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SOCIO-ECONOMIC AND ENVIRONMENTAL ATTITUDINAL DETERMINANTS OF RAINFOREST PROTECTION: A LOGIT MODEL ANALYSIS

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ABSTRACT

This paper investigates the nature of socio-economic and environmental attitudinal attributes of people on rainforest protection. The multi-stage sampling procedure was applied. The methodology involved descriptive statistics and binary choice logit model. The result shows public awareness of deforestation and the need to protect the forest resources for future generations. The need for their present survival over-rides the long term interest of sustainable use. The willingness to embrace cost sharing of rainforest protection with the industrialized countries of the world was equally shown. Weak pro-environmental attitudes were shown. The log of bid and rainforest visitor dummy had negative and significant effect on the willingness to pay (WTP) for rainforest protection ($p<0.01$). Income and educational level attained had a positive and significant relationship with rainforest protection ($p<0.01$). The food crop producer dummy was positive and significant ($p<0.01$). Environmental awareness needs to be put in place. Dialogues on sharing the cost burden of rainforest protection need to be effected. Wage increases and sustainable agro forestry practices need to be put in place. These will go a long way in enhancing food crop production and positive environmental accounting by the rainforests.

Keywords: Environmental attitudinal attributes, rainforest protection, binary choice model, willingness to pay, cost sharing.

INTRODUCTION

The causes of deforestation and by implication lack of rain forest protection have developed into a full grown literature (Brown and Pearce, 1994; Kaimowitz and Angelsen, 1998; Bulte and van Kooten, 1999). The surveys from these sources suggest the key factors that have important influence on tropical deforestation both within and across countries. These are income, population growth/density and agricultural exports/imports share. In addition are logging prices, production and returns, roads and road / building, scale factor (size of forest stock, land area etc) and institutional factors that border on political stability, property rights and rule of law.

Kant and Redantz (1997) on the same issue claim that there is a broad consensus that the expansion of cropped area and pastures is a major source of deforestation and that the expansion of pastures is especially important in Latin America. The source em-

phasizes that logging can be a direct source of deforestation as they create room for crop production. Burgess (1991) agrees with this by emphasizing that logging roads facilitate farmers' access to the forest. Kaimowitz and Angelsen (1998) link deforestation to fuel wood collection and open-pit mining. Okojie (1997) supports the latter and claims that it accounts for the "treeless plateau" in the once forested north and north – eastern part of Plateau State, Nigeria. There has also been the conventional poverty – environment argument. In this sense, poverty has been claimed to account for deforestation in developing countries. These problems border on economic, trade, legal and political considerations. They however failed in touching the very crucial factors of socio-demographic and environmental attitudes that affect the likelihood in the willingness to pay for rainforest protection. These attitudinal behaviours tend to stimulate the negative economic, legal and political consequences of deforestation. An analysis of how these factors affect the willingness to pay for rainforest protection will sensitize policies to be formulated to abate deforestation and so enhance rainforest protection to enable their proper "green accounting" functions.

It is in the light of this that this paper sets to identify, analyze and establish the nature of the relationships that exist between respondents' socio-economic and environmental attitudinal variables and their likelihood to pay for rainforest protection in the study area.

THEORETICAL FRAMEWORK

Deforestation brings about detrimental change in the environment. Non – market economic valuation is done in most cases to enable the assessment of people's preferences for such negative externality of environmental damage. This following Georgiou *et al.* (1997) serves as a proxy for valuing the extent of damage to such an environmental good.

The conceptual approaches for economic valuation of environmental goods such as rainforest protection are numerous. Those based on conventional market approaches include the dose – Response Relationship, Replacement Cost and the Opportunity Cost Approaches. In addition, are the Surrogate Market Approaches of Avertive Behaviour, Hedonic Property Pricing and Wage Risk Estimation. The non-market techniques of Contingent Valuation of the referendum type has however become the method of choice in practical settings for environmental valuation since the National Oceanic and Atmospheric Agency (NOAA) "Blue Ribbon" panel report (NOAA, 1993) recommended it in preference to other methods.

