WILLINGNESS TO ACCEPT COMPENSATION TO STOP CHARCOAL TRADE; A CASE STUDY OF CHARCOAL TRADE IN WEBUYE AND ITS ENVIRONS

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DECLARATION

I hereby declare that this project paper is based on my original work. I also declare that it has not been previously or concurrently submitted for any other degree at any other University.

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Date 26th, October 2011

This research paper has been submitted for examination with the approval of us as University Supervisors:

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DEDICATION

This work is dedicated to my mother Mayi Rodah KwaMuganda I always hear her praying for me saying, "Nyasaye Linda Omwana uno"

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First and foremost, all my thanks are due to God Almighty, His grace and guidance has given me the utmost strength to be able to complete my project.

I would like to extend my heartfelt gratitude to my supervisors, Dr Jane Mariara and Dr. John K. Gathiaka for having confidence in me, for guiding me throughout the toughest time during my research and for inspiring me. Their advice throughout my study is much appreciated.

I would like also to express my deepest gratitude and appreciation to my beloved family, my mum Mayi Rodah KwaMuganda, my dear wife Tabitha and children Joan, Brent, Jerioth, Innocent and Martha. I greatly appreciate their patience and apologies for the time taken away from all of them, but they are always in my heart. Mayi, you stood in the gap for me through your incessant prayers to God. Your prayers and wishes form the foundations and pillars of my success. Thank you, Mayi.

I would like to express my gratitude to my friends who were very supportive and helpful and to all those names are not mentioned here in one way or another contributed to the success of this study.

I also thank charcoal traders at Webuye. This paper would be incomplete without their acceptance to respond to the questionnaire.

Lastly, the results of this study are my own ideas as the author and not of those mentioned above. I therefore stand solely responsible for the contents and shortcomings contained therein.

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LIST OF ACRONYMS

ACK - Anglican Church of Kenya

CDF- Cumulative Distribution Function

CVM- Contingent Valuation Method

DC- Dichotomous Choice

E(Y) - Expectation of Y

FAO- Food and Agricultural Organization

ILO International Labour organization

MDGs- Millennium Development Goals

VIF- Variance Inflating Factor

ABSTRACT

Environmental issues are at the forefront of global media and political debates. Around the world, people are increasingly becoming aware that economic activity can generate significant environmental damages, with potentially serious repercussions for human welfare. It is increasingly recognized that forests provide a range of goods and services, some of which have significant economic value. These include fertile soil, timber, non-timber products, recreation, landscape value and a wide range of environmental benefits such as climate regulation, watershed protection and the conservation of biodiversity. Conservation of trees is a merit good with a lot of social benefits. The biggest challenge today is how to maintain equilibrium between human beings, the ecosystems and development and how to meet the needs of human beings without necessarily compromising the quality of the environment. There is therefore a conflict between meeting the needs of human beings and conservation of trees.

The general objective of the study was to estimate the value of trees around Webuye town, through determination of appropriate monetary values based on willingness to accept (WTA) compensation of charcoal traders in order to forgo trading in this product. Primary data using a questionnaire is collected from 148 respondents who are charcoal traders. A Tobit model is because the questionnaire was open-ended, eliciting a continuous variable of the amount to be compensated and the need to take care of the zero responses.

It is hypothesized that willingness to accept depends on the knowledge of charcoal traders on issues to do with environmental protection and conservation. Environmental conservation knowledge is important in informing whether the respondents will be willing to leave activities that are detrimental to the quality of the environment. The study establishes that environmental knowledge on conservation is quite significant. Another significant variable is the number of children that the respondent has in the household which has a negative relation with willingness to accept. Therefore, educating local communities on the importance of environmental conservation is important in order to built knowledge capacity to communities on environmental issues.

Chapter One:
Introduction

1.1 Background Information

Environmental issues are at the forefront of global media and political debates. Around the world, people are increasingly becoming aware that economic activity can generate significant environmental damages, with potentially serious repercussions for human welfare. Concern for the world's forests, has climbed to the top of the international policy agenda over the last fifteen years (FAO 2002). Many activities carried out by man have undermined and put the existence of the environment in jeopardy. Environmental degradation is continuously on the increase, hence need for remedies to mitigate this problem.

The world contains billions of trees that are of great value to man. All trees make a contribution to the environment and to the social and economic well being of humankind. Trees can be found in the forest and outside the forest. The relationship between people and the natural support system, especially forests and trees is dwindling with time due to overuse of these resources. Many people are depending on forests and trees for subsistence and income generation. Tree products at local markets are gradually on the increase whereas the resource is on the decline. The result is that the wood removal is exceeding sustainable growth of trees resulting in forest degradation. Almost 1.6 billion people in the world rely on forest resources for their livelihood (World Bank 2001) and 1.2 billion people in developing countries use trees on farms to generate food and cash (ILO 2002).

Use of wood, as a source of energy, dates back to the distant ages of human life. Wood fuel was and still remains the basic source of energy to many households in the world. Wood can be used as a source of energy either as firewood or charcoal. Majority of poor rural people in the developing world depend on wood as a source of energy. According to Persson, et al. (2003), there are about three billion people in the developing countries who are depending on wood fuel as a source of energy.

The wood that is used as fuel is derived from forests. This puts the existence of forests in danger since harvesting is done at a faster rate than the growth. Therefore the most likelihood is that trees are going to be cleared and the world will remain bare. Forests are renewable environmental resources in the sense that if the harvesting rate is less than the growth rate, then the forests will be sustained.

Kenya is a developing country and therefore a candidate to environmental degradation caused by the continued use of wood fuel. The role of the forests for Kenya's economy and biodiversity is vital. A majority of the population in Kenya depends on wood fuel as a type of energy for their daily activities. Records indicate that over 67% of the energy requirements of the country are wood based fuels (Ministry of Energy, 2002). Some 90% of households' energy used in Kenya is based on wood. In addition to energy production, forests are also source for poles, timber and pulpwood. Forests are also important groundwater distillation areas. For biodiversity and for ensuring the multiplicity of species the role of forests is important. Although forests cover only a small proportion of Kenya's land area, they contain a great proportion of the total biodiversity in country.

Wood fuel in Kenya is composed of either fuel wood or charcoal. Fuel wood is mainly used for cooking in rural areas while urban households use charcoal as a source of energy for cooking. Majority of the rural people use fuel wood because it is readily available within their surroundings. High dependency on wood fuel has a direct impact on the environment as more vegetation is harvested for firewood and trees cleared for charcoal burning to cater for the urban population. 82 % of the urban households use charcoal as their source of energy in Kenya (Republic of Kenya 2004).

Rising population and high poverty levels in developing countries are regarded as the major causes of increased use of wood fuel as a source of energy. Most of the poor and middle class households in Kenya use wood fuel for their energy needs because the

commodity is cheaply available in their surroundings. The cost of wood fuel is lower compared to other forms of energy like kerosene, Liquefied Petroleum Gas (LPG) and electricity. Hosier (1984) says that wood fuel is an inferior good and increased poverty levels will tend to increase its demand. When the income of households increases, then they will shift from this type of energy to kerosene, LPG or electricity.

1.2 Importance of Forests/Trees

It is increasingly recognized that forests provide a range of goods and services, some of which have significant economic value. These include fertile soil, timber, non-timber products, recreation, landscape value and a wide range of environmental benefits such as climate regulation, watershed protection and the conservation of biodiversity. Many valuable non wood forest products are such as, parts of plants for medicinal use, tanning compounds and waxes, extractives such as bark, dyes, fibres, gums, latexes, oils, resins, food such as, flowers, fruits, honey, nuts, leaves, seeds and spices and other products such as fuel-wood and bamboo. Forest benefits may be grouped into general categories. This follows a typology introduced by Pearce et al. (1988), which recognizes three types of environmental value.

1.2.1 Direct use value

The benefit of using forest resources as input to production or as a consumption good. Direct uses of forests include both commercial and non-commercial activities. Commercial uses such as timber production may be significant in both domestic and international markets. Non commercial direct uses, on the other hand, are often mainly local but can be very important for the subsistence needs of rural populations and poorer groups, e.g. fuel wood, edible and medicinal plants. Direct uses also include important services such as forest recreation, education and research, which are often conducted on a non-commercial basis.

1.2.2 Indirect use value

This comprises of the indirect support and protection provided to economic activity and property by natural forest functions, or forest environmental services. Indirect use values

comprise the many ecological functions of forests. Their value derives from supporting or protecting economic activities that have directly measurable market benefits. For example, some forests may have indirect use value through controlling sedimentation and flood damage that affects downstream agriculture, fishing, water supplies and other economic activities. Another important indirect use value associated with forests is the storage or sequestration of carbon in trees, offsetting the atmospheric accumulation of greenhouse gases that cause global warming. During the process of photosynthesis all green plants take in carbon dioxide and give off oxygen. Trees help to maintain low levels of carbon dioxide, thereby reducing the greenhouse effect, which threatens to make the earth uncomfortably warm.

1.2.3Non-use value

This includes all other benefits which cannot be characterized in terms of a current or future physical interaction between the forest and consumers. Non-use values refer to the intangible benefits derived from the mere existence of forests, above and beyond any direct or indirect use value that people may enjoy. Non use values include both existence value and bequest value. An example of existence value is the value, which people attach to the continued existence of certain species of wildlife found in a particular forest areas (e g birds). Bequest values arise when people place a value on the conservation of particular resources for posterity (future generations). Bequest values may be high among local populations using or inhabiting a forest area, to the extent that they wish to see a way of life with the forest passed on to their heirs. By the same token, those who live far from forests may wish to ensure that their descendants have an opportunity to visit and enjoy them.

1.2.4 Option value

Option value of forests considers both the direct and indirect use values of forest/trees, which might be realized in the future. For example, forest resources may be under utilized today but may have high future value in terms of scientific, educational, commercial and other economic uses. Similarly, the environmental regulatory functions

of a forest ecosystem may become more important over time as economic activities develop and spread.

Forests in Kenya are of great importance. They help to maintain constant supplies of good quality water. Loss of forests has been blamed for everything from flooding to aridity and for catastrophic losses to water quality. Evapo-transpiration from the leaves of forest plants and trees helps creates clouds and thus rainfall. Experiments have shown that, where forests have been cleared, rainfall may decline and, without tree cover, the ground becomes hot and dry.

Forests alter the environment in which we live by moderating climate. Climate control is obtained by moderating the effects of sun, wind, and rain. Radiant energy from the sun is absorbed or deflected by leaves of trees. We are cooler when we stand in the shade of trees and are not exposed to direct sunlight. Forests can affect wind speed and direction. The more compact the foliage on the tree or group of trees, the greater the influence of the windbreak. Trees intercept water, store some of it, and reduce storm runoff and the possibility of flooding.

