TOPIC: ECONOMIC VALUATION OF KENYA'S MANGROVE FOREST: A CASE STUDY OF MIDA CREEK; KILIFI, KENYA.

Abstract:

The purpose of this paper is to suggest and then illustrate an approach to contingent valuation of renewable natural Resources that we feel has considerable theoretical and practical appeal. Valuation of a Mangrove forest is linked to the community's Willingness To Pay (WTP) for it's conservation. A bid curve is estimated to investigate the determinants of WTP bids. Special focus has been placed on the negative effect associated with deforestation of mangrove forests on the livelihood of the Kenyan rural population with consequent implications on the urban communities. The study also investigates the relationship between the recent trend in coastal area urbanization increase and mangrove deforestation.

Keywords: Valuation; Deforestation; Conservation; Preservation; Urbanization; Welfare

CONTENTS:

SECTION ONE:

1.1 INTRODUCTION:

This study investigates the economic value of mangrove forests in Kenya. The mangrove forests form one of the world's most extraordinary ecosystem that are most productive and biodiverse but are under threat. Profound Ecological benefits are reportedly derived from mangroves such as nursery grounds for numerous fish, shellfish, oyster colonies, prevents the soil from being washed away, coastal stabilization, filtration of land runoff and flood control (De la Cruz,1979). The mangroves also provide habitat for birds, other vertebrates and invertebrates (Paw&Chua, 1991;Kimani et al 1996).

Economically, the mangrove ecosystem serves as a source of important products to Kenya's coastal communities in the form of poles and timber as building material for boats and houses, firewood, salt, tannins, dyes, charcoal, and food as well as medicinal herbs (Macnae,1968; Walsh 1974) .

Mangrove forest in Kenya covers some 64990 ha representing about 1% of the total land area of Kenya and approximately 3.8% of the total forest cover in Kenya. Given the apparent wide range of significant economic and ecological opportunities, emerging threats due to the effects of mangrove deforestation are of great concern in the making of appropriate Kenya's urban and rural environmental policy.

1.2 BACKGROUND:

The fate of forests is currently an issue of major international concern. Burning forests as they are cleared for agriculture, timber extraction and industrial/tourism development abound with most appeals to save the forests being emotionally directed to raise funds to secure outright protection (e.g. The ongoing fencing project of the Aberdare forest in Kenya), especially where indigenous people are present or to assist with sustainable uses of the forests. Forests have economic value when they are conserved or utilised sustainably. There are various land use options for mangrove forests, if no use of the forest land is permitted or the mangroves are left alone ,we might refer this land use option as preservation. Maintaining the forest stock in broadly it's original state but allowing human use of it can be defined as conservation. There is a broad spectrum of conservation options like allowing limited logging with subsequent natural or managed regeneration of the removed timber, permission of harvests of forest products such as latex production, medicinal herbs, might be done without removing the stock of timber. Agricultural clearing on a shifting cultivation might likewise be practiced with full regeneration of the forest being allowed as a new plot is exploited. The basic idea remains that conservation involves use without there being significant destruction of the forest ecosystem. Above all, any use option of the land that produces irreversible effects is not a conservation use of the land. Development options would then include clearance for agricultural use without any intent of securing regeneration, clear-felling of timber without regeneration, removal of the forest for use of the land for infrastructure, e.g. a road or mining or industrial development.

1.3 STATEMENT OF THE PROBLEM:

Today the vital life support system is under threat due to failure by the communities to protect and rejuvenate their forests and failure to combat the twin problems of extreme poverty and the looming desertification. In developing world the livelihoods of more than a billion people depend on the production of farms less than two hectares in size, when only annual crops are grown, land degradation is the common result. Natural resources like the mangrove forests are decimated in the process they are stripped for fuelwood or timber or burnt to make way for more crops. Soil depletion, species extinction and poverty and hunger are the typical consequences. The answer is to provide farmers with options. For example, alternatives are provided for farmers in the Peruvian Amazon to replace the slash and burn programs which is a main cause of tropical deforestation and a major contributor to Global warming and poverty.

Over the years there has been massive deforestation of mangrove forests in Kenya's coastal region despite the forest department of Kenya's efforts to control overcutting and exploitation of the mangroves through licensing procedures. The exploitation of the mangrove ecosystem for poles and charcoal caused serious political concerns, with the Government of Kenya imposing a ban on the use

of mangrove poles for charcoal production in 1975; this was followed by a ban on the export of mangrove poles in 1982, a step that seriously affected the economy of coastal communities.