Contingent valuation is a method of estimating the value that a person places on a good and in this paper rainforest protection. The approach asked people to directly report their willingness – to – pay (WTP) to obtain this good, or willingness – to – accept (WTA) to give up the good, rather than inferring them from observed behaviors in regular market places. The principal use of contingent survey data is to produce a mean or median estimate of WTP to mitigate the welfare benefit that is lost through deforestation. The mean or median WTP added across every household in the study area gives the total WTP.

The theoretical framework for the empirical valuation of rainforest protection is based on the fundamental assumption that the neo-classical concept of economic value based on utility maximization behaviour can be extended to non-market goods such as rainforest protection. In this sense, individual or house-holds should demand greater or less quantities of rainforest protection if variable price of this amenity exists. It therefore stands that if shadow prices for the amenity can be estimated and a demand curve traced out, the familiar concept of consumer surplus can be used to assign economic value. Consumer surplus is the difference between aggregate WTP and aggregate actual payments (Hirsholeifer, 1984). Koutsyianis (1979) defines it as the difference between the amount of money that a consumer actually pays to buy a certain quantity of a commodity and the amount he would be willing to pay for this quantity rather than do without it. The value of the surplus can be measured or estimated using the area under the demand curve that is above the price.

The easiest way to think about the estimation of WTP using the close – ended contingent valuation method (CVM) approach as adopted for this paper is to model the dichotomous – choice CVM data obtained from the cross-sectional survey as a demand function with the bid levels elicited for WTP modeled along the horizontal axis and the probability of saying "yes" along the vertical axis following the method of Ryan *et al.* (1997). This implies modeling the demand for rainforest protection at a given price. Mean WTP is estimated as the area under this curve. This area shows the proportion of the population who would consume the good at each price level and their associated utility. The cumulative density function that represents the probability of a "yes" response as represented by the area under the demand curve is assumed to be logistic (Hanemann, 1984; Turcin and Giraud, 2001). The logit model is therefore applied to analyze the relationship between WTP and the socio-economic and environmental attitudinal variables that affect it.

METHODOLOGY

Study area

The study area is the South-West of Nigeria and the scope covers the four Agricultural Development Zones of Ogun State that has 20 Local Government Areas and a total land area of 16,085km^2 (see Fig.1) The natural vegetation ranges from fresh water swamp with mangrove forest in the south – east and diverse forest communities to the woody Guinea Savannah in the northwest. The rainforest is the largest ecological belt running through the centre of the state from the east to the west. The tropical climate enjoys two main seasons – the rainy season (March to October) and the dry season (November – February). Rainfall ranges from 1600mm in the forest zones to 900mm in the Guinea Savannah zone. The temperature is between 28^{0}C and 35^{0}C while humidity is between 85 and 95 percent.

Data sources and collection

The data for this study are from primary and secondary sources. The primary data were derived from the contingent valuation survey that provided the basis for the valuation of rainforest protection benefits. The secondary data were from the National Population Commission, Ogun State Min-

istries of Forestry and Agriculture respectively, Bureau for Lands and Surveys and the Forest Management, Evaluation and Coordinating Unit (FORMECU).

There was a pre-test open ended format contingent valuation survey that helped to work out the bid amounts elicited in the actual dichotomous – choice contingent valuation method (DC-CVM) close – ended survey. The goal was to ask how much the respondents were willing to pay if necessary to ensure that the productive and environmental welfare loss resulting from forestland use changes were mitigated. The respondents were shown two sets of imageries in photographs so that they could be properly informed on what they were being expected to value through the elicitation of their WTP. This is following McCollum and Boyle (2005). The first depicted deforested and degraded environmental scenes while the second showed "lush" green undisturbed forests. The forest reserve areas in their individual zones were used as the reference points. The multi – stage sampling procedure was applied in selecting randomly the 260 respondents that participated in the survey based on probability proportionate to size in selecting the extension blocks from the zones and the extension cells from the blocks. Ten respondents randomly chosen from the resultant twenty six extension cells amounted to the 260 respondents from which the dichotomous-choice contingent valuation method (DC-CVM) question, socio-economic and environmental attitudinal attributes were elicited.