Forests also help to regulate soil erosion and hence reduce sediment load, although the extent and significance of this will vary. Forested catchments can also have important local impacts in regulating water flow, for example for communities in upland areas. In addition, the undisturbed forest with its leaf litter and organically enriched soil is the best watershed land cover for minimizing erosion by water.

In Kenya, forests occupy a small section of the total land area, but despite the relatively small forest cover, there is a high dependence on forest for provision of wood and non-wood products. As noted by Mogaka et al, (2001), it is estimated that about 3 million forest adjacent dwellers in Kenya depend on forests for provision of all households' wood and non-wood products need.

Forests also provide a very important service in the new and growing leisure industry, which involves the non consumptive use of biological diversity, for example eco-tourism

and other activities. Forests also provide very important ecosystem services that are generally considered to be free.

1.3 Statement of the Problem

Forests play a very crucial role in the sustainability of human life. Management of such resources should take a leading role in the policies of the country to ensure that the life of tomorrow is not compromised as a result of current human actions. We need a clean environment, where trees will sequester carbon from the atmosphere. The destruction of forests/trees is one of major contributors to global climate change, as many trees are burned, releasing carbon dioxide into the atmosphere. Forests are regarded as the lungs of the planet in the sense that they absorb carbon dioxide, thereby acting as sinks.

Thousands of species of wildlife could become extinct as a result of destruction of forests. Amongst the tree species that are disappearing are those that could potentially be of great benefit to humanity, such as in the discovery of new medicines. Forest clearance can also disrupt local weather patterns, as well as increasing soil erosion, floods and droughts. Indiscriminate tree cutting for fuel wood and poor agricultural practices has led to catchment degradation, sedimentation and reduced dry season flows.

Most of the poor people are unemployed and therefore engage in all sorts of small scale income generating activities in order to get income to support their families. Majority of these people use the readily available environmental resources in their income generating activities. One of these activities is that of engaging in charcoal trade. Since urban households require charcoal as a source of energy, the rural people become suppliers of this environmental product. This implies that such traders become agents of environmental degradation, because trade in charcoal reduces vegetation cover (trees). To the rural population who are poor, forests are very important in poverty reduction and development. One of the overarching goals of the Millennium Development Goals (MDGs) lies in the fight against poverty. Many millions of people, use forest and woodland resources to sustain livelihoods, or as a basis for risk mitigation and to meet

contingent needs. However, as poverty is being fought through the use of woodland resources another goal of the MDGs- sustainability of the environment-is being put at risk.

It is noted that forests are of great use because they conserve endemic biological diversity. They serve as water catchment areas or water towers. Trees are also a source of timber and other non-wood products like medicinal plants, animal fodder and fruits. They also provide firewood for rural and urban communities. These are the externalities associated with forest resources and hence there is a gap between the value and notional price. The positive externalities are generally in terms of various ecological, biological and aesthetic benefits. Most of the externalities are not accounted for and this results in gross under estimation of environmental value of forests.

It is mostly the value of timber that gets reflected in the contribution of forests in a country's gross domestic product. Such an under-estimation often leads to inadequate allocation of funds for maintaining the forests. It is due to these reasons that there is need to take complete stock of forest resources and assign economic value to all intangibles including goods and services, soil erosion and agricultural productivity, health, etc.

Trees require decades to mature, forests require centuries to develop and stabilize. We need to think of these trees and forests as our green infrastructure. We must each do our part to preserve the forest resources that we have and restore forests and tree canopy throughout the county for a healthier environment and community today, while we are also putting future generations in mind.

A larger section of Kenya is dry. As a matter of urgency, there is need to protect the existing trees for the country to be able to capture the benefits of such resources. Among natural-resource-degrading activities, charcoal production is prominent. It is a vilified industry, widely blamed for deforestation, loss of biodiversity, reduced water catchment utility, atmospheric pollution, and environmental degradation. Trade in charcoal imposes grave danger to trees outside the forest in many areas. There is indiscriminate cutting of

trees by people in order to burn charcoal. No audit is carried out to establish the depth of the impact of trade in charcoal in relation to environmental degradation and loss of values from trees, which cannot be priced in a market. The loss of these non-marketed values from trees is the aim of this study. The benefits of biodiversity can be difficult to measure, define and value. However, if these benefits are disregarded or given a low priority in appraisal work, there is a risk of excessive and potentially irreversible degradation of natural resource stocks.

The biggest challenge today is how to maintain equilibrium between human beings, the ecosystems and development and how to meet the needs of human beings without necessarily compromising the quality of the environment. There is therefore a conflict between meeting the needs of human beings and conservation of trees.

Most of the urban dwellers in Webuye and its environs depend on charcoal, which is a product acquired from the environment through the cutting of trees. The price of charcoal cannot give the true measure of the cost put on the environment, since trees have more value apart from the actual price of charcoal. By understanding the value of these trees, it will be possible to establish proper mechanisms for integrating these values back into the original decisions of ensuring that trees are conserved. There is need for coming up with a method of compensation to various stakeholders to encourage expansion of forest cover in the country. There is need to have compensation for avoided deforestation. The answer is to provide charcoal traders who are agents of environmental degradation with options. For example, alternatives were 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.

1.4 Objectives of the study

The general objective of the study was to estimate the value of trees around Webuye town, through determination of appropriate monetary values based on willingness to accept (WTA) compensation of charcoal traders in order to forgo trading in this product.

The specific objectives

a) To assess the willingness to accept (WTA) by charcoal traders to forgo trade in charcoal.
b) To investigate factors determining traders' valuation of trees
c) To draw policy implications from the findings of this study.

1.5 Rationale of the study

According to the Webuye A.C.K (2000), people in Webuye are mostly peasants with a per capita income of about Kshs 60.00 per day. The town has most of its population being workers who do casual jobs in the Pan African Paper Mills. The income received is not sufficient for them to sustain a good living. Most of them use wood fuel as a source of energy.

To many Webuye town dwellers, charcoal forms the basic energy source. It is used for cooking and much other domestic work that requires heating. By using charcoal the environment is being deprived off the importance of trees. Environmental degradation due to of cutting of trees will worsen the state of life. This condition can be internalized through a mechanism that can create an incentive for the true preference revelation. Therefore this study provides information using the willingness to accept (WTA) compensation by charcoal traders to forgo trade in this commodity and by doing so will protect the existence of trees outside forest in this region

The study uses contingent valuation method (CVM) to estimate the use and non-use values of trees. This is a divergence from other studies that have used other methods of measuring value like the hedonic pricing method and travel cost method. The study uses willingness to accept (WTA) for the charcoal traders to state the value of trees. The study contributes to the use of CVM in deriving values of unpriced environmental resources trees in this case. The study contributes to the current literature and also provide further case study in the same field. The findings of this study are important to the government policy makers when they are designing and implementing policies on forest conservation. This paper contributes by developing an understanding, in economic

terms, of the value of the benefits derived from protecting trees at the traders' level and makes use of the resulting data to address questions about the efficacy of conservation approaches to create incentives to mitigate the problems of illegal cutting of trees and unsustainable use.

The rest of the paper is structured as follows. Chapter two gives an analysis of the literary works on forests and contingent valuation method (CVM) The chapter goes on to look at the empirical review relevant to CVM. The chapter reviews the different valuation methods which can be used to express non market forest goods and services in monetary terms Chapter three presents the theoretical framework and methodology, specifying the model to be used in an econometric framework The chapter also establishes the expected relationships of the identified variables in the study. Chapter four presents and discusses the results of the study, while chapter five gives a summary of the research findings, policy recommendations and the gaps within the study where further research needs to be undertaken.

Chapter Two:
Literature Review

2.1 Introduction

This chapter gives an overview of contingent valuation method (CVM) as an approach used in valuing non marketed environmental goods. This is through an examination of literature reviews of studies on forests and wood fuel. The chapter also considers literary works done on willingness to pay (WTP) and willingness to accept (WTA) valuation with an emphasis on forest resources.

2.2 Valuation of environmental goods

For environmental assets, markets can fail if prices do not communicate society's desires and constraints accurately. As Hanley et al., (1993) discussed, prices often understate the full value of services provided by an asset or do not exist to send a signal to the market place about the value of the asset. Market failure occurs when private decisions based on these prices or lack of them, does not generate an efficient allocation of resources. A primary requisite to avoid a market failure is for markets to be complete.

There are two main arguments for putting a price on environmental goods such as water, air quality, biodiversity and natural environments. First, we need to know the marginal value of environmental goods to find the socially optimal quantity/quality of different environmental goods. Second if environmental goods are not valued explicitly, they will still be valued implicitly through policy decisions. According to Navrud (1992), this procedure produces an arbitrary and inconsistent set of prices

Economists have developed a variety of techniques to value non-market environmental and cultural amenities consistent with the valuation of market goods i.e. based on individual preference Navrud (1992), Hanley et al. (1993). Navrud (2000) discussed these valuation techniques based on either observed behavior i.e. revealed preference,

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towards some marketed good with a connection to the non marketed good of interest, or stated preferences in surveys with respect to the non marketed goods.

For decades economists have grappled with the challenge of valuing public goods. The contingent valuation method (CVM) is one of a number of ingenious ways they developed to accomplish the task. The goal of CVM is to establish a hypothetical market for a particular non-market good. A sample of individuals is presented with a hypothetical situation, in which they have the opportunity to purchase a particular good (Mitchell and Carson, 1989). The CVM uses surveys to elicit willingness to pay or willingness to accept compensation payment for a hypothetical change in the availability of a particular environmental amenity or other non-market good. The willingness to pay (WTP) or willingness to accept (WTA) responses collected, are used to estimate welfare benefit measures deemed to be appropriate for use in an economic analysis, such as benefit cost analysis, of a project affecting that environmental amenity

Since the early 1970s, the contingent valuation technique has been used by economists to measure the benefits of a wide variety of goods. Contingent valuation circumvents the absence of markets for environmental goods by presenting to consumers with a hypothetical market in which they have an opportunity to buy the good in question. Because the elicited willingness to pay (WTP) and/or willingness to accept (WTA) values, are contingent, upon the particular hypothetical market given to the respondent, this approach came to be called the contingent valuation method, Mitchell et al. 1(989).

Other approaches used in valuation of the environment include travel cost method (TCM), hedonic pricing (HP), and surrogate markets. The travel cost method is used to estimate economic use values associated with ecosystems or sites that are used for recreation. The basic premise of the travel cost method is that the time and travel cost expenses that people incur to visit a site represent the "price" of access to the site. TCM is based on the assumption that consumers value the experience of a particular site (e.g. a forest) at no less than the cost of getting there, including all direct transport costs as well as the opportunity cost of time spent traveling to the site (i.e. foregone earnings). This

survey-based method has been used extensively, especially in richer countries, to estimate environmental benefits at recreational sites (including wildlife reserves, special trekking areas and beaches).[1]

The hedonic pricing method is used to estimate economic values for ecosystem or environmental services that directly affect market prices. It values environmental quality by analysis of prices for market goods that are tied or linked to environmental quality. Land price analysis is common since land values are tied to local amenities. It is also most commonly applied to variations in housing prices that reflect the value of local environmental attributes.