Indiscriminate cutting of mangrove trees in coastal environment has resulted in release of greenhouse gases, loss of canopy, loss of arboreal organisms and soil erosion in farm plots near the shoreline and creek zones. The ecological consequences have been disastrous, with the clearing of the mangrove forests for agriculture and other land use options, carbon and other greenhouse gases, i.e.toxic pollutants like methane are released. Deforestation of the mangrove forests has eroded the incomes of both the urban and rural coastal communities and it's being alluded that it has contributed to their impaired health status due to the effects of Air pollution (carbon dioxide) causing various health problems like skin cancer, impaired vision and blindness due to exposure to UV radiation, including incidences of death arising from exposure to toxic substances in the atmosphere this has not reflected positively on the coastal tourism industry .As a result the coastal communities have been calling for strict legislation on mangrove harvesting practices which appears to be accelerating the rate of air pollution,coastal soil erosion and the destruction of breeding grounds ,e.g. for pawns, crabs ,fish and pearl oysters.

There is still no clear Government policy Guidelines for the sustainable management of Kenya's mangrove forests and although mangrove cutters have to be licensed, their numbers are not controlled. Moreover, Kenya's Forest Department lacks sufficient resources to undertake large-scale forest operations, hence it's an accepted fact that Kenya's mangrove forests are threatened and there is an urgent need to invent sustainable mangrove management options.

1.3.1 **SUSTAINABLE FOREST ECONOMICS AND MANAGEMENT**

Logging for timber can be consistent with conservation if timber management regime practices sustainable forestry consistent with leaving the original ecosystem broadly intact. This requires effective natural forest management or the strong sustainability 'ss' view (Ecological Economics Approach) of selective cutting combined with natural regeneration to ensure that atleast some stocks of this environmental asset are prevented from rising or falling below certain threshold levels.

A self-regulating economic system is ecologically sustainable if it serves a set of consumption and production objectives that are themselves sustainable. But this is against the principle of consumer sovereignty that privileges the existing preferences and technologies. If therefore the existing preferences and technologies are not ecologically sustainable, it will be necessary either to regulate activity levels or to change the structure of preferences or both since in such circumstances consumer sovereignty implies system instability. In this context innovative economic incentives for forest resources like Area based forest taxation, Tradeable Reforestation credits, Forest management Bonds, long-term forest concessions, property rights changes etc will be used for sustainable development but would vary depending on institutional and other characteristics[2].

1.3.2 THE **CONCEPT OF STRONG SUSTAINABILITY 'SS' VIEW (ECOLOGICAL ECONOMICS APPROACH)**

Following the most publicized definition of sustainable development by the World Commission on Environment and Development (WCED 1993,43) also known as the Brundtland Commission, "as development which meets the needs of the present generation without compromising the ability of future generations to meet their own needs."

Environmental Economists have widely acknowledged the fact that SD is principally an equity, rather than an efficiency issue (Howarth and Norgaard, 1993.)And although efficiency is a necessary condition it fails to be a sufficient condition since this involves equity both within generations (intragenerational equity) and across generations (intergenerational equity) (Hanley N.1997).

The strong sustainability 'ss' view includes a commitment to protect the health and integrity of ecological systems (Norton, 1992). The London School of Economics argued that a non-declining stock

[2] For further exposition of suitable economic incentives for sustainable forestry see, Panayotou, T. "Economic Instruments For Environmental Management And Sustainable Development". International Environment Program, Harvard Institute for International Development ,Cambridge: Harvard University.(1995)

of natural capital overtime is a necessary condition for sustainability in production processes hence fulfills the just or fair compensatory bequest to future generations. This is a rule that requires that the critical capital or natural capital k_n (non-substitutable) be constant by constantly monitoring and measuring k_n using physical indicators which implies a changing economic resource allocations overtime and not a steady state, stationery economy. Therefore the 'ss' view is consistent with the concept of ecological sustainability which is a fundamental requirement in sustainable development

1.4 OBJECTIVE OF THE STUDY:

The broad objective of the study is to investigate the economic value of Kenya's mangrove forest using contingent valuation method with an attempt to formulate a suitable policy for the Kenya government for sustainable management of it's indigenous mangrove forests resources while looking into possible ways of conserving it.

