, R.A. and Sherman, P.B. (1994). *Economic analysis of environmental impacts.* pp. 70–81, 165–86 (London: Earthscan Publications Ltd)

Echeverria, J., Hanrahan, M. and Solorzno, R. (1995). Valuation of non-priced amenities provided by the biological resources within Montverde Cloud Forest Preserve. *Ecological Economics,* **13**, 43–52

Food and Agriculture Organisation (1995). *Valuing Forest: Context, Issues and Guidelines.* Forestry Paper 127 FAO, Rome, pp. 5–10

Freer-Smith, P.H. and Broadmeadow, M.S.J. (1996). *The improvement of urban air quality by trees.* Arboriculture-Research and Information Note. Department of the Environment, UK. No. 135-ERB-96. 4pp.

Gusmailina, S. (1996). The role of several urban forest plants on the mitigation of emission in the Air. *Bulletin-Penelitian-Hasil-Hutam,* **14**(2), 76–83

Hanemann, W.M. (1994). Valuing the Environment through Contingent Valuation. *The Journal of Economic Perspectives,* **8**(4), 19–43

Hoehn, J.P. (1992). Contingent valuation in fisheries management: The Design of satisfactory Contingent valuation Formats. In Markandya, A. and Richardson, J. (eds). *The Earthscan Reader in Environmental Economics.* pp. 101–11 (London: Earthscan Publications Ltd.)

Kramer, R.A., Mercer, E. and Sharma, N. (1996). Valuing tropical rainforest protection using the contingent valuation method. In White, W.A., Boxal, P.C., Lockert, M.K., Phillips, W.E. and Adamowicz, W.Z. (eds) *Forestry, Economics and the Environment.* pp. 181–4 (Oxford: CAB International)

Kramer, R.A. and Mercer, D.E. (1997). Valuing a global environmental good: US residents' willingness to pay to protect tropical rainforests. *Land Economics,* **73**, 196–210

Lamb, A.F. (1941). *Eleiyele Forest Reserve working plan,* Vol. 1 Ministry of Agriculture and Natural Resources, Forest Division, Ibadan

Laverne, R.J. and Lewis, G.M. (1996). The effect of vegetation on residential energy use in Ann Arbor Michigan. *Journal of Arboriculture,* **22**(5), 234–43

Lockwood, M., Loomis, J. and Delacy, T. (1993). A contingent valuation study and benefit cost analysis of forest preservation in East Gippsland, Australia. *Journal of Environmental Management,* **38**, 233–43

Loomis, J.B. (1996). Measuring general public

preservation value for forest resources: Evidence from contingent valuation survey. In White, W.A., Boxal, P.C., Lockert, M.K., Phillips, W.E. and Adamowicz, W.Z. (eds), *Forestry, Economics and the Environment.* pp. 91–101 (Oxford: CAB International)

Mather, A.S. and Chapman, K. (1995). *Environmental Resources.* pp. 24–40, 92–117 (London: Longman Scientific and Technical)

Mbakwe, R. (1992). Prospects of Recreational Forest in Nigeria. In Akinsanmi, *Proceedings of annual Conference of Forestry Association of Nigeria,* 2nd–7th November, 1992, Kano, Nigeria, pp. 36–9

McPherson, E.G., Nowak, D., Heirsler, S., Grimmond, C., Souch, C. Grant, R. and Rowntree, R. (1997). Quantifying urban forest structure functions and value: The Chicago urban climate project. *Urban Ecosystems,* **1**(1), 49–61

Ogigirigi, M.A. (1986). Deforestation: Its impact on the environment. In Oguntala (ed.), *Proceedings of Annual Conference of Forestry Association of Nigeria.* pp. 49–57

Oguntala, A.B. (1993). Forestry for urban and rural development in Nigeria with particular reference to urban environments. In Oduwaiye (ed.) *Proceedings of Annual Conference of Forestry Association of Nigeria,* 29th November–3rd December, Ikeja, Nigeria, pp. 1–10

Olembo, R.J. and de Rham, P. (1987). In two different worlds. *Unasylva,* **155**(39:1), 26–35

Panayotou, P. (1992). The economics of environmental degradation, problems, causes, and responses. In Markandya, A. and Richardson, J. (eds), *The Earthscan Reader in Environmental Economics.* pp. 316–63 (London: Earthscan Publications Ltd)

Pearce, A., Markandya, A. and Barbier, E.B. (1989). *Blueprint for a Green Economy.* pp. 51–92 (London: Earthscan Publications Ltd)

Popoola, L. (1995). Valuation of tropical forest resources. In *Proceedings of UNEP/CIFOR Conference on Intergenerational Maintenance.* Kumasi, Ghana, pp. 72–87

Portney, R.R. (1994). The contingent valuation debate: Why economists should care. *The Journal of Economic Perspectives,* **8**(4), 4–17

Schulze, W.D., d'Arge, R.C. and Brookshire, D.S. (1981). Valuing environmental commodities: Some recent experiments. *Land Economics,* **57**(2), 151–71

Shultz, S., Pinazzo, J. and Cifuenctes, M. (1998). Opportunities and limitations of contingent valuation surveys to determine national parks entrance fees, evidence from Costa Rica. *Environmental and Development Economics,* **3**, 131–51

United Nations Conference on Environment and Development (1992)

William, R.G. (1932). *Alalubosa forest reserve working plan.* Vol. 1. Ministry of Agriculture and Natural Resources, Forest Division. Ibadan

Xie, W., Du, H., Wang, Z., Li, C.H. and Yan, M.S. (1998). Research on integrated environmental efficiency from urban circulating forest in Fushun City. *Journal of Plant Resources and Environment,* **7**(2), 42–7