Analytical procedure

The descriptive analytical tools consisting of frequency, means, standard deviation and ranking were used to describe the environmental attitudinal and socio-economic variables of the respondents. The DC – CVM component of the cross-sectional survey that terminated to the binary choice logit model was applied in assessing the WTP. The effect of the environmental attitudinal an socio-economic variables as they affected the likelihood in the WTP for protection was determined from the logit method.

The mean WTP was calculated based on the Hanemann (1984) Approach as used by Turcin and Giraud (2001) and from Cooper and Loomis (1992) as follows:

$$Li = \frac{1}{1+\exp^{-}(a+\beta_i x_i)} \quad \text{.....} \quad (1)$$

where:

Li = Respondents acceptance probability to the bid offered

βi = Vector representing the coefficients of all covariates including that of bid (βi)

X_1 = Vector representing all covariates including that of bid (X_1).

X_2 = Income (Naira)

X_3 = Educational level attained (Years)

X_4 = Household size (Number)

X_5 = Sex dummy (1 = if male, 0 = female)

X_6 = Tropical deforestation dummy (1 = deforestation awareness, 0 = if not)

X_7 = Rainforest visitor dummy (1 = visitations to the forest, 0 = if not)

X_8 = Intergenerational equity dummy (1 = support rainforest protection for future generations, 0 = if not)

X_9 = Cost sharing dummy (1 = support for developed countries sharing from the cost of rainforest protection in developing countries, 0 = if not)

X_{10} = Immigrant status dummy (1 = if migrant, 0 = non migrant)

X_{11} = Food crop producer dummy (1 = non –food crop producers, 0 = food crop producers)

L_1 (Logit) is a proxy for willingness to pay (WTP). It represents the dependent variable which is a dummy by the binary choice logit model adopted for the paper. It is defined as "1" if respondents accept bids elicited for rainforest protection and "0" if otherwise. X_1 represents the bids elicited in the DC – CVM survey. This is the variable price (shadow prices) of the environmental amenity (rainforest protection for which the stated preference is sought). X_2 is the monthly derivable income. Tropical deforestation dummy (X_6) implies rainforest awareness of the respondents. Where they were aware of the problem, the dummy takes the value "1" and when otherwise "0". Rainforest visitor dummy (X_7) portrays the respondents' answer to whether they had ever visited the rainforest or not to benefit from the numerous productive and environmental service functions. Where they stated "yes", the dummy takes the value of "1", and when otherwise, the value "0". Intergenerational equity motive (X_8) stands for the respondents support for rainforests being protected for the benefit of future generations. Where their answers were in the affirmative, the dummy is "1", and where not "0". The cost – sharing dummy (X_9) relates to respondents' answer to the question whether industrialized countries should help developing countries pay for preserving/conserving the tropical rainforests as forest benefits go beyond national boundaries. For "yes", the dummy was "1", and when otherwise "0". The immigrant status dummy (X_{10}) depicts respondents' claims to being migrants or non-migrants in the study area. The interest here was whether on ethnocentric ground, the non-migrants were more interested in rainforest protection of their area than the migrants. Where the respondents were migrants, the dummy took the value of "1", and non-migrants, the value "0". The food crop producer dummy (X_{11}) indicates whether the respondent is a food crop producer or not. The purpose is to determine whether the non-food crop producer will have the more likelihood to pay for rainforest protection as compared to the food crop producer who may have a greater stake in deforestation for food crop production. The dummy value "1" stands for non – food crop producers while "0" for food crop producers. The Cooper and Loomis (1992) procedure for the determination of mean WTP is as follows:

$$P^{-} = 1/|\beta| * \ln (1+ \exp^{a}) \ldots\ldots\ldots\ldots\ldots (2)$$

where:

a = intercept
β = coefficient of bid
p = restricted mean WTP

RESULTS AND DISCUSSION

With respect to the environmental attitudes, the awareness of the existence of rainforests and the phenomenon of deforestation appears to be well known to the general public in the study areas as 86.6 percent of the respondents answered affirmatively to the question "Before today, have you ever read, heard or seen TV shows about tropical rainforests?" and 90.8 percent claimed to be familiar with the reasons for deforestation (Table 1). This is not surprising since the timing of the survey coincided with the activities of the controlling government in this area suspending all logging activities and private taungya practices (i.e. raising