1.5 SPECIFIC OBJECTIVES:

(1) To estimate the community's willingness to pay (WTP), for the conservation of Mida Creek mangrove forest.

(2) To investigate the link between mangrove deforestation and urbanization.

(3) To assess the effectiveness of Kenya Government's policies in the conservation and protection of Mida Creek mangrove forest.

1.6 HYPOTHESES:

1.Ho: The local community will be willing to pay (WTP) for the conservation of Mida Creek mangrove forest.

H_1**:** The local community will not be willing to pay (WTP) for the conservation Mida Creek mangrove forest.

2.Ho: There will be a significant relationship between mangrove deforestation and Urbanization.

H_1: There will be no significant relationship between mangrove deforestation and urbanization.

1.7 SIGNIFICANCE OF THE STUDY:

No study has been done on the economic value of Mida Creek mangrove forest using the contingent valuation studies. Therefore, it is of great importance to investigate the applicability of the methodology in trying to solicit the community's participation in the conservation of Mida Creek mangrove forest to primarily sustain the livelihood of the community.

By the use of the contingent valuation method incorporating baseline economic valuation methodologies, the value of the true benefits derived from mangrove forests ecosystem and biodiversity will be realized. The outcome of this study, in a narrow sense, is intended to provide a base value for the mangrove forest from the viewpoint of people who use it for livelihood purposes (user value) and a value from society's point of view (existence value).

Mida Creek will then serve as base area of study, of which the results can be generalized to other mangrove forest areas of similar nature in Kenya or Africa.

1.8 UNIT OF ANALYSIS:

The study will employ the conventional Household as a unit of analysis. This usually consists of a person or a group of persons, who live together in the same homestead/compound but not necessarily in the same dwelling unit, have common housekeeping arrangements and are answerable to the same household head. It is important to remember that members of a household are not necessarily related (by blood or marriage).

SECTION TWO

2.1 METHODOLOGY; Data Type, Sources and Methods

The data to be used is primary and if possible secondary data from Kenya Marine and Fisheries Research Institute, Mombasa Kenya [KMFRI], Ministry of Environment and Natural Resources, International Union for Conservation of Nature [IUCN] ,Kenya Wild Life Service[KWS]and Kenya Forest Research Institute [KEFRI].

Open ended, closed questionnaires will be used to solicit the primary data required. Three Questionnaires will be administered, the first will elicit responses on background information that will be used to check expected relationships. The second one will look into the mangrove deforestation and the third one will look into the individual willingness to pay to conserve the mangrove forest.

2.2 THEORETICAL MODEL

Following Dasgupta (1982) we have a model of the environment as a Renewable Natural Resource which has typically reflected aggregate wellbeing with a set of (agent-relative) accounting prices whose use in estimating the National Net Domestic Product, ensures that the measure reflects aggregate wellbeing (see Dasgupta and Weale, 1989)[3]. However, this model is a statement of principle since in practice and especially for natural resources like forests, estimates of net domestic products are biased ,in that prices which are used for valuation are systematically different from their accounting prices. Normally the accounting prices for natural resources are positive but their values are set at zero in estimates of net domestic product. (i.e. A reduced form of aggregate well-being)[4].

Samuelson (1961) and Weitzman (1976) showed that real net domestic product (by definition; the sum of the social or accounting value of an economy's consumption's and the social value of the changes in it's stock of real capital stocks) at any date along an optimal economic path reflects it's long-run consumption possibilities.

To make this precise, assume Aggregate wellbeing in an economy at any given date (t) depends on:

(1) The flow of consumption, C(t)
(2) The stock of assets , S(t)[5]
(3) Quality of environment, Q(t)

Let U(C(t),S(t),Q(t))…….(1)…..Flow of aggregate wellbeing at t.

Using the all purpose commodity as our numeraire, we can show that;

(1) $\partial u/\partial c(t) = U_c$ >or < 0; (2) $\partial u/\partial s(t)=U_s$ >or < 0; (3) $\partial u/\partial Q(t) = U_Q$ >or<0

Real net domestic product Y(t) in this economy should read as:

$$Y(t)= C(t) + d S(t) / dt +(U_s/U_c)S(t)\text{…….(2)}$$

In equation (2) U_s and U_c are respectively ,the marginal aggregate wellbeing of resource stock and consumption flow.