According to Diamond et al., (1993), CVM, in spite of the potential biases, if properly designed, offers a unique possibility for finding the total value, i.e. both use and non-use values of changes in environmental quality. Other major advantages of the method include the possibility of designing in to value future environmental changes.

The key elements of a CVM survey include a description of the good to be valued, a hypothetical payment vehicle such as user fee or tax increases; and a set of questions to obtain data on preference and socioeconomic factors that are likely to affect valuation (including interest in nature, income, education, age, etc.). There are several types of CVM surveys according to different elicitation methods: payment card, open-ended and discrete choice. A payment card survey introduced by Mitchell and Carson (1984) provides a range of WTP (or WTA) values for the good to be valued and asks respondents to choose their maximum WTP (or minimum WTA) value. The survey simply asks the respondent to state directly her maximum WTP (or minimum WTA) for a change in environmental quality. A discrete choice survey provides the respondent with less latitude: the respondent is asked to state "yes" or "no" as to whether she is willing to pay (or willing to accept) a particular amount, known as the "bid value". Modified

[1] TCM has been used to value the benefits of the alternative water supply and sanitation systems in the developing world (See for example, Wittington et al 1990, 1991)

versions of the discrete choice approach have been increasingly introduced, double-bounded dichotomous choice (Hanemann 1984, 1985).

There are many advantages to using CVM: it evaluates both the use value and non-use value of non-market goods; it is incentive compatible under some assumptions (Hoehn et al., 1987); and a respondent's task is to provide a one time answer to a question, which is relative easy.

Roba (2000) in his study on Marsabit Forest Reserve in Kenya explored the main forest products and services provided by the reserve to local communities for various economic needs. The study assessed the market prices of forest products used by the local communities. The study evaluated the public polices in influencing patter of forest resource use and assessed the impact of the existing resource use pattern in the area on biodiversity. The study in its policy implication has advised the natural resource managers be sensitive to the socio –economic needs of the people.

2.3 Willingness to pay (WTP) and willingness to accept (WTA)

WTP and WTA represent two alternative means to measure value. WTP is the amount (measured in goods, services, or monetary units) that an individual is willing to give up for a particular good or service. WTA is the amount (measured in goods, services, or monetary units) that a person is willing to accept to forgo a particular good or service. In general, increases in value are often associated with WTP, and decreases in value are often associated with WTA. Historically, economists were largely indifferent between the use of WTP and WTA for valuation purposes, with most of the literature focusing on WTP. More recent research has identified divergences between valuations using WTP versus WTA, and the decision as to which measure to use may have important policy implications. In the context of non-market goods and services, both measures may be relevant depending on the property rights regime in place.

By comparing the results of 45 studies that measure WTP and WTA, Horowitz and McConnell (2002) highlight the importance of choosing the most appropriate measure for

valuation purposes. For example, in the case of preserving coastal land from development, the authors suggest that the amount of land that would be preserved, if development deeds were in public hands (i.e. WTA compensation), would be approximately seven times higher than if the rights were in the hands of the landowner and had to be purchased by the public (Horowitz and McConnell 2002). The authors also show that the less a good behaves like a market good, the higher is the ratio of WTA/WTP. Public and non-market goods have the highest ratio, meaning that the choice to use WTP versus WTA to value a non market good or service can have a significant impact on the choice of policy alternatives for that good or service.

The use of CVM in developing countries is now quite widespread. As is the case for studies in developed countries, WTP format has been largely favoured over WTA, even when the objective of the study is to assess a welfare loss to the individuals being surveyed. As a result, there is a general avoidance of WTA format surveys, even when it is theoretically the more appropriate welfare measure to use for a given situation (Knetsch, 2000).

2.4 Empirical Literature Review on CVM

CVM elicits individual expressions of value from respondents for specific increases or decreases in the quality or quantity of non-marketed good mostly using studies from interviews. Valuations produced by CVM are 'contingent' because value estimates are derived from a hypothetical situation that is presented by the researcher to the respondent. The two main variants of CVM are open-ended and dichotomous choice formats, the former involving the respondents determining their 'bids' freely while the latter presenting the respondents with two alternatives among which they choose.

Proponents of CVM (e.g. Carson 1991) argue that its theoretical foundations are firmer than those of other valuation techniques, because it directly measures Hicksian welfare measures, or true WTA (or WTP). Moreover, CVM is the only generally accepted method of estimating non-us values, which are not traded in markets and for which there

are no traded substitutes, complements or surrogate goods, which can be used to impute values.

Critics on the other hand argue that CVM fails to measure preferences accurately, especially where poorly or badly designed CVM surveys are used which influence and distort responses, leading to results that bear little resemblance to the relevant population's true WTA (or WTP). Resolving these difficulties involves pre-testing of questionnaires, rigorous survey administration and good econometric analysis to detect and eliminate biased data.

According to university of California department of Economics there are more than 530 recent papers concerning (CVM) for valuing non market resources. Among these very few of them are devoted for using CVM for valuing environmental goods and especially forests. A study by Johansson et al (1995) shows that many forest services have no market prices to reflect their value. While timber is priced on the timber market, the forest as an environment for recreation is a non-priced public good. The article summarizes a number of Nordic studies which focus on the value of forest goods other than timber. Basically, it shows that two different methods, travel cost method and the contingent valuation method, have been used in the valuation of such goods.

Campbell (1993) discussed the potential valuation methodologies for valuing tree based resources and how CVM is more applicable to such kind of goods and services. Gregerson et al (1997) and Dosman et al (1999) have analyzed how to measure the relevant forest values. Kohlin (1997) applied CVM to the Orissa Social Forestry Project (OSFP) and showed how the method can be applied to support design for certain development projects. He also showed that, analysis of the bid function can give qualitative information that is difficult to identify by other methods.

Lynam et al., (1994) applied CVM to elicit the preferences of Zimbabwean small holder farmers for the products they obtain from trees. They concluded that, the use of contingent valuation method for valuing common access resource in the small holder

farming sector can produce reliable and valid results. Their results showed that non-market goods and services such as ecological services, social services and shade comprise a significant proportion of the total value to small holder households of the goods and services provided by tree resources.

Alemu (2000) used CVM to examine the determinants of the value of community forestry in rural Ethiopia and used its feasibility when plantations are established, managed and used by the community themselves. As an outcome of the study, household size, household income, distance of homestead to proposed place of plantation, number of trees owned and sex of the household head becomes the variables that explains the willingness to pay (WTP). Tegegne (1999) also applied this method to elicit people's valuation for environmental protection in terms of both cash requirement and labour contribution.

Loomis, et al., (1993), conducted a study to determine Victorians WTP to reserve unprotected East Gippsland National Estate Forests in National parks in Australia. Both income and number of years of schooling had significant influence in WTP. The ratio of females to males, age and number of people per household did not have statistically significant effect on the magnitude of WTP

Fissehа (1997) applied CVM for measuring the willingness to pay for improved water quality in Maki town in Ethiopia. In the study, income and time (distance) spent to fetch water were significant factors determining the willingness to pay of the household whereas education and wealth were insignificant. Dunffa (1998) also applied CVM in measuring WTP in Ada'a-Liben district in Ethiopia, for improved water quality. Distance and income were also found to be significant determinants of WTP while family size and sex of the household were insignificant.

Kramer *et al.*, (1994) used the opportunity cost approach and a contingent valuation method to analyze the economic and social impacts of establishing the Mantadia National Park in Madagasgar on village households living adjacent to tropical rainforests

Contingent valuation method was used to assess villagers' willingness to accept (WTA) compensation for loss of access to the park. The opportunity costs borne by the villagers as a result of lost access to the forest in the park were estimated using a cash flow model constructed from a socioeconomic survey and Contingent Valuation Method (CVM). Estimates based on CVM showed that on average, a compensation of US $108 per year per household would make households as well off with the park as without it.

Contingent valuation was used to value tropical forest resources for a rural population in Madagascar. Welfare losses from land-use restrictions associated with a newly established national park in Madagascar were estimated with a willingness-to-accept format. Because of a limited local cash economy, the contingent valuation question was denominated in baskets of rice as the payment vehicle. The analysis indicated that contingent valuation can be successfully applied to rural households within the developing country context. The econometric analysis undertaken reveals a systematic association between various socioeconomic variables of interest and the expressed willingness to-accept.

Groothius et al. (1998) examined an application of the CVM to measure the compensation required for the siting of a hazardous waste disposal facility. A contingent valuation survey to measure willingness to accept (WTA) using a dichotomous choice referendum framework was carried out. The authors concluded that CVM can be used to estimate reasonable measures of WTA and is a potentially useful tool for assessing the compensation required to site a hazardous waste disposal facility.

Li and Mattsson (1995) used a contingent valuation survey to assess the preservation value of forests. The survey asked respondents what they would be willing to pay to continue to visit, use and experience the forest environment in northern Sweden. Bid amounts took one of the following values: 50, 100, 200, 700, 1000, 2000, 4000, 8000 and 16000 SEK. A follow-up question asked how certain the respondent was about her 'yes'/'no' answer on a 0-100 percent scale with 5% intervals. About 14% of the 'yes' respondents and 11% of the 'no'

respondents reported confidence levels below 50%. Similar to the Canadian survey, some 35% of the 'yes' and 16% of the 'no' respondents indicated that they had complete confidence in their response to the valuation question.

Abala (1984), Walingo(1995) and Tulyenge(2002) in their studies used a multiplicative model to estimate the continuous value of the WTP. Tulyenge in his model used an additional variable- separating distance, to estimate WTP for air pollution control around Webuye town. In the study, he concluded that separating distance was a significant factor in the determination of a positive WTP, although this was only at 95% significance level.

2.5 Overview of Literature

From the literature reviewed we infer that buyers and sellers can be able to directly reveal their preferences if the commodities in consideration can be traded in a market. However, environmental products cannot be revealed directly since there is no market for such environmental goods. Therefore to value environmental goods in the absence of market, we use indirect methods designed to value these resources. Some of the indirect methods used include, travel cost method (TCM), hedonic pricing method (HPM) and contingent valuation method (CVM). Some of these valuation methods have failures in their applicability to environmental valuation.

CVM is the best method that we resort to in order to be able to get revealed preference in the provision of non marketed environmental goods like the non use values of trees. By using CVM, we are able to get the specific response behavior from the respondent, like establishing the minimum amount he/she is willing to accept for a particular environmental aspect not to be destroyed. Generally little has been done to value natural resources and especially trees in Kenya, especially those that are outside the forest.