of food and forest crops on the same land management unit) in all forest reserves as the farmers were engaging in the non-permitted planting of tree crops – cocoa, kolanuts and oil palm. The enhanced media coverage at this time must have contributed to this awareness. In response to the question, "should industrialized countries help developing ones pay for preserving/conserving their rainforests," 88.3 percent of the respondents answered in the affirmative. This is of great importance in resolving the ongoing debate on cost sharing as noted by Ruintenbeck (1992), Bojo (1983) and Kramer et al. (1995) on the role of industrialized countries in sharing from the cost burden of environmental protection in Less Developed Countries. This is especially so as forest benefits are enjoyed beyond national borders hosting such forest estates. It was also agreed in the study area that 51 percent of the cost sharing burden should be borne by the industrialized countries. On intergenerational equity motive, 96 percent of respondents overwhelmingly supported rainforest sustainable use for the benefit of future generations. This was 96 percent in the whole study area and between 94 to 98 percent in the four zones of the study area. The use value of the rainforests seemed to be properly understood in the study area as 83 percent of respondents claimed to have visited the rainforest to benefit from the numerous productive and environmental service functions.

The environment placed third with an average ranking of 2.98 when six general problems of the society were considered on a 1 to 6 scale with 1 being most important (Table 2). It came behind education (2.05), hunger and poverty (2.91) but was followed by the economy (3.34), politics (4.73) and crime (4.91) in that order in the study area. This indicates that environmental problems and the resultant consequences may not be what people are seriously aware of in the study area. This weak pro-environmental attitude must have manifested in respondents valuing the WTP for rainforest protection very poorly from the binary choice logit model in line with the assertion of Kotchen and Reiling (2000). In a similar fashion, deforestation was in the fourth position when respondents were encouraged to weigh tropical deforestation against other environmental problems. Soil erosion and loss of fertility ranked above deforestation with 2.92 (Table 3). It was followed by water and air pollution (3.13), global warming (i.e. the green house effect) – an international environmental problem that has received a lot of media attention was next with 3.16. The hole in the ozone layer, acid rain and cutting of old growth forests followed the problem of deforestation in that order. That the respondents ranked the cutting of old growth forests last not minding the environmental consequences corroborate the lower awareness of the problem of environmental damage as linked to deforestation phenomenon in the study area. The implication was the valuation of the likelihood in the WTP for rainforest protection very poorly as stated earlier.

Some socio-economic characteristics considered as they affect the respondents WTP for rainforest protection were sex, household size, educational level attained, income and the bid which was the proxy for the variable price (shadow price) of rainforest protection. Respondents being migrants or non-migrants or food crop pro-

ducer or not were other variables considered. Majority of the respondents were of the male gender (76.2 percent) in the entire study area. The household size was 5 persons. The distribution of respondents by educational status showed that 39.6 percent attained tertiary educational level while secondary, primary and no formal education were on the levels of 26.5, 21.9 and 11.9 percents in that order respectively. The high level of sophistication in education portends a proper understanding of the essence of environmentally sound and sustainable development and the role a conserved forest will have to play in this direction on the respondents in the study area. This is also expected to affect positively the likelihood of respondents WTP for rainforest protection in accordance with Abala (1987). This was tested in the logit regression. The respondents weighted monthly income in the study area was N21,121.15. The belief is that the higher the income, the greater is the acceptance probability to the bid offered for rainforest protection and the higher the estimate of the WTP. This relationship was also tested in the logit regression. The belief is equally that non-migrants and non-food crop producers may be more interested in conserving the forest for sustainable use-bequeath and existence values. This is because the migrants who are in most cases the timber contractors being non-indigenes in the study area may be less interested in the environmental welfare of the area for the present or the future generations. In the light of same reasoning, food crop producers supporting rainforest protection will mean paying their way out of their business of "slash and burn" farming.

The logit regression shows relationship of the environmental attitudinal and socio-economic variables and the likelihood in the WTP for rainforest protection (Table 4). The log of the offered bid had a negative and significant effect ($p<0.01$) on the likelihood of bid acceptance for rainforest protection. This is a confirmation of the expected negative relation between price and quantity of the environmental good (rainforest protection).