The budget constraint ,which specifies a consumer's optimization problem is:

[3] The technical restriction amount to the requirement that both the set of feasible allocations and the social ordering reflecting well being are convex.

[4] Aggregate well being is strictly concave in consumption.

[5] For simplicity of exposition, we shall think of an economy possessing a single all-purpose environmental good e.g. Building poles from the mangrove forest.

$$Y - \sum_{t=1}^{n} P_t\, C(t) - S(t) > 0 \ldots\ldots\ldots\ldots (3)$$

(1) This is income minus the sum of consumption expenditures

$$\left[\sum_{t=1}^{n} P_t\, C(t)\right]$$

(2) P_t is taken as price of consumption goods.

$t=1,2\ldots.n$

To get the marginal willingness to pay (MWTP) for environmental quality for a particular consumption activity; we maximize equation (1) subject to (3).

We obtain;

$$U_c / U_s = - \left[\sum_{t=1}^{n} P_t\, d\, C\,(t) / d\, Q(t) + d\, S(t) / d\, Q(t) \right] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

This gives the marginal willingness to pay for environmental quality.

From equation (2) the second term on the right hand side denotes the depreciation of environmental capital in our case being deforestation/loss of the mangrove forest.
The final term in this equation is alluded as follows:

If the stock is directly beneficial (as with the reportedly ecological benefits of mangrove forests in coastal stabilization, flood control, ozone layer protection, etc), U_s is positive.

If it is damaging (as with atmospheric pollution associated with mangrove slash and burn harvesting practices) U_s is negative.[6] Therefore neglecting environmental resources in national accounting would lead to an overestimation of aggregate wellbeing.

[6] Notice that a commodity can have direct wellbeing effects, which are deleterious even while being indirectly beneficial because of the consumption benefits it provides. Pollutants like pesticides have this common property .The model in our study is merely illustrative proper model of pollution would lead us to the idea of negative accounting prices.see Dasgupta (1982 ch.8).

2.2 EMPIRICAL MODEL.

Data on WTP collected from Contingent Valuation surveys are normally in one or both of the following settings:

- Cross section primary data
- Cross section secondary data

A cross section is a sample of observed units all drawn at a given point in time. Normally the WTP data is one where the observations at or below zero are censored. This calls for the application of the Tobit model, which is merely an extension of the probit model and is mainly applied when we have censored data. This approach follows to a large extent that of Agresti, A., et al. (2000), which applied the contingent valuation WTP question to a household survey on the benefit of greenhouse gases reduction policy in Korea.

Recently Discrete choice questionnaires have been advocated for valuing environmental benefits following the report by the National Oceanographic and Atmospheric Administration (NOAA). It is argued that discrete choice questions offer a more realistic market and lead to more valid responses. (Shabman, l., and K. Stephenson, (2000).

The standard Tobit model to be used is based on the following latent variable model:

$$Y_i^* = X_i\beta + \varepsilon_i \qquad [2.2.1]$$

$$Y = \begin{cases} Y_i^* & \text{if } Y_i^* > 0 \\ 0 & \text{if } Y_i^* \leq 0 \end{cases}$$

Where:

(a) X is a vector of explanatory variables.

(b) $Y = Y_i^*$ is a vector of WTP for (household, i) censored at zero with the latent variable observed only if $Y_i^* > 0$ .Y for example is the willingness to pay for conservation of mangrove forests given the respondents characteristics X.

(c) β is a vector of the unknown parameters to be estimated.

(d) ε is an error term; $\varepsilon \sim N(0,\sigma^2)$ distributed.

The likelihood function of the Tobit representation shown above is;

$$L = \prod_{y \leq 0} \left[1 - \Phi\left(\frac{X_i\beta}{\sigma}\right)\right] \prod_{y>0} \frac{1}{(2\Psi\sigma^2)^{1/2}} \exp\left[-\tfrac{1}{2}\frac{(y_i - X_i\beta)}{\sigma^2}\right]$$

Taking the logs;

$$L = \sum_{y \leq 0} \ln\left[1 - \Phi\left(\frac{X_i\beta}{\sigma}\right)\right] + \sum_{y>0}\left[\ln\frac{1}{(2\Psi\sigma^2)^{1/2}} - \tfrac{1}{2}\frac{(y_i - X_i\beta)^2}{\sigma^2}\right]$$

The first part resembles that of the probit where the observed dependent variable Y takes on one of the values 0 and 1, with a normal distribution of the disturbance term.
The second part of log likelihood function resembles that for the conventional OLS on those sample points that are not censored i.e. $Y^* > 0$.