Previous valuation studies have concentrated on WTP. This may be as a result of the continued debate over the disparity between WTP and WTA values. Nevertheless, there can be valid justification of using WTA in developing countries. Money values placed on

environmental goods and services are typically low, especially in low income areas. In such situations it may be plausible to measure benefits of environmental improvements in terms of WTA income for loss of amenity, as opposed to WTP for improvement. Moreover, where ownership rights are strongly perceived to be private this provides the primary motivation for utilizing the WTA format. In effect, it would be very difficult to ask owners their WTP for an imposed foregone use on trees they consider their own. If property rights in environmental goods and services are held by or are conventionally assigned to people experiencing the effects of environmental changes, then WTA would be the appropriate welfare measure to be used instead of WTP (Desvousges et al., 1998).

It is therefore imperative to highlight the importance of choosing the appropriate welfare measure. In general, the choice between welfare measures - whether to use WTA or WTP - depends on the property rights structure and on the type of change from the *status quo* position. If a respondent is entitled to the utility level implicit in the current situation then he/she should be compensated for any negative changes occurring and WTA is the adequate measure. In this particular case study, on both instances, WTA was considered the appropriate measure. First, the property rights structure in the charcoal traders is consistent with the WTA format: charcoal traders were asked to stop trading in charcoal. Secondly, the proposed change would result in economic losses to charcoal traders and therefore support the use of a WTA format. In conjunction with the property rights issue and the severe income constraints faced by the respondents, this suggested that the WTA format was more appropriate.

Chapter Three:

Theoretical Framework and Methodology

3.1 Introduction

In this chapter, we examine the theoretical framework, model specification, estimation techniques, area of study, scope and data collection procedures. The chapter also outlines the assumptions and limitation of the study.

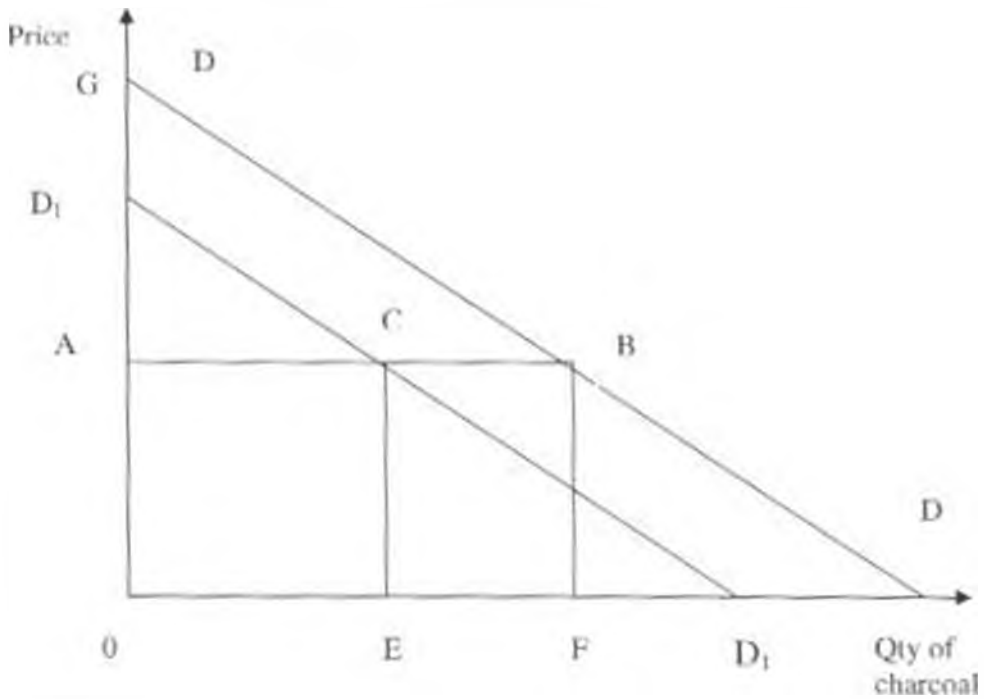
3.2 Theoretical Framework

The basic theoretical framework for this study is premised on the concept of indirect utility maximization. A household always aims to maximize utility from any given consumption bundle. Non marketed goods are represented in the utility function just as other goods are. Consider any two goods X_1 and X_0 where X_1 is an environmental good/service and X_0 is the "numeraire" or the value of all goods and services other than X_1. The utility for the two goods is given by $U = u(X_1, X_0)$. We consider WTA to be a proxy to the utility since it is not possible to observe WTA just the same way utility cannot be observed. X_1 is environmental quality that is to be improved. In this context, improvement of environmental quality would be done through a reduction in the level of trade in charcoal-an environmental product.

We can model this through the use of a graph by letting price to be a proxy of WTA and the quantity of charcoal traded to be proxy of environmental destruction. We assume that trade in charcoal is an inferior good, where, an increase in one's income reduces trade in charcoal. If the quantity of charcoal traded is high, this can be interpreted to mean that the traders are cutting more traders to burn charcoal and then sell the same at Webuye, leading to deterioration in environmental quality. This can be modeled as the demand for improvement in environmental quality.

If a market for environmental quality existed, the loss in welfare of charcoal traders could be approximated by considering charcoal prices. However, because of the lack of trade in environmental quality, the value of the welfare loss from stopping to trade in charcoal is established by using contingent valuation. Let WTA be the amount of income charcoal traders will need as compensation to make it as well off without charcoal trade as it was with it in order to satisfy their subsistence needs. Graphically, this can be shown as follows:

Figure 1: Demand for improvement in environmental quality (saving of trees)



Source: Own construction

DD represents a demand schedule for an individual charcoal trader. At A (price), the demand level is at F. If the price is at G, the quantity of charcoal being traded will be zero, which means that more trees will be saved. At a price A, the quantity of charcoal traded increases from zero to F. If we now suppose that there is an increase in the income of the charcoal trader, while price A remains constant, then his demand curve shifts to the

left to D_1D_1, implying that he will trade less in charcoal as before. The quantity of charcoal traded reduces from I to E.

The area ECBF represents the improvement in environmental quality as a result of charcoal traders being compensated an income equal to the area in order to reduce the quantity of charcoal trade. An increase in income is shown as a shift in the demand curve to the left under the assumption that trade in charcoal is ' an inferior good', which is equivalent to a reduction in charcoal trade. The opportunity cost of the charcoal trader completely stopping trading in charcoal, is the minimum amount he/she will accept as compensation which is equivalent to the area OABF.

3.3 Model specification

The study examined how different explanatory variables affect the probability of obtaining a positive WTA answer hence the use of the Tobit model. The study further considers how the explanatory variables influence individual's WTA· thus a multiplicative model

3.3.1 Indirect Approach

The study uses both the indirect and direct approaches of the CVM. Indirectly, the respondents are asked if they are willing to accept compensation to stop trading in charcoal so that trees are not destroyed. Respondents are informed that a policy change-improvement in the tree cover would require a stoppage in charcoal trade. Respondents are asked to either accept or reject the idea of being compensated, so that the policy is either implemented or not.

3 3 2 Direct Approach

Directly, they are asked to state how much they are willing to accept as compensation in order to stop trading in charcoal. An open-ended framework is used, where respondents

state the amount which represents their willingness-to-accept (WTA) or compensation demanded and which is a welfare measure (Horowitz et al., 1999). WTA is considered as a proxy for price the traders would be paid if the environmental commodity was to be traded in a normal market. In this case, the WTA which is a dependent variable will be continuous. This reflects the economic value of that environmental resource as observed by Loomis (1990).

To explain the welfare measures that are empirically estimated in this study, consider the following indirect utility function for a representative charcoal trader:

$U = U(Y, S, E_0)$.....(1)

where Y is income, S a vector of individual socio-economic characteristics, and E_0 the current level of the environmental services provided by trees. The proposed stop in charcoal trade implies an increase in tree coverage in this area, since charcoal traders are asked to stop trading in charcoal for improvement of environmental quality. Stopping to trade in charcoal is expected to result in a welfare loss for the charcoal traders since their trade which earns them income is now restricted. The welfare loss accounts for the environmental benefits that conservation of trees generate and the minimum amount of compensation demanded by the traders is equivalent to that welfare loss in order to maintain them at the same utility level.

With the change in environmental quality, then

$U(Y, S, E_0) = WTA(Y, S, E_1)$.....(2)

where, E_1 is the envisaged new environmental quality when trees are conserved. Therefore, WTA is a function of factors affected by socio-economic variables of the respondents together with environmental quality factors.

If charcoal traders positively value environmental services from trees, then the welfare reduction due to stopping trade in charcoal will be at least offset by the welfare gains that may accrue from extra environmental benefits.

3.3.3 The linear model

It is important also to come up with a linear model. This is in effect to test the extent of how the hypothesized variables affect WTA. The multiplicative model is adopted from the WTP models by Walingo (1995), Abala (1984), and Tulyenge (2002). The empirical model specification in this study is based on the premise that WTA (behavioral intentions) is determined by charcoal traders' knowledge on environment conservation, the ranking of environmental problems in their locality due to cutting of trees, and socioeconomic variables.

The nature of the multiplicative function (3) is such that if the error term $E(\varepsilon) = 0$, then the function becomes trivial.

$$WTAamount = \beta_0 .age^{\beta_1} .children^{\beta_2} .disY^{\beta_3} .yrssch^{\beta_4} .ldsize^{\beta_5} .gn^{\beta_6} .ms^{\beta_7} .envproblem^{\beta_8} .envconserv^{\beta_9} \varepsilon \quad \ldots\ldots(3)$$

Therefore, we transform the function into a logarithmic form of base e. Elasticities of the continuous variables are directly given by the logarithmic model. The binary variables are marital status, gender, environmental problem and knowledge on environmental conservation. We can combine the continuous and binary variables in the multiplicative model to give a complex equation of the form, Thus the function will be of the form;

$$\ln WTAamount = \beta_0 + \beta_1 \ln age + \beta_2 \ln childrenY + \beta_3 \ln disY + \beta_4 \ln yrssch + \beta_5 \ln ldsize + \beta_6 gn + \beta_7 ms + \beta_8 envproblem + \beta_9 envconserv + \varepsilon \quad \ldots\ldots(4)$$

The choice of potential explanatory variables regarding a charcoal trader's interest saving trees was guided by reviewing existing research on forests and communities and their attitudes, motivations, concerns, and issues relative to forests, Kramer et al (1996).