Income had the expected positive and significant effect on WTP ($p<0.01$) in the entire study area and the four component zones. This means as incomes rise, there is a shift to the right in the demand curve for rainforest protection. Educational level attained by respondents equally had a positive and significant relationship ($p<0.01$) on the likelihood of bid acceptance for rainforest protection in the entire study area. This confirms the assertion of Abala (1987) and Kramer *et al.* (1995). The non – significance in the Ijebu – Ode and Ilaro zones could be explained from the stand point of the major and largest areas of forest reserves being in these two zones. The lumbering business may therefore be providing the major source of likelihood here despite the high levels of educational attainment and the positive impact it provides on the likelihood in the WTP rainforest protection. The need for the immediate sources of livelihood may therefore be over -riding the overall interest of rainforest protection.

The rainforest visitor dummy was negative and significant ($p<0.05$). This negative contribution to the probability of bid acceptance for rainforest protection is surprising as one would have thought the more the

respondents visited the rainforests to benefit from their numerous services, the more they would have been willing to use them sustainably. The result however shows that their visits were inimical to the rainforest protection objective. It confirms Kotchen and Reiling (2000) assertion that respondents with weaker pro-environmental attitudes have the less likelihood in their WTP valuation. The cost sharing of rainforest protection with the industrialized countries was positive and non significant in the study area. The implication is it would contribute more positively to rainforest protection though the process can be achieved without the assistance. This is in line with the assertions of Ruitenbeck (1992) and Kramer *et al.* (1995).

The household size had positive and non-significant relationship with WTP for rainforest protection in the entire study area. It was expected for bequest or intergenerational motive, this variable was not only expected to vary positively with the WTP but also be significant. The explanation can be found in the poverty pervasive in the area and the management of the forest sector without indigenous participation. The tendency was for the people to think of immediate survival while leaving the future to take care of itself. The sex and immigrant dummies were negative with the latter significant ($p<0.05$). This lends credence to the male and female gender being culpable for the deforestation situation. This supports the assertion of Teal and Loomis (2000). The immigrant dummy representing the migrants in this variable being negative and significant implies attributing the deforestation situation mainly to them. The food crop producer dummy was positive and significant ($p<0.01$). The indication is that the non-food crop producers as represented by the dummy variable 1 have the greater likelihood in their WTP for rainforest protection than the food crop producers. This is rational as the latter group showing a greater likelihood to pay for rainforest protection will mean paying their way out of their business of farming that is characterized mainly by "slash and burn" agriculture.

CONCLUSION

There was the general awareness of rainforest existence in the study area and the numerous benefits derivable from them. The ranking of environmental problem among societal problems was low. This is also true for deforestation among environmental problems. This implies weak pro-environmental attitudes in the study area and explains the low valuation of the WTP for rainforest protection. The need to share the cost burden of rainforest protection with the distant beneficiaries of rainforest environmental benefits – the industrialized countries of the world was indicated though the study showed the protection can be carried out without the external support.

The bequest or intergenerational equity motive in rainforest protection was sacrificed in the study area for the needs of immediate survival despite the high level of educational attainment. The bid (shadow prices of rainforest protection) and income had positive and significant relationship ($p<0.01$) with the likelihood in the WTP for rainforest protection. The respondents' visits to the forests were inimical to the protection objective. Deforestation is not attributable to any particular gender. The

male and female gender is therefore equally culpable in deforestation phenomenon. The migrants rather than the indigenes and the food crop producers in the study area have the lower probability in their WTP for rainforest protection. Otherwise for the latter would mean paying their way out of their; "slash and burn" agriculture.

There is the urgent need to inculcate efficient environmental education in the study area. This can be effected through mobilization in all communication media – radio, television, newspapers and through the various extension arms of government agencies. Political, economic and trade dialogues need to be initiated with the countries of the north to make them effect international transfers in form of grants to offset conservation costs in the developing countries that still harbour much of these rainforests. Policy instruments that encourage wage increase without aggravating inflation need to be put in place. Sustainable practices in food crop production such as agroforestry cultivation methods should also be put in place. This will not only take care of agricultural but forestry cultivation as well. In such a way socio-economic and environmental aspirations of the people will be met.