In the analysis of censored data, Estimation is by MLE. The Standard Tobit model imposes the conditions that the relationship generating the ones and zeros is the same process that produces the positive values. Amemiya (1981) has shown that maximizing the function produces an estimator with all the usual desirable properties assumed for MLE. Hessian is always negative definite as such Newton's method of iterations is simple to use and usually converges quickly.

The widely used Tobit is unfortunately not robust to heteroscedasticity and as it turns out, this problem is much more vexing than in the probit or the standard linear model. However, recent developments due to Powell, J.,(1984) have allowed consistent estimation of the tobit ,even in the face of heteroscedasticity.

A priori factors influencing WTP represented by the X vector are;

Y= Income of the individual
AG= Age of the individual
HS= Size of the household
PB= Price of building poles
PC= Price of charcoal/fuelwood
ED = Education level of the individual
MS = Marital status
SX= Sex of respondent
HH= Household head
MD= Rate of mangrove deforestation

Apart from the first five variables, all the rest are dummy variables and are defined as;

ED: 1=Secondary education level and above
0= Below secondary education
MS: 1=Married
0=Single
SX: 1=Male
0=Female
HH: 1=Respondent is Household head
0=Not Household head
MD: 1=Rate of mangrove deforestation is high
0=Not high

To specify the monetary values, we will use the general model of the form,

$WTP=f(Y,AG,HS,PB,PC,ED,MS,SX,HH,MD)$ …….[2.2.4]

Then the model assumes a multiplicative form of;

$WTP=\alpha Y^{\beta 1}.AG^{\beta 2}.HS^{\beta 3}.PB^{\beta 4}.PC^{\beta 5}.e^{k}$…….[.2.2.5]

Where;
e= is the exponential
k= Vector of all the above dummy variables.
$k= \beta 6ED+ \beta 7MS+ \beta 8SX+ \beta 9HH+\beta 10MD$

Taking the natural log of equation [2.2.5] we get a log linear function of the form;

$$InWTP=\alpha+\beta 1In[y]+\beta 2In[AG]+\beta 3In[HS]+\beta 4In[PB]+\beta 5In[PC]+\beta 6ED+\beta 7MS+\beta 8SX+\beta 9HH+..$$
$$..+\beta 10MD+e\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots[2.2.6]$$

The estimation of equation [2.2.6] will give elasticity's with respect to the quantitative explanatory variables while the coefficients attached to the dummy variables will give their respective differential intercepts, showing how each of the retained categories relate to the base variable, the one that has been dropped.

2.4 Estimation Techniques

The data will be screened using the SPSS software. Then use Intercooled STATA 7 for estimating the Tobit and log-linear functions stated above.

SECTION THREE

3.1 LITERATURE REVIEW:

This chapter deals with the fundamental forces giving rise to forests deforestation and mangrove forests in particular . It also evaluates the CVM methodology in terms of it's theoretical framework conventional biases involved and the divergence between WTA and WTP valuations.

3.2 FUNDAMENTAL FORCES GIVING RISE TO FORESTS DEFORESTATION:

Various factors have been responsible for mangrove forests deforestation but the two fundamental forces are:

(a) Competition between humans and non-humans for the remaining ecological niches on land and in coastal regions. In turn, this competition reflects the rapidly expanded population growth of developing countries (i.e. the urbanization problem);and
(b) 'failures' in the workings of workings of the international and national economic systems.' 'Failure' in this sense means the failure of these economic systems to reflect the true value of environmental systems in the working of the economy. Essentially many of the functions of forests are not marketed and, as such, are ignored in decision-making. Additionally, decisions to convert forests are themselves encouraged by fiscal and other incentives for various reasons.

In a comprehensive view we would need to add misdirected past policies by bilateral and multilateral aid agencies, corruption, the indifference of much big business to environmental concerns, the results of international indebtedness, and poverty itself (Brown and Pearce,1994b)

3.2.1 Competition for space (the urbanization problem);

Population pressure has contributed to mangrove forest loss/deforestation because of the competition for space between man and nature as evidenced by conversion of land to agriculture, aquaculture, infrastructure, urban development, industry and unsustainable forestry. Table 3.1 shows land use conversions by world region between 1979 and 1991.

