

# **Willingness-To-Pay for Protecting Endangered Environments**

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SSRR No. 31

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# WILLINGNESS-TO-PAY FOR PROTECTING ENDANGERED ENVIRONMENTS

## The Case of Nechsar National Park

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**Abstract:** Although national parks, wildlife sanctuaries and reserves are established to conserve biodiversity and enhance eco-tourism, most of the country's protected areas are under serious threat. The local threats usually arise from human encroachment. To rescue these resources, appropriate conservation strategy must be put in place. This, however, requires proper valuation of the environment. Taking Nechsar National Park as a case, it was tried to measure people's willingness-to-pay (WTP) to protect the endangered environment and identify its determinants. Using dichotomous choice contingent valuation method (CVM), it was found that the local community is willing to protect the park. The result shows that the means for the WTP are Birr 28.34 and Birr 57.07 per year per household; and its determinants are primary economic activity of the households, dependency ratio and distance from the park. The study suggests that the park management should involve the local community in its conservation endeavour and share the benefits with them.

## 1. INTRODUCTION

### 1.1 Background

Environmental degradation may jeopardize economic development of the world. Rapid population growth, urbanization, increased production and consumption, intensification of agriculture and acceleration of landscape transformation have put serious pressure on the environment. This, *inter alia*, brings environmental protection into the development agenda.

According to World Development Report (World Bank 1992), environmental damage can hamper development in two ways. First, it reduces the level of welfare of the society by depleting the environmental resource and reducing the quality of the environment. Secondly, it reduces long-term productivity and thereby the future earning of the population.

The level of environmental problems varies from country to country depending on the stage of development, the structure of the economy and the environmental policy in place (World Bank 1992). The recognition of environmental problems, per se, brings the question of sustainable development into the picture.

Sustainable development refers to meeting the needs of present generation without compromising the needs of future generations. In fact, the current trends indicate that developed countries have begun integrating environmental issues into their development programs. Moreover, studies indicate that the rate of return from investment on resource conservation is comparable to that of conventional capital investment (Georgiou, Pearce, and Moran 1997).

National parks, wildlife reserves and other protected areas play significant role in the conservation of biological diversity. However, evidence from different countries indicates that many of the most important protected areas are being increasingly degraded as a result of large scale development projects, expanding agricultural frontiers, illegal hunting and logging, fuel wood collection and uncontrolled burning (Michaelwell and Katrina 1992). Ignoring the dependency of local community on the parks and reserves has also made the sustainability of national parks and reserves questionable (Brandon and Wells 1992).

Ethiopia is among those countries known for their rich biodiversity and natural resource, but losing their environmental assets at an alarming rate. The country is known for its diversified and unique flora and fauna. Most of the endemic animals and other habitats are found in the country's nine national parks and eleven wild life sanctuaries and reserves. With the process of decentralization, a good deal of this national parks and sanctuaries are under critical conditions. The level of rural poverty, lack of incentives, increasing demand for grazing and cultivable land, and many other multi-faceted problems put a lot of stress on the conservation strategy of the country. The situation in Nechisar National Park can be a case in point.

Nechsar National Park is located 500 km away from Addis Ababa in North Omo Zone, Arba Minch. The park was established in 1974 in an area of 514 km<sup>2</sup> in a scenic part of the Rift Valley floor between two lakes. The National Park supports 315 species of birds, 38 species of large mammals including 9 leopard (*Panthera pardus*) sightings and 22-23 species of small mammals (Duckworth *et al.* 1992). The Guji and Kore communities have settled in the eastern part of the park and in areas adjacent to the park. These pastoralist communities are using the park as grazing field for their cattle.

This is not the only danger the park is facing. As there is no other road linking the park area to Arba Minch town, people have to use the park area to cross to the town, which makes the park management difficult. In addition, people who live in the vicinity depend on the park for fuel wood collection, grazing, fishing, farming and hunting. Although the park management tries to prevent this, the number of people who encroach on the park has increased significantly over time. The human threat has drastically increased in recent years and it is imperative to put appropriate conservation strategy in place to protect the endangered national park under study. This, however, requires appreciation of the total economic value of the park and its contribution to development.

## 1.2 Problem Statement

Traditional conservation strategies that emphasize on protection without taking into account its implication on the local community often aggravate the damages on the national parks. Studies indicate that a proper conservation strategy requires integrating the management of the parks and

the benefits accrued from them with the community (Brandon and Wells 1992). This calls for proper valuation of the national parks; under-valuation of the environmental asset may cause the government to give lower priority to eco-tourism and over-valuation can also lead to distortion in the public resources allocation.