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Fig. 1.1: Map of Ogun State (Study area) showing the Local government Areas and Study Zones

Table 1: Knowledge of, Visits to and Obligations to Pay for Rainforest Protection in Study Area and its Zones

Environmental Attitudinal Questions	All Zones (Ogun State)		Zone 1 (Ijebu-Ode)		Zone 2 (Abeokuta)		Zone 3 (Ikenne)		Zone 4 (Ilaro)	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
Any knowledge of rainforests	86.61	13.39	91.67	8.33	91.14	8.86	74.00	26.00	86.00	14.00
Knowledge and causes of defor-estation	90.79	9.21	93.33	6.67	91.14	8.86	92.00	8.00	86.00	14.00
Previously vis-ited rainforest and benefited from the numer-ous functions	83.33	16.67	81.67	18.33	87.50	12.50	78.00	22.00	84.00	16.00
Support for inter generational equity motive	96.25	3.75	98.33	1.67	93.75	6.25	96.00	4.00	98.00	2.00
Should industri-alized countries help developing countries pay for preserving their rainforest	88.25	11.15	85.00	15.00	80.00	20.00	98.00	2.00	100.00	0.00
Range and mean in that order industrialized countries should help developing countries in pay-ing for the pres-ervation of their rainforests	20-100%; (51.34%)		20-70%; (47.21%)		30-100%; (55.71%)		30-90%; (51.10%)		20-100%; (51.34%)	

Source: Computed from Field Survey Data, 2004

Table 2: Relative Rankings of the Importance of Six General Problems by Respondents (1 = most important … 6 = least important)

Study Area	Problem	Average Rank 1 = most important 6 = lest important	Percentage for Each Rank					
			1	2	3	4	5	6
All Zones (Ogun State)	Education	2.05	46.86	21.76	17.57	9.21	2.51	2.09
	Environment	2.98	20.75	17.01	24.48	21.99	9.96	5.81
	Hunger & Poverty	2.91	21.34	27.20	16.74	17.99	6.28	10.46
	The Economy	3.34	6.78	21.19	27.54	26.27	11.44	6.78
	Politics	4.73	1.63	5.31	8.57	14.69	41.63	28.16
	Crime	4.91	2.98	7.66	5.11	9.79	27.66	46.81
Zone 1 (Ijebu-Ode)	Education	2.02	50.00	16.67	18.33	11.67	3.33	0.00
	Environment	2.87	21.67	18.33	30.00	16.67	8.33	5.00
	Hunger & Poverty	2.55	21.67	36.67	16.67	18.33	3.33	3.33
	The Economy	3.31	3.39	25.42	23.73	33.90	11.86	1.69
	Politics	4.87	0.00	1.59	9.52	15.87	42.86	30.16
	Crime	5.34	3.45	1.72	1.72	3.45	29.31	60.34
Zone 2 (Abeokuta)	Education	2.15	41.77	22.78	22.78	6.33	3.80	2.53
	Environment	2.90	25.61	10.98	21.95	30.49	7.32	3.66
	Hunger & Poverty	2.73	24.05	29.11	15.19	18.99	6.33	6.33
	The Economy	3.33	7.79	20.78	29.87	22.08	11.69	7.79
	Politics	4.77	1.23	8.64	4.94	14.81	38.27	32.10
	Crime	5.08	0.00	7.79	5.19	6.49	32.47	48.05
Zone 3 (Ikenne)	Education	2.06	40.00	34.00	10.00	14.00	0.00	2.00
	Environment	3.20	16.00	18.00	26.00	18.00	8.00	14.00
	Hunger & Poverty	3.10	26.53	12.24	20.41	18.37	10.20	12.24
	The Economy	3.24	10.00	20.00	30.00	18.00	14.00	8.00
	Politics	4.62	3.85	5.77	5.77	15.38	46.15	23.08
	Crime	4.61	4.08	10.20	8.16	16.33	20.41	40.82
Zone 4 (Ilaro)	Education	1.92	58.00	14.00	16.00	6.00	2.00	4.00
	Environment	3.04	16.33	24.49	20.41	18.37	18.37	2.04
	Hunger & Poverty	3.42	11.76	27.45	15.69	15.69	5.88	23.53
	The Economy	3.48	6.00	18.00	26.00	32.00	8.00	10.00
	Politics	4.59	2.04	4.08	16.33	12.24	40.82	24.49
	Crime	4.46	5.88	11.76	5.88	15.69	25.49	35.29