3.3.4 The Tobit model

The study uses open-ended questions in the contingent valuation and this leads to some respondents giving a zero WTA value for the change under analysis. The first part of

estimation therefore uses ordinary least squares and this ignores censoring hence may make the results biased and inconsistent. To address the problem, a Tobit model is used which recognizes that WTA values are censored at zero

The Tobit model is of the form

$$WTA^{*} = \beta X_{i} + \varepsilon_{i} \quad \text{.....(5)}$$

Where WTA^{*} is an unobserved continuous dependent variable, X_{i} is a vector of exogeneous variables, β is the associated vector of parameters and ε_{i} represent the error, independently and normally distributed with a mean zero and variance σ^{2}, so that the observed variable WTA takes the form below and it is censored at zero because all negative values of WTA_{i}^{*} are observed at zero

$$WTA_{i} = WTA_{i}^{*} \text{ if } WTA^{*} > 0 \text{ and } WTA_{i} = WTA^{*} \text{ if } WTA^{*} \leq 0 \quad \text{.....(6)}$$

WTA is determined by the following hypothesized factors;

- Disposable Income of the charcoal trader per month (disY)
- Age of the charcoal trader (age)
- Size of the trader's household (children)
- Land size owned by trader (ldsize)
- Education level of the charcoal trader (yrssch)
- Marital status of the trader (ms)
- Gender of the trader (gn)
- Environmental problems due to less trees(envproblem)
- Knowledge of the trader about environment conservation (envconserv)

3.4 Study variables

3.4.1 Continuous variables

In the model, the minimum amount a trader is willing to accept (WTAamount) as compensation is a dependent variable that is continuous. Similarly, explanatory variables consisting of age, number of years in school, number of children, land size and income constitute continuous variables.

3.4 2 Discrete variables

Variables in the model that are discrete in nature include marital status, gender, knowledge on environmental conservation, environment problem and Willingness to accept (WTA). Therefore these values are dummy variables in the model. As such, according to specification, they will either have a value of one or zero.

3.4.3 Hypothesis of the study: Willingness to accept versus knowledge of charcoal traders of environmental conservation

Knowledge of environment conservation issues can be used as a parameter to ascertain the perception of charcoal traders towards environmental protection. This requires that the charcoal traders have an understanding of the positive effects of environmental conservation before they can report a positive attitude towards environmental protection, specifically through saving of trees. Some traders may have a feeling that since trees are on their farms, it is their legal right to use such a resource in any manner as they want. Thus, traders with knowledge in environmental protection will have a positive attitude to conserve trees, and are therefore likely to report a positive WTA.

Knowledge of environment conservation is therefore a discrete variable with a value of 1 if the trader has knowledge in the same and 0 otherwise. If knowledge towards environmental protection is considered important then we expect the traders to be willing to accept compensation to forgo trade in environmental products. We therefore note that in both cases of discrete and continuous responses of WTA, respondents are likely to give

a 'yes' response to the WTA discrete question and in effect give a monetary amount they are willing to accept as a minimum level of compensation in order for them to leave trading in charcoal, if the traders report to have knowledge on issues of environmental conservation.

H_0: There is a positive relationship between traders willing to accept compensation to stop charcoal trade and knowledge about environmental protection and conservation

H_1: Reverse of the case.

3.5 Expected relationships

3.5.1 WTA and income of the traders (disY)

We consider charcoal to be an inferior good in the sense that if somebody's income is high, he/she may not be willing to trade in charcoal, but would rather deal in more advanced energy sources like gas and electricity. From economic theory, there exists a negative relationship between income and inferior goods. Therefore, we expect that as income of individuals' increase, they will be very much willing to accept to forgo charcoal trade than those with little income.

Similarly, the probability of the traders' WTA increases, with an increase in their disposable income. Plausibly, charcoal traders, who in most obvious cases are under financial stress, view charcoal trade not only as a necessary subsidy, but also as the main source of income and livelihood, and consequently are unwilling to forgo the subsidy. Amiques et al., (2002) in their study of conservation of riparian habitat found that higher incomes of respondents had a positive impact on WTA

3.5.2 WTA and age of the trader (age)

As one advances in age, he is not able to withstand the effort needed in the transportation and trade in charcoal. The person has now grown weak. In this regard, we expect that the minimum amount the trade is willing to accept will increase with age. At the same time the probability of willingness to be compensated increases with age. Therefore, the relationship between age and WTA is positive. Amiques et al., (2000) in the analysis of

benefits and costs of riparian habitat conservation using WTA in Toulouse, France established that the older the respondent the more likely was a positive response to WTA.

3.5.3 WTA and number of years of schooling (yrssch)

People who are educated are more aware of the benefits that result from the environment, especially the non market uses of trees. As the number of years in schooling for an individual increases, he/she will be more aware of the environmental needs and therefore is more willing to accept compensation to improve the environment. Therefore, it is expected that the probability of a 'yes' WTA response increases with the number of years that a respondent is in school and hence the likelihood of the respondent to give an amount that he/she is willing to accept to quit trading in charcoal (Kline et al., 2000).

3.5.4 WTA and family size (Children)

A family with a high number of dependents will require more income to be able to meet its budget needs. The family requires more money for food, clothing and other domestic requisites. Thus the family may be dependent on environmental products as a source of income to provide for their sustenance. As such, one who has more children will not be willing to accept compensation to stop trading in charcoal. Similarly the probability of WTA will decrease as the family size becomes larger

3.5.5 WTA and marital status (ms)

People who are married have more pressing needs than those who are single, since they require taking care of extra hands in the family. Therefore it is expected that the relationship between a 'yes' WTA response and marital status will be closely related to that of respondents with children. This is out of the expectation that, more often than not, a married couple may have more children than those who are single. In this regard, the probability of a 'yes' WTA response is expected to increase, if the respondent is married.

3.5.6 WTA and gender (gn)

Men are thought to be the main breadwinners of families within this area of study. In most cases men are the ones who are involved in burning and ferrying charcoal to the buyers, and is done mostly for purposes of providing food for the family,. As a result, men will not be willing to accept compensation to stop trading in charcoal. This is because this trade is their main source of income.

3.6 Area of study

Webuye town is located in Bungoma district of Western province. However, due to the recent introduction of districts, Webuye has now been curved out of the larger Bungoma district. The town is an administrative area, with a resident population of about 10,000 people. The town is the home of Pan African paper mills, which has employed quite a good number of people who are domiciled in the same town. Bordering the town are districts like Kakamega North and Lugari, which also supply some of the basic necessities to the residents of Webuye.

The area around is quite arable and well supplied with rainfall sufficient to support agricultural activities. The region surrounding Webuye town engages in sugarcane farming. This has led to the clearing of trees on farms in order to open space for sugarcane cultivation. Due to the problems persistent in the sugar industry, returns to farmers who engage in this agricultural activity have been so minimal, therefore relegating the farmers to edges of poverty. A larger percentage of the population around is poor and heavily dependent on peasant farming, casual jobs and small-scale business activities, which only enable them to live a "hand to mouth" lifestyle. Therefore there are pockets of poor in and around this town. From the larger Bungoma district, statistics indicate that the district poor are 52% of the entire population (Bungoma District Development Plan 2002-2008).

Webuye being an urban centre, more people are concentrated in the town. This is possibly because of the various infrastructures available and the presence of a few

factories that attract people who are in search for employment. Major tree/forest based industries in this area are the pulp and paper, fodder, fuelwood/charcoal, furniture making, joinery and timber sales. There is no gazzetted forest in Bungoma West district. However, there are afforestation efforts being undertaken on the Webuye hill which has an extension of about 400 ha.

River Nzoia is also one of the major environmental assets, which is very close to the town and provides water for both domestic and industrial use. However, due to destruction of trees along this river, its sustainability in future is in danger. Similarly, the source of the river in the Rift Valley is in danger of drying up due to the continued felling of trees for charcoal burning and other domestic use. Trees are also being cleared along the river banks due to population upsurge that requires more land for farming. This is being done oblivious of the devastating environmental repercussions that will follow. The population in the urban centres in the former Bungoma district that uses firewood and charcoal is estimated at 84%. Therefore, there is a lot of destruction of the trees around this place.

The survey covered Webuye town, parts of Matete and Luandeti in Lugari district and Manda in North Kakamega district. These regions are included in the study because many charcoal traders collect this good from the said regions and transport the same using bicycles and other available means to Webuye town to sell.

3.7 Source of Data and method of collection

In the absence of organized markets, an appealing approach to revealing the preference of individual is the use of contingent valuation method (CVM) (Mitchell and Carson, 1989).This technique uses a hypothetical market situation to obtain bids from individuals indicating their willingness to accept (WTA) for a commodity.

The study used primary data, cross-section in nature, collected through the use of questionnaires. The questionnaire was modeled in a way such that it captured information

from correspondents that relates to the personal characteristics such as age, marital status, number of years in school, income earned per month and number of children. Similarly the questionnaire captured behavioral aspects of the traders and also whether they were willing to accept compensation and if so, by how much

The data was collected for a period of two weeks between 8/8/2008 to 21/8/2008, from 9.00 am to 3.00pm. The anticipated period was one week. However, due to rains in the area in this period, and reluctance of some respondents to stop and be interviewed, the period was extended to two weeks. Similarly, most of the traders are not licensed to carry out this activity. As a result, some of the would be respondents always evaded being interviewed thinking that this was a trap to arrest them.

The questionnaire was designed in a way that each would take about 15 minutes to complete it. This was due to a successful pilot study carried out on the outskirts of Eldoret town. The questionnaire was then reorganized basing on the response criteria of these respondents who had almost similar characteristics as those of the area of study.

Stratified random sampling was utilized in order to select our sample. Specifically, seven roads that lead to Webuye town were used and a representative sample from each area was randomly selected. These roads are; Manda Chimoi, Luandeti-Chimoi, Marete-Kaburengu, Lugulu Dimnah, Mausi-Dimnah and Nabuyole-Webuye. Nevertheless, the sample was representative compared to the statistics of charcoal traders' data, according to the Webuye town council. Each road had an enumerator who carried out the survey The enumerators had an understanding of the local language for the purpose of easy translation to help respondents during the interviews. Much time was spent in discussion with the survey team to ensure their full comprehension of the underlying concepts behind the survey so that more appropriate and detailed translation could be made when administering the survey locally The survey was carried out in three days starting at 10.00am to 3.00pm. This is the peak time when the traders are going to the market.

3.8 Scope of the study

Quite a number of projects that impact on the environment have effects that are irreversible. Non market resources valuation may be necessary because the importance and scarcity of the natural resources may not be captured in values indicated in formal markets. This is particularly the case in developing countries like Kenya where many natural resources are not traded in the market place for monetary value.

The study examines factors that affect valuation of trees by charcoal traders at Webuye and its environs. The study further investigates whether or not the charcoal traders are able to approximate the damages to the environment- thus is an indirect price which is taken as a proxy for the WTA to forgo logging, i.e. cutting of trees in order to burn charcoal.

From the information that is solicited from the respondents, the study analyzed the socio economic factors affecting WTA. The influences of the factors were tested using econometric methods.

3.9 Assumptions of the study

The property rights for land on which trees are found are de facto with the locals who are the people participating in charcoal trade. This then implies that they can cut trees and burn charcoal for sale. It is also assumed that the respondents- charcoal traders are going to act rationally. Further, it is also assumed that a respondent is entitled to the utility level implicit in the current situation, the status quo, and as such should be compensated for any negative changes occurring, i.e. loss in stopping to trade in charcoal.