Table 3.1 Land conversions

	Area(million hectares)				
	Cropland	Pasture	Forest	Other	Total
Africa	+9	+8	-26	+11	+1
N. and C.America	-2	+4	+2	-4	0
S.America	+13	+21	-42	+11	+3
Asia	+6	+66	-26	-43	+3
Europe	-2	-3	+1	+4	0

Notes: Other land includes roads, uncultivated land, wetlands, built-on-land.The forest column Suggests annual loss rates of about 9 million ha.

Source: Estimated from World Resources Institute (1995), Table 17.1.

The loss of the worlds forests, rich sources of biodiversity, is apparently specially in S.America but also in Asia and Africa .The loss rate expressed as a percentage of 1981 forest coverage similar in this three regions: 3.8% in Africa, 4.9% in Asia, and 5.1% in S.America. Unless the reasons for this conversions are understood the outlook for the conservation of biodiversity looks bleak. The conversions appear to be mainly to pasture, with cropland and 'other' land uses roughly cancelling each other out.
Population increase in these regions has been associated with land conversion linkages: each (net) individual added to the population in the 1980's was associated with 0.16 hectares of land conversion in Africa, 0.13 hectares in Asia and 0.75 hectares in S.America.Population increase (urbanization indicator) in Kenya and the coast has seen a marginal increase in the share of coast to the total population as shown in Table 3.2 below;

Tables 3.2:Urbanization increase indicators in Kenya's Coastal Province;

	1969	1979	1989	1999
Coast	944,082	1,342,794	1,825,761	2,487,264
Kenya	10,942,705	15,327,061	21,448,774	28,686,607

Source: Republic of Kenya.

3.2.2 Economic Failures

Market failure means that the interplay of market forces will not secure the economically correct balance of land conversion and land conservation. This is because those who convert the land do not have to compensate those who suffer the local consequences of that conversion for example; extra pollution to urban dwellers from carbon dioxide emission after forest conversion /deforestation.

Panayotou (1993) provides a convenient listing of local market failure:

(a) ill-defined or non-existent property rights;
(b) missing markets;
(c) high transaction costs inhibiting trade in conservation benefits;
(d) publicness of conservation benefits;
(e) market imperfections such as monopoly;
(f) myopia and hence high discontinuities;
(g) uncertainty and risk aversion;
(h) irreversibility.

A second explanation of deforestation is 'intervention failure' or 'government failure'-the deliberate intervention by the government in the working of market forces. For example, failure to tax logging companies sufficiently, giving them an incentive to expand their activities even further; the encouragement of inefficient domestic wood processing industries, effectively raising the ratio of logs and hence deforestation.

3.2 THE CONTINGENT VALUATION METHOD (CVM) FRAMEWORK:

3.3.1 INTRODUCTION

CVM has emerged as the principle means for estimating the value of non-market goods like the environmental resources, which possess both, use values and non-use values (passive use value)[7] . CVM is a survey based value elicitation approach which queries individuals in systematic ways to estimate a willingness to pay for better environmental management or greater preservation, comparable to estimates obtained through observations of market transactions.

The monetary measure of a change in an individual's wellbeing due to a change in environmental quality is called theTotal Economic Value [TEV] of the change in the environmental quality.It measures preferences of individuals for changes in the environmental good in question.The questions that are asked are usually in the form of a bidding game involving 'yes/no' answers to questions regarding maximum WTP and minimum WTA.Econometric techniques are then employed to find the mean bid values of WTP.This is supported by Rubinfield and Pindyck (1989) who alludes that the most direct way to obtain information about demand is through direct interviews in which consumers are asked how much of a product they might be willing to buy at a given price.

3.3.2 CONVENTIONAL BIAS ISSUES IN CVM:

Following Smith and Desvousges (1986), and Kristrom (1990), CVM is an expressed preference valuation method and as such is inherently susceptible to various types of bias. The conventional classification partitions CVM bias into general, procedural and instrument types. The general bias entails both free riding and strategic bias, typically environmental goods are non-excludable in consumption or are non-rivalries in the sense that providing them to one provides them to all and consumption by one does not diminish consumption by others. Samuelson, (1954) observed that for a public good there is a tendency for an individual to 'pretend to have less interest than he/she really has and therefore to understate his/her WTP on the assumption that others will pay for it's provision which he/she will then enjoy (the free-rider problem).