Source: Computed from Field Survey Data, 2004

Table 3: Relative Rankings of Seven Major Environmental Problems by Respondents (1 = most important… 7 = least important)

Study Area	Environmental Problem	Average Rank 1 = most important 7 = least important	Percentage for Each Rank						
			1	2	3	4	5	6	7
All Zones (Ogun State)	1. The Greenhouse effect (Global warming)	3.18	21.10	27.85	15.19	11.81	7.17	6.75	10.13
	2. Soil Erosion and loss of fertility	2.92	28.45	23.01	17.99	10.46	5.44	5.86	8.79
	3. Water and air pollution	3.13	16.81	25.63	22.27	16.39	4.62	3.36	10.92
	4. Tropical deforestation	4.21	7.41	6.58	21.81	20.99	19.75	11.52	11.93
	5. The hole in the ozone layer	4.50	8.79	4.18	10.04	22.18	24.69	19.67	10.46
	6. Acid rain	4.57	10.83	8.33	9.58	9.58	22.08	24.58	15.00
	7. Cutting of old growth	5.39	6.75	4.64	2.95	8.44	16.03	28.27	32.91
Zone 1 (Ijebu – Ode)	1. The Greenhouse effect (Global warming)	3.50	13.11	29.51	19.67	6.56	6.56	11.48	13.11
	2. Soil Erosion and less of fertility	2.87	31.15	21.31	18.03	9.84	6.56	1.64	11.48
	3. Water and air pollution	2.97	19.67	27.87	21.31	14.75	4.92	3.28	8.20
	4. Tropical deforestation	4.03	6.67	8.33	20.00	28.33	21.67	6.67	8.33
	5. The hole in the ozone layer	4.51	10.17	1.69	10.17	25.42	18.64	25.42	8.47
	6. Acid rain	4.46	13.56	5.08	10.17	11.86	28.81	13.56	16.95
	7. Cutting of old growth	5.66	5.08	5.08	0.00	3.39	13.56	38.98	33.90
Zone 2 (Abeokuta)	1. The Greenhouse effect (Global warming)	2.96	11.84	38.16	18.42	18.42	3.95	5.26	3.95
	2. Soil Erosion and less of fertility	3.14	25.64	23.08	19.23	7.69	3.85	8.97	11.54
	3. Water and air pollution	3.23	18.99	20.25	22.78	17.72	5.06	2.53	12.66
	4. Tropical deforestation	4.29	8.54	4.88	23.17	18.29	18.24	10.98	15.85
	5. The hole in the ozone layer	4.38	10.13	6.33	10.13	18.99	25.32	18.99	10.13
	6. Acid rain	4.63	16.25	5.00	3.75	6.25	23.75	32.50	12.50
	7. Cutting of old growth	5.22	8.86	3.80	2.53	12.66	18.99	20.25	32.91
Zone 3 (Ikenne)	1. The Greenhouse effect (Global warming)	3.67	22.00	16.00	10.00	12.00	16.00	6.00	18.00
	2. Soil Erosion and less of fertility	2.57	36.00	18.00	18.00	14.00	6.00	6.00	2.00
	3. Water and air pollution	2.66	14.58	37.50	25.00	16.67	0.00	0.00	6.25
	4. Tropical deforestation	3.58	9.62	11.54	28.85	19.23	21.15	5.77	8.85
	5. The hole in the ozone layer	4.90	3.92	0.00	9.80	25.49	25.49	19.61	15.69
	6. Acid rain	4.92	6.12	14.29	4.80	8.16	14.29	30.61	22.45
	7. Cutting of old growth	5.41	8.00	4.00	4.00	4.00	16.00	32.00	32.00
Zone 4 (Ilaro)	1. The Greenhouse effect (Global warming)	2.41	44.00	22.00	10.00	80.00	4.00	4.00	8.00
	2. Soil Erosion and less of fertility	3.00	22.00	30.00	16.00	12.00	6.00	6.00	8.00
	3. Water and air pollution	3.76	12.00	20.00	20.00	16.00	8.00	8.00	16.00
	4. Tropical deforestation	4.92	4.08	2.04	14.29	18.37	18.37	24.49	18.37
	5. The hole in the ozone layer	4.26	10.00	8.00	10.00	20.00	30.00	14.00	8.00
	6. Acid rain	4.24	3.85	11.54	23.08	13.46	19.25	19.23	9.62
	7. Cutting of old growth	5.31	4.08	6.12	6.12	12.24	14.25	24.49	32.65