Another assumption in this case of economic valuation of the environment is that environmental resources are essentially treated identically to produced goods and services in estimating welfare measures. The most critical aspect in this regard is that individuals are willing to trade off environmental quality changes in exchange for changes in their income.

3.10 Limitations of the study

One of the limitations of the study is with regard to the literacy levels of the respondents and especially in understanding matters to do with environmental conservation. This poses a major problem since it requires more time to explain to the respondents the real meaning of the scenario. This limitation, in effect, can cause the respondents to give faulty responses. When such data is used in analysis, it may not give the true picture of the expected findings and results. To overcome this problem, the enumerators who carried out the interviews were well versed with the local language to enable correct translation and interpretation of the survey questions.

There was also a problem of double interviews since traders do not only use one road when ferrying charcoal to the market depending on which area they are collecting charcoal. To overcome the problem, enumerators asked the respondents if they had used another route to the market and interviewed. Another problem encountered was that of the respondents thinking that the enumerators were agents of the Webuye municipal council who wanted to collect cess from them. Therefore some would be respondents avoided using roads to the market where enumerators were stationed.

Chapter Four:

Results and Discussion of the Study

4.1 Introduction

This chapter presents and discusses the results of the study. As a start, the chapter discusses the general descriptive results. The results of both the ordinary least squares (OLS) regression and Tobit model are also discussed. The data is tested for heteroscedasticity and multicollinearity since the presence of these would lead to the regression being spurious, especially for OLS

A total of 148 respondents were interviewed. Table 1 shows the distribution of respondents interviewed on each entry point (categorized depending on entry roads) to Webuye town and their respective percentages in relation to the entire group. The Webuye Town Council provided the statistics of the approximate number of traders on each road based on the collections of council charge records for charcoal traders. Since names of traders are not attached to the records, a target of at least 15% for each road was set to capture randomly the traders who came and were willing to be interviewed.

Table 1: Number of Respondents on each road

ROAD	Total no. of traders on the road	Sample size	Sample Percentage
Manda-Chimoi	87	32	36
Luandeti Chimoi	66	17	25
Maiete-Kaburengu	79	26	34
Lugulu-Dimnah	32	7	22
Matisi-Dimnah	102	29	28
Muji-Dimnah	92	23	25
Nabuyole-Webuye	65	14	21
TOTAL	523	148	28

4.2 Socio-Economic Profile of Households Surveyed

The design of the questionnaire used in this study aimed at capturing information of respondents regarding their socio-economic characteristics, together with information on environmental attitude, knowledge and the WTA response both in discrete and continuous forms. Sample summary statistics of the data set are presented in Table 2..

Table 2: Statistical Summary of the Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Age of charcoal traders	148	38.97	11.05	19	71
Children	148	4.34	2.01	0	10
Income per month (disY) in Kshs.	148	2516	1930	500	15000
Years in School (yrssch)	148	7.80	3.03	0	14
Gender (gn)	148	0.69	0.46	0	1
Marital Status (ms)	148	0.68	0.47	0	1
Land Size (ldsze)	148	1.44	1.28	0	7
Amount trader is willing to accept (WTAamount) in Kshs. Per month	148	11182	7072	500	30000
Environmental problem (Envproblem)	148		0.40	0	1
Knowledge of trader on environmental conservation (Envconserv)	148		0.40	0	1
WTA	148		0.39	0	1

4.2.1 Age of Respondent (age)

The maximum age of the charcoal traders interviewed is 71 years while the minimum is 19 years old with a mean age of 39 years. This is a prime age when breadwinners are not only expected to provide food for their households, but also other necessities like school fees. Therefore this is an indicator that trade in charcoal is done by those at the age with prime responsibility to their families. Those who indicated to be 55 years and above, accounted for only 10% of the respondents. 61% of the respondents are 40 years and below, indicating that this trade is dominated by young men who may be bringing up

young families that require constant provision in terms of food and other basic requirements. This may also mean that due to unemployment, many respondents who are young resort to charcoal trade as a source of livelihood.

Table 3: Comparison between those willing and not willing to accept compensation

	Willing to Accept		Not Willing to Accept	
Variable	Obs	Mean	Obs	Mean
Age (age)	120	38.15	28	40.96
Children	120	4	28	4.97
Income per month (disY) in Kshs.	120	2480	28	2340
Years in School (yrssch)	120	8	28	7
Land Size (ldsze) in acres	120	1.29	28	2.05

Comparing the two groups of respondents, i.e. those who are willing to accept compensation and those unwilling vis a vis (Table 3) the age variable, the mean age of the group willing to accept compensation is 38 years while that for those unwilling is 41 years. This implies that WTA is likely to be negatively related with age. The higher the age, the lower the likelihood for the respondent to accept compensation.

4.2.2 Children

The maximum number of dependents for the respondents interviewed is 10 while the minimum is 0. The number of children referred to are those directly dependent upon the trader. The mean of the household family size is 4. Apart from the mean size it can also be noted that 101 respondents reported to have 4 or more children in their households.

As shown in Table 3 above, the mean number of children for those who accepted compensation in order to stop trading in charcoal is four (4) while those who declined is five (5). This indicates that the respondents who have more children are likely not to

accept compensation. Perhaps it is due to respondents having more dependents that they will engage in charcoal trade in order to provide food for them.

4.2.3 Disposable Income (disY)

The difficult part was the inquiry on the level of income the charcoal traders earn. Most respondents were not keen to state their earnings and others did not really know their average monthly income. But due emphasis was given in the training session to this part and the enumerators were able to come up with a fair estimate of the traders' average monthly earnings. The personal disposable income include all the incomes from both formal and informal sources that respondents get apart from that derived from the sale of charcoal.

The minimum income on record was ksh.500.00 while the highest amount was ksh.15000.00 per month. The mean of the monthly incomes from the respondents stood at ksh2425. This implies that in this region, most traders are operating below the poverty line. This is based on the fact that the mean number of children in each family is 4. This then implies that an income of 2425/- per month for a family of more than 4 people translates to each family member spending less than a dollar a day. Thus, most families of charcoal traders are operating below the poverty line[1].

The mean disposable income for those who are willing to accept compensation is Kshs.2450, while for those unwilling to accept compensation is Kshs.2340 (Table 3). This may be indicating that a higher income is positively correlated with WTA.

Table 4 presents the distribution of income and it indicates that about 90% of the respondents reported an income that is less than Ksh 4000.00. This is an indicator that most of those who participated in this activity come from poor subsistent families. The table indicates that 98 % of the charcoal traders earn less than ksh6000.00 per month. Only 3 of the traders earn over ksh6000.00 per month.

[1] The poverty line is predicated at 2 dollars per day at the purchasing power parity (PPP). The exchange rate is Ksh. 80.00 per dollar.

Table 4: Income Distribution (Kshs. per month)

Income Group	Frequency	Percentage	Cumulative Frequency
0-2000	88	59.5	59.5
2001-4000	45	30.4	89.9
4001-6000	12	8.1	98.0
6001-8000	1	0.7	98.7
8000 and over	2	1.3	100
Total	148	100	

4.2.4 Gender (gn)

The record indicates that charcoal trade is a male dominated activity. Only 21 of the respondents are female. One of the reasons why this trade is male dominated may be the fact and belief that men are considered to be the providers of the family in terms of food and other necessities. Cases where you find female involvement in charcoal trade may be a result of perhaps divorce, widowhood or in extreme cases where the man is incapacitated. The number of men interviewed justifies the fact that charcoal trade is male dominated.

4.2.5 Years in School (yrssch)

From the record of the respondents, it shows that there are some respondents who have no formal education or if any, they have a very basic level. The best respondent in terms of years of schooling is 14 years, which is equivalent to one having done a tertiary course representing 1.4% of the total respondents. The mean number of years in school is 7.8 indicating that most of the respondents fall in the category of primary education. This can be shown by the cumulative percentage of respondents who have been in school for 8 years being 70.2% Table 5). Implicitly, low level of schooling contributes to the general poverty levels.

The mean number of years of schooling for those who are willing to accept compensation as shown in Table 2 is 8 years, while the mean of the unwilling group is 7.1 years. This indicates that a higher level of schooling has a positive impact on environmental conservation, since they are ready to accept compensation to conserve the environment.

Table 5: Distribution of Years of Schooling

Years in school	Frequency	Percentage	Cumulative Frequency
0	7	4.7	4.7
1-4 (Lower primary)	12	8.1	12.8
5-8 (Upper primary)	85	57.4	70.2
9-12 (Secondary)	42	28.4	98.6
Above 12 (Tertiary)	2	1.4	100
Total	148	100	

4.2.6 Marital status (ms)

This is also a binary variable taking a value of 1 if the response is 'yes' and 0 otherwise. The data indicates that 131 of the respondents are married. This translates to 88.5% of the respondents. The reason for this is that the married require fending for their immediate families, hence the need for them to engage in an activity that will generate some income for them. This variable is analyzed in the context that if one is married he will not be willing to accept compensation to stop trading in charcoal.

4.2.6 Land size

The respondents were interviewed on the size of land they own. The mean land size in acres is 1.4. There are some respondents who do not own land. Out of the female respondents, 13 indicated that they do not own land while 8 of them own some piece of land. This may be interpreted in the context of the general cultural setting of the communities surrounding this area in which ownership of land is vested in men. Considering the group of respondents who were willing to accept compensation, their mean acreage of land owned is 1.29 acres while those who were unwilling reported a

mean acreage of 2.05 acres. This implies that land size is negatively correlated with WTA. Those who own bigger sizes of land are likely not to support conservation efforts in order to save trees.

4.3 Environmental Related Issues

4.3.1 Knowledge of environmental conservation (envconserv)

This is a binary variable that takes a value of 1 if the response is positive for knowledge in environmental conservation and 0 otherwise. Out of 148 respondents interviewed, 80 responded positively to the fact that they have knowledge on environmental protection.

4.3.2 Environmental problem being caused by lack of trees (envproblem)

The response to this question is binary, taking a value of 1 if the response is 'yes' and 0 otherwise. This variable is analyzed in the context that if one reported that lack of trees is a cause of environmental problems then the respondent is willing to accept compensation to stop trading in charcoal, hence save trees to improve environmental quality. Out of the 148 respondents interviewed 80% reported that lack of trees from their localities is a major environmental problem. Therefore charcoal trade can be considered as a contributor to destruction of trees hence causing an environmental problem.

4.4 Willingness to Accept (WTA)

4.4.1 WTA response

This is a discrete variable that takes a value of 1 if the response is positive and 0 otherwise. Out of the 148 respondents, 120 were willing to accept compensation to stop trading in charcoal. This represents 81% of the total respondents. Out of the remaining 28 respondents, some gave a negative answer, because they thought the government would not do such a thing. Individuals who indicated that they were not willing to participate in the programme of compensation in order to stop trading in charcoal did so for a variety of reasons. The most common reason cited for not being able to accept was lack of adequate information about the program, i.e., they have never heard of such a programme. Two respondents noted that they were quite comfortable with charcoal trading because they are assured of getting the income as long as they have burnt charcoal.