However, no attempt has been made to measure peoples' willingness-to-pay (WTP) for protecting national parks in Ethiopia. This study attempts to bridge the lacuna by taking Netchsar National Park as a case study.

### **1.3 Objectives of the Study**

The study aims at estimating individuals' willingness-to-pay for protecting the endangered Netchsar National Park using contingent valuation method. Specifically, the study sets out to:

- i. Estimate the individuals' willingness-to-pay for the change in the environment;
- ii. Identify the factors that determine the individuals' willingness-to-pay; and
- iii. Identify ways of integrating the community in the conservation of the National Park.

### **1.4 Hypotheses**

The study tries to test the following hypotheses:

- i. Individuals are willing to pay for the change in protecting the park.
- ii. Age, education, gender, income, knowledge about the environment and household size are major determinants of willingness-to-pay in protecting the park.

### **1.5 Significance of the Study**

The results of the study are relevant in many ways:

- i. Setting environmental standards and efficient management should be supplemented by economic valuation;
- ii. Conserving the environment is important in the country's development endeavour;
- iii. Environmental valuation will have an important impact on national development strategy, sectoral policies, project evaluation and sustainability of the development process in the country; and
- iv. Using the benefit transfer approach, the results of the study can be used to estimate the value of other national parks in the country.

### **1.6 Scope and Limitation of the Study**

The study will estimate the WTP for protecting the park. However, due to time, resource, and methodological limitations the study will not cover simulation exercises and reflect the effects of various types of conservation strategies on people's WTP for protecting the environment.

## **2. LITERATURE REVIEW**

### **2.1 Economic Valuation of Environmental Resources**

#### ***2.1.1 Valuing Environmental Goods***

The economic value of an item is measured by individual willingness-to-pay for the item. If the item has a market, then its economic value would be approximated by the market price of the product. The problem usually arises when the item has no market. Environmental resources are a case in point, which may also have intrinsic value, residing in the environmental asset and existing irrespective of the individual's preference. Valuation of the environmental good, however, captures only the economic value of the good. Thus, it would be very difficult, if not impossible, to attach a monetary value to an environmental asset. In public choice or decision-making process, both values are important. The problem is that the intrinsic value cannot be captured in valuation of environmental good. However, if respondents consider some of the intrinsic value in their valuation of the environment, then part of the intrinsic value can be captured (Georgiou, Pearce, and Moran 1997).

Total economic value (TEV) is a useful concept to measure the economic value of an environmental good. The TEV of the park can broadly be divided into two: use-value (UV) and non-use value (NUV). The use value of the park can also be divided into direct use value (DUV), indirect use value (IUV) and optional value (OV). The direct use value refers to the consumptive and productive use value such as forest products, medicinal value, water for humans and their livestock, food, and as a resource for economic activity. The indirect use value refers to the indirect effects of the environment on the society through the ecosystem. It refers to the ecological functions of the park and its implication on the welfare of the society. The optional use value of the park refers to the value that people attach to use the environment in the future. The non-use value of the park, on the other hand, consists of existence value (EV) and bequest value (BV) of the park. The existence value reflects people's preference to preserve the environment without any intention to use the environment. The bequest value refers to the people's preference to preserve the park for the use of future generation. In short,

$$TEV = UV + NUV$$

$$TEV = (DUV + IUUV + OV) + (EV + BV)$$

Fig.1. Total economic value

### ***2.1.2 An Overview of the Methods of Valuing Environmental Goods***

Different techniques have been proposed and applied to estimate the total economic value of natural resources and environmental assets. The methods can be categorized into two groups: direct and indirect methods. The direct method of valuing an environmental good includes Contingent Valuation Method (CVM), Contingent Ranking (CR) and Conjoint Analysis (CA) while the indirect method includes surrogate and conventional market approaches.

Direct methods are basically stated preference methods while indirect methods are revealed preference methods. Stated preference methods such as CVM have the following advantages over revealed preference approaches: i) they are the only methods that empirically measure the optional and existence value of environmental goods; and ii) they are good to measure people's preference for government policies or programs to changes in the quality of environmental goods (Hall, Hall, and Murray 2001).

#### **I. Direct Valuation Method**

The stated preference approach includes Contingent Valuation Method (CVM), Contingent Ranking (CR) and Conjoint Analysis (CA).