Source: Computed from Field Survey Data, 2004

Table 4: Maximum Likelihood Estimations of Responses to Willingness-to-Pay (WTP) Questions and Estimation of Mean WTP

Variables	Study Area and Its Zones				
	All Zones (Ogun State) Coefficient and Z-Value	Zone 1 (Ijebu – Ode) Coefficient And Z-Value	Zone 2 (Abeokuta) Coefficient and Z-Value	Zone 3 (Ikenne) Coefficient and Z-Value	Zone 4 (Ilaro) Coefficient and Z-Value
Constant (β_0)	0.18	0.70	-1.83	-1.95	-1.94
	(0.19)	(0.43)	(-0.86)	(-0.44)	(-0.50)
Bid (β_1)(X_1)	-0.0074***	-0.011***	-0.0053***	-0.14***	-0.02***
	(-7.35)	(-3.84)	(-3.41)	(-2.79)	(-2.65)
Income (X_2)	0.13***	0.00020***	0.000033*	0.00014	0.00032**
	(3.33)	(2.98)	(1.84)	(1.53)	(2.28)
Educational Level (Dummy) (X_3)	0.0063***	0.37	0.18**	0.42**	0.30
	(3.40)	(0.39)	(2.23)	(2.36)	(1.45)
Household Size (Dummy) (X_4)	0.0066	-0.10	0.17	0.24	0.35
	(-0.084)	(-0.56)	(0.15)	(0.76)	(0.86)
Sex 1 (Dummy) (X_5)	0.31	-0.11	0.26	-1.64	2.39
	(0.44)	(-0.14)	(0.29)	(-1.20)	(1.60)
Tropical Deforesta-tion (Dummy) (X_6)	-0.13	0.95	-0.08	-0.0029	1.90
	(-0.36)	(1.04)	(-0.13)	(-0.002)	(0.94)
Rainforest visitor dummy (X_7)	-1.16**	-0.27	-1.26	-0.26	-2.01
	(-2.18)	(-0.21)	(-1.23)	(-0.21)	(-0.70)
Intergenerational Equity dummy (X_8)	0.87	-1.17	2.67**	0.61	-
	(1.40)	(-0.82)	(1.98)	(0.26)	-
Cost sharing dummy (X_9)	1.17	1.37	-0.78	-	-
	(1.11)	(1.26)	(-0.93)	-	-
Immigrant status dummy (X_{10})	-0.71	-0.86**	-0.62**	-2.44*	-2.89*
	(-2.00)	(-1.04)	(-0.99)	(-1.74)	(-1.49)
Food crop producer dummy (X_{11})	0.00012***	0.014***	0.0032***	.00047**	0.0023***
	(3.05)	(2.85)	(3.26)	(2.01)	(2.93)
Number of observa-tions	260	80	80	50	50
Goodness of fit	Pseudo R^2 = 0.45	PsedoR^2=0.48	PseudoR^2= 0.28	Pseudo R^2 = 0.61	Pseudo R^2 = 0.71
	LR X^2 = 47.55***	LR X^2= 47.55***	LRX^2= 29.86***	LRX^2 = 38.67***	LR X^2 = 47.23***
Mean Willingness to Pay	N552.50 /household/ month	N51.31 /household/ month	N157.47 /household/ month	N4.99 /household / month	N32.80 /household/ month

Dependent variable is the yes/no responses to the offered bid amounts.

*** Significant at 1% level

** Significant at 5% level

* Significant at 10% level

Source: Computed from Field Survey Data, 2004