Of the respondents who gave a 'yes' response to the WTA question, 67 of them indicated to have four or less children, representing 55% of the respondents. Similarly, of the respondents who gave a 'no' to the WTA question, 20 of them indicated that they have five or more children in the household. This indicates that the number of children is negatively related to the WTA response.

In terms of land size, 78 respondents who reported to own less than 1.5 acres of land gave a 'yes' WTA response, while 22 out of the 28 respondents who indicated that they own more than 1.5 acres of land gave a 'no' response to the WTA question. This may be indicating that the size of land owned by the charcoal traders may also be negatively influencing the WTA response. Those with a bigger land size may likely report a 'no' response.

Under marital status, 103 respondents who indicated to be married also gave a 'yes' response to the WTA question. This indicates therefore, that those who are married are likely to accept compensation in order to stop trading in charcoal. Of the 21 female respondents interviewed, 16 (76%) responded positively to the WTA question while 104 male respondents out of 127 (81%) also responded positively. This implies that there is a higher chance of a male respondent accepting compensation in order to stop trading in charcoal compared to a female respondent.

With regard to age, 74 respondents who are above the age of 35 years gave a 'yes' response to the WTA question. This is an indication of the positive relationship between WTA and an increasing age.

4.4.2 Knowledge on Environmental Conservation

Respondents were asked if they knew anything about environmental conservation in their areas. The response is discrete, taking a value of 1 if the response is yes and 0 otherwise. 54 % gave a positive response indicating that they knew something about environmental conservation issues in their locality in regard to saving trees. Out of the 120 respondents

who responded positively to the WTA question, 63 gave a 'yes' response to the question on environmental knowledge. This indicates that conservation is positively correlated to WTA.

Of those who responded positively, 49 indicated their years of schooling to be above 8 years, indicating that, knowledge on environmental protection and the number of years schooling determine a positive WTA response.

4.4.3 Amount willing to accept (WTAamount)

The elicitation method used was the open format model. The open format method was chosen for several reasons. First, since respondents seem to interact when they meet at the market when selling charcoal, we wanted to avoid suggesting to them values, which they would have been able to compare with one another. The second reason is more pragmatic. Suggesting values would have been difficult. If the suggested values were perceived as being "too low", respondents would be upset. On the other hand, suggesting too large values would have meant that the study and programs proposed were not credible, or it might have encouraged them in giving high WTA estimates.

The response from this variable is continuous. The percentage of the individuals who are accepted the scenario was relatively high, at 81%. The minimum amount that the respondents are willing to accept is ksh5000.00 while the maximum is ksh30000. The results in Table 6 show that about 75% of the respondents are willing to accept a compensation of a minimum amount of about ksh15, 000.00 per month. We can therefore deduce that a payment in the class 1001-15000 is acceptable to the respondents in order for them to stop engaging in charcoal trade.

Among respondents who are above the age of 35 years, 25 of them gave a figure of Kshs. 10,000.00 or less as compensation while 67 indicated that they would require more than Kshs. 10,000.00 per month as compensation in order to stop trading in charcoal. This indicates that as age of the respondent, increases with the amount of compensation needed also increases.

Table 6: Frequency distribution of the amount charcoal traders are willing to accept (per month) as compensation

Amount	Frequency	Cumulative frequency	Cumulative percentage
0 or not Willing to Accept	28	28	18.9
1-5000	3	31	20.9
5001-10000	45	76	51.3
10001-15000	36	112	75.6
15000-20000	29	141	95.2
20001-25000	5	146	98.6
25001 and over	2	148	100
Total	148		

Considering the responses on land size, 69 respondents who reported to own land of less than 1.5 acres indicated that they would accept compensation of more than Kshs. 10,000.00 in order to stop trading in charcoal. Thirteen (13) respondents of those who own more than 2 acres of land gave a compensation amount of less than Kshs.10,000. Infact, those respondents who reported to own more than 4 acres are 4. Three of these respondents indicated that they would accept a compensation of less than Kshs.10,000 in order to stop trading in charcoal. Similarly, of the 25 respondents who do not own any piece of land, 19 of the respondents indicated that they would accept a compensation of more than Kshs 10,000. This may indicate that there is a negative relationship between the amount of compensation and the land size owned by respondents.

Of the 80 respondents who reported to have knowledge on environmental conservation, 56 of them reported an amount of more than Kshs. 10,000 as compensation to stop trading in charcoal, implying that knowledge in environmental conservation and

protection may lead to an increase in the amount of compensation. The same is seen with those who indicated that environmental problems in their locality are caused by lack of trees

Out of the respondents interviewed, 19% did not accept the scenario and were not willing to accept compensation of any amount. This group was regarded zero responses. One of the reasons given for rejecting the scenario is that the government will not be able to pay and that this is not sustainable. Others indicated that they do not have faith in the government to effectively manage such a scheme, while others said that they do not regard environmental quality as something important.

4.5 Correlation analysis of Explanatory variables

In linear regression it is assumed that the explanatory variables should not be highly linearly correlated. The presence of this problem makes the application of the formula of the variances of coefficients in tests of significance and construction of confidence intervals not applicable. This makes the estimates of OLS to be inefficient in the prediction. Moreover, the standard errors of the estimates become infinitely large.

Table 11 in the appendix shows the partial correlation coefficient matrix obtained from the cross-sectional observations. The correlation analysis indicates that the coefficients are not more than 0.5. This signifies that there is no serial correlation or if there is correlation, then it is not a serious problem which can cause spurious regression.

4.5.1 Multicollinearity

This is a situation where explanatory variables are significantly correlated, and it becomes impossible to determine which of the variables account for variance in the dependent variable. Classic symptoms of multicollinearity include; having a significant F, but no significant t-ratios, wildly changing coefficients when an additional collinear variable is included in the model, and unreasonable coefficients. Multi collinearity is a common problem in analysis of cross-sectional data. Apart from using the correlation matrix to check multi-collinearity the severity of multi-collinearity among explanatory

variables can also be checked using the Variance Inflation Factor (VIF) comparison. According to Gujarati (1995), if VIF exceeds 5, this is considered as an indicator for the existence of serious multi collinearity. Table 7 below shows the results.

Table 7: VIF for Explanatory Variables

Variable	VIF
Ln age	1.06
Ln Income	1.21
Ln landdsize	1.31
Ln children	1.32
Environmental problem	1.06
Environmental conservation	1.06
Marital status	1.40
gender	1.47
MEAN VIF	1.23

4.5.2 Heteroscedasticity

This is a phenomenon quite common with cross-section data. Heteroscedasticity exists when the variance across the observations is unequal. This makes the parameter estimates unbiased but inefficient because the estimated parameters do not have minimum variances. To correct for heteroscedasticity, we regress using robust standard errors, which normalizes the errors.

4. 6 Determinants of Willingness to Accept

4.6 1 Summary WTA amount statistics

Sample summary statistics for respondents who gave a positive WTA is as shown in Table 8 below. The mean WTA of the respondents is Kshs.13791. Since the data used is

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A classical test for diagnosing collinearity is the variance inflation factor (VIF) which can be expressed as $V = \frac{1}{1 - R_i^2}$. If there is no collinearity between the explanatory variables, then VIF=1 (Besley et al 1980)). The lower the VIF the lower the degree of multicollinearity.

open ended, Carson (1991) proposes the use of a trimmed mean sample at predetermined percentages. A trimmed average is essentially a weighted average that attaches a weight of zero to the largest and lowest αx100% of the observations and which effectively disregards them.

Table 8: WTA of the sample

Maximum WTA	**Kshs.30000**
Minimum WTA	**Kshs.5000**
Mean WTA	**Kshs.13791**
5% Trimmed Mean WTA	**Kshs.13640**
10% Trimmed Mean WTA	**Kshs.13500**
20% Trimmed Mean WTA	**Kshs.13395**
Median WTA (50% Trimmed Mean WTA)	**Kshs.12000**
Standard Deviation	**Kshs.6756**
Range	**Kshs.25000**

The 5% trimmed mean is calculated by first dropping the lowest and highest 5% of the observations and then calculating the mean WTA based on the remaining 90% of the observations. By utilizing the trimmed means, high outliers are discarded from the resulting sample mean. For our sample data, the maximum reported WTA amount of Kshs.30000 is an outlier, thus excluding the specific value from the analysis reduces significantly the mean WTA. The median WTA is obtained by a 50% trimming of the data which gives us a value of Kshs.12000.

4.6.2 OLS regression

A multiple linear regression model based on equation (4), where responses to the open ended WTA question produced a continuous variable, is estimated, with the WTA question being the dependent variable. For this estimation of WTA, only positive WTA responses were included. This is a common practice in CVM studies. This is an

alternative to the average WTA and trimmed averages of WTA derived from the sample The results are presented in table 9 below

Table 9: Results of the OLS regression on WTA Amount

Number of obs = 120
F (9, 110) = 22.45
Prob > F = 0.0000
R-squared = 0.6475
Adj R squared = 0.6187
Root MSE = 6.5944

lnwtaamount / Variable	Coefficient	Robust std error	t-values	P>|t|	95% conf. Interval
lnage	-0.0222	0.00123	-0 18	0.858	-.0002222
gender	2.599958	2.145768	1.21	0.228	-1.652451
marital status	3.551294	2.040457	1 74	0.085	7.595
lnchildren	-2.965877	0.3440589	-8.62	0.000	2.284033
lnmonthly income	.08152	.03936	2.07	0.041	.0000353
lnyears in school	0023787	.0233727	3.95	0.000	1.386981
lnland size	2.481997	.6539654	3.80	0.000	1.185991
environmental problem	1.148598	1.601166	0.72	0.475	-2.024537
Conservation knowledge	.4796868	.1918234	2.49	0.013	-.859502
Constant	27.75445	3.773629	7.35	0.000	20.276

The theoretical validity of the WTA estimates is tested using the multiple regression analysis. The regression results are well explained by the independent variables as shown in Table 9. The adjusted R-squared value of 0.6187 and the F value of 22.45 indicate that the model is significant at the 0 1% level. The model explains a large proportion in the variability of the WTA values and the fit of the model is good

As can be seen in the OLS (Table 9), most parameters are significant at the 5% significance level. Nine variables were included in the OLS model. The variable associated with children is the strongest determinant of WTA with the WTA amount rising with a higher number of children. It is positive and significant contrary to our expectation. The variable associated with marital status is positive and significant. This implies that married respondents are likely to require a higher level of compensation compared to those who are not married. This is also consistent with our a priori expectations.

The coefficients associated with the variables on monthly disposable income, years of schooling, land size and environmental conservation are also significant and positive, implying that the level of education is quite important in determining the amount of compensation in order to conserve trees.