Varian (1984) notes that such behaviour in CV studies will depend upon both the respondents' perceived payment obligation and his/her expectation about the provision of the good. Hence the instrument related bias entailing the payment vehicle concludes from a number of studies that WTP varies depending on whether an income tax increases or some entrance fees is used (Rowe, et al,(1980).

In procedural bias we have the prevalence of aggregation bias where the estimation of some spatially fixed environmental goods such as mangrove forests using on-site surveys normally ignores the non-use values held by non-visitors. Such surveys therefore can only claim to estimate non-use values (see for example Brookshire et al. 1983) when aggregated over a larger non-visitor population, total non-use value may be significant and may even exceed total use value as a significant factor.

3.3.3 DIVERGENCE BETWEEN WTP AND WTA VALUATIONS

Because of the divergence between WTP and WTA valuations, many practitioners have taken the pragmatic decision to regard stated WTP valuations as reliable measures of the true WTP and therefore to use CVM only in cases in which WTP is the appropriate measure of benefit. But this raises the question as to what is the exact set of cases in which WTP is appropriate. Harris and Brown (1992) have argued that WTP is in fact the most appropriate measure of welfare change for a majority of situations. They identify only self-interested losers from a resource change as the appropriate groups to be surveyed with WTA format questions.

A mail survey of Idaho taxpayers undertaken in (1988) by the same researchers indicated that 53% of the sample felt that all taxpayers should pay for the loss of non-game wildlife with tax dollars (a WTP rather than WTA approach). Only 32% of the survey respondents said that only those responsible for the loss should pay to prevent it (WTA).Therefore altruism and moral responsibility play an important role in influencing policy judgements.

[7] Passive use values refer to values derived from utilization of the goods in ways, which are not directly linked to observable behaviour. They are also referred to as non-use and indirect use values in the literature.

A significant body of empirical evidence has been developed which provides convincing evidence that WTP and WTA measures are quite different measures of welfare. Willig (1976) developed a precise analytical expression of the size of this divergence. He showed that in a wide variety of priced normal goods or market situations this divergence would be relatively small (thus promoting Marshallian consumer surplus as a valid welfare measure), so long as there was absence of strong income effect.[8] However, this divergence will clearly increase with greater income elasticity.

Hanemann, (1991) simulates WTP and WTA levels for a generalized CES utility model under a variety of assumptions .He confirms the inverse relationship between elasticity of substitution measure and the WTA/WTP ratio i.e. for unique and irreplaceable environmental goods (Hanemann cites Yosemite National Park as an example) with very low substitution elasticities. In this context we should expect WTA to be much greater than WTP as shown in table 3.1 below.

Table 3.1
Empirical divergences between WTP and WTA

STUDY	WTA/WTP RATIO
Knetsch and Sinder (1984)	4.0
Coursey et al. (1983)	3.8 1.6
Brookshire et al.(1980)	1.6 2.6 6.5
Bishop and Heberlein (1979)	4.8
Banford et al.(1977)	2.8 4.2
Hammack and Brown (1974)	4.2

Source: adopted from Pearce and Markandya (1989).

[8] A result confirmed by Just et al. (1982) who also show that the Willig approach may be generalized to the multiple price change case (1982,375-86).

SECTION FOUR

4.1 AREA OF STUDY; MIDA CREEK, KENYA:

Mida Creek or Watamu Marine National Reserve is situated 100km north of Mombasa in Kilifi district. The reserve was established in 1968,it contains natural elements such as mangroves, coral reefs, and mud flats and is a sanctuary for shorebird populations. Seven of the nine mangrove species found in Kenya are found in Mida, and occupy a total area of 1746 ha. The dominant species are *R. Mucronata, C.Tangal* and *A.Marina* .The mangroves of Mida are separated naturally by the main creek and the two areas are named according to the nearby local villages or islands: Kirepwe and Uyombo Fig 2). In the framework of this study this two areas will be sampled separately and compared. Kirepwe covers the eastern side of the creek and includes mangroves near the villages of Sita, Dabaso and Dongokundu .In the area of the forest approaching Sita seaward (fig.2), trees attained a height of 20m and a diameter above 18cm.There are 573 ha of mangroves in Kirepwe. Uyombo, on the western side of the creek, stretches between the villages Uyombo and Majaoni.Because of a large intertidal area, there is a marked difference in the vegetation structure of the seaward and the landward forest in Uyombo. The landward forest is mostly dwarf *A.Marina* while the seaward forests consists of tall *R.mucronata*. The total mangrove cover in Uyombo is 1172ha.