The level of education of the respondent, impacts positively on issues to do with environmental conservation. An increase in level of schooling by 1 year increases the amount by 9%. The coefficient associated with the variable 'age' is negative and insignificant. Similarly, the coefficient associated with environmental problems is insignificant.

The coefficient on knowledge of environmental conservation is positive, which suggests that when charcoal traders report to have knowledge on environmental conservation, it is more likely that they will accept compensation in order to stop trading in charcoal. From the parameter's sign it is observed that the charcoal traders who have knowledge on conservation of environment would state amounts for compensation in order to quit trading in charcoal

4.6.3 The Tobit model

WTA estimates were also tested using a Tobit model where factors affecting whether or not a charcoal trader is willing to accept compensation. Table 10 presents the maximum likelihood estimates of the parameters.

Table 10: WTA Determinants-Tobit regression of the stated compensation

Variable	Coefficient	t-ratio
Constant	7.0523	1.94
Age	0.096	2.22
Gender	0.3114	1.57
Marital status	0.514	5.88
Children	-0.3901	1.91
Monthly income	0.024	1.84
Years in school	0.1861	1.75
Land size	0.3849	-1.94
Environmental problem	-0.1765	-0.25
Environmental conservation	0.3420	2.61
σ	6.928	
Log likelihood function	-1279.6	
N	148	

Table 10, provides estimates of the parameters of the Tobit model. In this case, the dependent variable is the compensation stated by the respondent in the open-ended question that was used to elicit WTA. As in the linear model, the Age variable is significant and positive indicating that the higher the age of the respondent, the higher the WTA stated. Another variable that exhibits the positive sign is marital status and it is significant, implying that respondents who are male have a higher WTA than females. We note that most of the respondents who were interviewed are male. The coefficient associated with the income variable also exhibits a positive sign, indicating that the higher the income of the respondent, the higher the WTA stated. The number of years in

school is positive and significant implying that respondents with a higher level of education are likely to demand a higher compensation.

The variables associated with children and land size are significant and exhibiting negative signs, indicating that respondents who have a higher number of children, stated a lower. Similarly, the bigger the size of land owned by the respondent, the lower the WTA stated

The coefficient to the variable associated with knowledge on environmental conservation is also very significant and positive. Hus indicates that, respondents who report to have conservation knowledge are willing to accept compensation compared to those who report lack of environmental knowledge. Jones et al., (2008) in their study on economic valuation on improvement of coastal water quality in Greece found that the attitude towards knowledge of water pollution to be an important and significant factor.

4.6.4 Aggregation and bid equation

To estimate the value of trees around Webuye town requires the aggregation of the individual benefits for an increase in the environmental quality. The purpose of the bid equation in CVM is to indicate the most significant variables influencing the WTA (Bishop et al., (1995). The proposed bid equation used here was based on the Tobit model which considered the open-ended responses of the WTA amount. The resulting equation is;

$$WTA^{*} = 7.05 + 0.096age + 0.514ms - 0.3901children + 0.024disY + 0.1861yrssch - 0.3849ldsize + 0.342enwconserv \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

where WTA^{*} denotes the unobserved or latent willingness to accept and

$WTA = \begin{Bmatrix} 0 if WTA^{*} \leq 0 \\ WTA^{*} if WTA^{*} > 0 \end{Bmatrix}$ is the respondent's actual WTA amount.

The aggregation made here is over the population of charcoal traders as an entity that holds economic values regarding conservation of trees. Therefore, in this study,

considering the payment vehicle used was a monthly payment made to the respondents, the aggregation criteria used is the total population of charcoal traders (523). The aggregation valuation is based on the mean and median values which are Kshs.13520 and Kshs 12000 respectively. Taking into consideration this population, we conclude that the aggregate WTA was Kshs.7070960 whereas the median WTA yielded an aggregate WTA of Kshs.6376000

Chapter Five:

Summary, Conclusion and Policy Recommendations

5.1 Introduction

This chapter gives a summary of the research findings, policy recommendations and goes ahead to identify the gaps within the study where further research can be done

5.2 Summary and Conclusion

In conclusion, this study attempted to estimate the value of trees around Webuye town. Reducing deforestation means imposing restrictions on the use of tree resources by households that currently use trees to maintain their livelihoods. There is the need to assess social and economic impacts in communities that use trees for livelihood in order to offer alternatives for conservation purposes. It is therefore imperative to come up with management strategies focused on integrating people into sustainable management in terms of usage and harvesting of trees and forest resources.

The research was undertaken with the primary purpose of estimating to assess willingness to accept of charcoal traders in Webuye town to stop trading in charcoal in order to save trees. The secondary aim was to investigate the factors determine the traders valuation of the importance of trees and draw policy recommendations from the findings. The research used an open ended WTA contingent valuation method, because respondents were asked to state their willingness to accept. This is because in the pilot study carried out did not have enough responses as to be able to construct a reasonably wide bid vector that would have allowed the use apply a closed ended format in the final survey. The survey in form of a questionnaire was administered over a period of three days to 148 respondents (charcoal traders) selling this product in Webuye town.

The study used both ordinary least squares (OLS) and the Tobit model in estimating the parameters. The reason of using the Tobit model is because, the chosen elicitation format was open-ended, hence the need to take care of the zero responses. From the results of the study, knowledge on environmental conservation was found to be significant and

positively related with WTA. Other variables found to significant to the research were the number of children, disposable income, years of schooling, land size of the respondents in the traders and marital status.

Using the CVM, it is estimated that charcoal traders will accept a compensation of about Kshs. 13520 per month in order to stop trading in charcoal. This is aggregated to give an estimated valuation of Kshs.7070960 which represents the value of trees. The analysis indicates that contingent valuation has the potential for estimating the value of non-marketed products like environmental products. The econometric analysis is indicative of a systematic association between various socio-economic variables of interest and the expressed willingness to accept in order to stop charcoal trade.

5.3 Policy Recommendations

The findings of the study also point to a pertinent issue that can be integrated in the conversation efforts-that of educating local communities on the importance of environmental conservation. The study shows that knowledge on issues of environmental conservation was strongly significant. It is imperative to therefore build knowledge capacity to communities on environmental issues.

Closely connected to knowledge, is the fact that investment in education generally is of great significance. An educated community, having a better source of income with a smaller family is a mix of factors that may promote environmental conservation. Therefore, it is important for the government to continue investing in education of people, while also making sure that forums are provided through which issues to do with environment conservation are imparted to people. Programmes tailored to the local conditions and designed to improve environmental literacy to local communities would have a positive impact in terms of saving of trees and improving the quality of environment in general. These may include organized public gatherings through which leaders can articulate environmental conservation issues.

Similarly, considering that the mean WTA reflects the welfare loss if traders were to quit trading in charcoal, it would be appropriate for the government to establish ways in which incomes can be boosted, especially for those communities who depend on exploitation of environmental products for subsistence. Gunatilake *et al.*, (1993) estimated the composition of income in the peripheral communities, particularly from the extraction of non timber forest products and found income very significant. Economic incentives seem to be required to stimulate the involvement of all affected local community in the process of conservation of trees

Moreover, larger families- higher population have a negative impact on conservation of trees. As such, it is important to continue educating local communities on the merits of having smaller manageable families. Therefore, the government should increase the family planning advocacy initiatives. At the local level, the findings can be used to determine appropriate compensation for local villagers/charcoal traders' foregone access to trading in forest/tree products. At the same time, the findings indicate future issues that need further exploration. Population pressure is widely recognized as the dominant cause of forest resource depletion. Population growth undoubtedly imposes more pressure on natural resources and threatens sustainable development because more population needs to use forest resources to meet the needs of fuel wood, timber and other subsistence needs (Ostrom 1990).

5.4 Future research

In this study, we provided a mechanism to identify and assess various factors influencing charcoal traders willingness to accept the identified practice of saving trees. The methodology applied in the study has its own limitations and hence, it cannot alone provide a definitive answer to such an important issue as the improvement of environmental quality through conserving of trees. Other researchers can therefore engage in evaluation studies to improve the information base for designing new environmental policies and projects.

Charcoal traders are only but a small component of the community set up that use environmental products for their livelihoods. Future research can look at wider set of respondents within thus framework of conservation of trees/ forests and utilize closed-ended approaches.

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Questionnaire:

My name is _____. currently studying at the University of Nairobi This research project is a partial fulfillment for the award of a Master's degree in Economics. I would like to know the current situation of trees around Webuye town in relation to charcoal trade

Charcoal trade is a basic income source to traders in this commodity.

The interview will take a few minutes and the answers will be completely confidential and strictly for academic purposes only. Please answer these questions as truthful as you can

Date..... Area..... Respondent's No.....

A) Individual characteristics of charcoal traders

1) (AG) How old are you (years)? _____ _____

2) (GN) Gender? 1) Male 2) Female

3) (MS) Are you married? 1) Yes 2) No

4) (Children) How many people live under your household who are under the age of 18 years?

5) Children (Under the age of 18 years) _____

6) (DISY) How much is your monthly income in Kenya shillings, apart from income from charcoal trade: Ksh_____

7) (yrssch) Have you ever been to school? 1) Yes 2) No

8) If yes, how many years have you been in school? _____

9) (Ldsize) Do you own a piece of land? 1) Yes 2) No

10) If Yes, what is the size of the piece of land in acres? _____

B) Environmental Related issues

11) (Ensproblem) Have you had any environmental problems in your location that result from lack of trees? 1) Yes 2) No

12) If Yes, state any one of the problems you think is caused by lack of trees

13) (Envconserv) Do you know anything about environmental conservation in your location (especially in conservation of trees)? 1) Yes 2) No

C) Willingness to accept (WTA)

14) (WTA) Suppose the government has decided to come up with a scheme to conserve trees in your location. Suppose that you are compensated in cash per month to stop trade in charcoal. In this situation, you can use the income for your basic requirements, but loose any benefits you derive from charcoal trade. Are you willing to forgo trade in charcoal for compensation? 1) Yes 2) No

15) (WTA amount) If Yes, what is the minimum amount of compensation would you accept?

16) If No, what is the reason making you not to accept compensation?

17) Give any suggestions on how trees can be saved in your locality.

Annex 1

Table 9: Coefficient Correlation Matix

	1.00									
	.2212	1.000								
	.0311	-.009	1.000							
	.078	.3069	.0101	1.000						
	.3944	.1108	.0945	.3439	1.000					
	-.369	.0687	-.015	-.2176	.0414	1.000				
	.4044	.1261	-.009	.2918	0808	-.075	1.000			
	.0336	.760	-.074	-.0069	.051	.0656	-.063	1.000		
	.0073	-.014	149	.0926	.064	.1093	.1106	.0360	1.000	
	-.120	.1456	-141	.0707	.069	.1089	.0376	.0059	.0045	1.00