The mangrove forest of Mida plays an important role as life support for the Watamu Marine National Reserve. This is in addition to the profound ecological benefits reportedly derived from mangroves such as coastal stabilization, filtration of land run of land run off and flood control.

REFERENCES:

Amemiya,T.,(1981),“ Qualitative Response Models : A Survey” *Journal of Economic Literature,*vol.19 481-536.

Bjornstad, D.and Khan, R. ed.,(1996),*The Contingent Valuation of Environmental Resources.*UK,Edward Elgar Publishing company.

Brookshire, D.S et al., (1983), Estimating Option Prices and Existence Value for Wild life Resources ,*Land Economics 59,1-15.*

Brown, K. and Pearce, D.W.(eds) (1994b),*The Causes of Tropical Deforestation:The Economic and Statistical Analysis of Factors Giving Rise to the loss of the Tropical Forests,* University College Press, London,and University Of British Columbia Press, Vancouver.

Dasgupta, P.(1991). “The Environment as a commodity,”*Economic Policy Towards the Environment. Cambridge* USA: Blackwell Publishers.

Grigalunas, T.A. and Congar, R. ed., (1995). “Environmental Economics for Integrated Coastal Area Management: Valuation Methods and Policy Instruments.”*Regional Seas Reports and Studies:* No.164.UNEP.

Harris,C. and Brown,G.,(1992),Gain ,loss and personal responsibility: The role of motivation in resource valuation decision-making. *Ecological Economics* 5, 73-92.

Howarth, R.B., and Norgaard ,R.B., (1992) Economics and sustainability or the sustainability of economics : Different paradigms.*EcologicalEconomics* vol.4.93-116.

Just et al.,(1982), *Applied Welfare Economics and Public Policy.*Prentice Hall,England Cliffs,NJ.

Kairo, J.G., et al. (2002), “Regeneration Status of Mangrove Forests in Mida Creek, Kenya: A compromised or Secured Future”? *Ambio* vol.31 No.7-8.

Kristrom,B. (1990), *Valuing Environmental Benefits Using the Contingent Valuation Method-An Econometric Analysis* ,Umea Economic Studies No.219. University of Umea, Sweden.

Norton, B.G. (1992),Sustainability, human ,welfare and ecosystem health. *Environmental Values* vol.1, 97-111.

Panayotou, T.(1993), *Green Markets*: The Economics of sustainable Development, Institute for contemporary Studies Press, San Francisco.

Pearce D.W. and Turner, R.K. (1990), *The Economics of Natural Resources and the Environment,* London, Harvester-Wheatsheaf.

Perrings, C. et al.(1992).The ecology and economics of biodiversity loss. *Ambio* 21, 201-11.

Powell, J.,(1984), “Least Absolute Deviations Estimation for the Censored Regression Model,” *Journal of Econometrics ,vol.25,303-325;*and,vol.54.

Republic of Kenya,(1999),*Population and Housing census vol. 1* ;Central Bureau of Statistics,Ministry of Finance and Planning.

Ronnback, P., et al. (2002),“ Coastal Aquaculture Development in Eastern Africa and the Western Indian Ocean: Prospects and Problems for Food Security and Local Economies.” *Ambio* vol.31 No.7-8.

Rowe, R.D.,(1980), An experiment on the economic value of visibility. *Journal of Environmental Economics and Management* vol. .7,1-19.

Samuelson,P.,(1954), The pure theory of public expenditure. *Review of Economics and Statistics* 36, 387-9.

Smith, V.K., and Desvousges ,W.H.,(1986), *Measuring Water Quality Benefits*. Kluwer-Nijhoff, Boston.

Turner, R.K (ed.)(1988a). *Sustainable Environmental Management*: Principles and Practice.Belhaven, London.

Willig, R. D, (1976), Consumer's Surplus without apology. *American Economic Review* vol.66, 587-97.