##### *i. Contingent Valuation Method (CVM)*

CVM is different from other methods in that it generates both market and non-market values of resources. The approach is particularly important in a situation where there is no market information about people's preference to an item. Thus, it is widely used in valuing changes in

environmental good. It is also applied in valuing such attributes as species preservation, historical and cultural phenomena, genetic diversity and the preservation of open spaces (Gerogiou, Pearce, and Moran 1997). However, the environmental good must be well defined.

CVM is basically a survey-based approach. To measure the economic value of an environmental good, respondents are asked questions that reveal their willingness-to-pay to improve or reduce the deterioration in the quality of an environmental good. Alternatively, respondents can be asked to state their willingness to accept in order to forgo or tolerate deterioration in environmental quality. Theoretically, it is argued that the WTP and WTA should result in equal amount. However, evidence shows that WTA measures usually give higher value than that of WTP (Georgiou, Pearce, and Moran 1997; Hanemann and Kanninen 1998). The decision to use willingness-to-pay (WTP) or willingness to accept (WTA) depends on, among other things, individuals' perception as to who has the property right over the resource in question.

To elicit respondent WTP for changes in an environmental asset, for instance, the questionnaire should contain at least three major parts

- a. *Realistic portrayal of the scenario*: A hypothetical description of the conditions under which a good or service is to be offered, or policy change or program would be implemented should be stated to the respondent. Since there is no real market for environmental goods, a hypothetical but vivid program must be stated. Similarly, the quality of the program, the method of payments, etc. must be well defined.
- b. *WTP questions*: After the realistic portrayal of the scenario is given, respondents will be asked questions regarding how much he/she will be willing to pay to protect an environment, to obtain a good or service, etc. under specified terms and conditions.
- c. *Questions on socio-economic and demographic characteristics*: Information is collected on the socio-economic and demographic characteristics of respondents to analyse factors that determine their WTP for the change in the environmental good.

The valuation format may take open-ended or closed-ended format. The open-ended format requires the respondents to state the amount they are willing to pay. On the other hand, the closed-ended format may be presented in various forms.

- a. *Single-bounded format*: The researcher asks whether a respondent is willing to pay a stated threshold.
- b. *Double-bounded format*: An initial bid amount is offered to the respondent, and when the respondent says "yes" for the offered amount, the researcher increases the amount. If the respondent says "no" for the initial bid amount, the researcher reduces the threshold.
- c. *Multiple-bounded format*: It is similar to the double-bounded format except that it will continue asking the respondents until they say "no" to the higher amount and "yes" to the decreasing amount (see Fig. 2).



Fig. 2. Dichotomous choice responses

The two main arguments that are proposed as to the advantage of the use of dichotomous choice format over open-ended question format in eliciting WTP are the simplicity for respondents and reduced incentives for strategic responses (Bateman *et al.* 2000).

Double-bounded contingent valuation is preferred by many scholars since it increases efficiency and avoids many of the biases inherent in CVM.

### *ii. Contingent Ranking*

Contingent ranking method is implemented in the same manner as CVM, except that respondents are asked to rank multiple programs simultaneously or various combinations of environmental goods with respective costs (Georgiou, Pearce, and Moran. 1997; Heinemann and Kanninen 1998). A researcher presents each program with a specific cost and asks respondents to rank them. The problem is that respondents may face difficulties in arriving at a complete rank of the programs.

### *iii. Conjoint Analysis*

Unlike the CVM and CR, in the conjoint analysis, each respondent should rank a number of tasks and each task has a number of alternatives. After it is completed, a utility index model is estimated for each individual and a representative random utility model is estimated for the population.

## **II. Indirect Valuation Method**

The revealed preference approach includes surrogate market and conventional market approaches. The former consists of travel cost and hedonic pricing methods along with averting behaviour technique. The latter consists of a dozen response and replacement cost approaches.

*i. Surrogate Market Approach*

*a. Averting behaviour:* It is one of the methods that can be used to value environmental change in a revealed preference manner by taking the cost of averting inputs used to substitute for environmental change. However, to get good estimate of the value of environmental change, the good must be perfect substitute or it may understate the value. Moreover, the averting behaviour of the good may have other beneficial effect.

*b. Travel cost method:* The travel cost method can be used to measure the demand and the value of environmental assets. The method relies on the costs incurred by visitors to arrive at the environment under consideration (Khandke *et al.* 2001). Although the method has been used commonly to estimate value of recreational sites, it has virtually no application to valuation of environmental loss or damage. Besides, since it deals with active participation, travel cost method measures the use value of the site and hence, the total economic value of the environmental asset cannot be captured. It also has a serious shortcoming in that the visitors who arrive to the areas are not always coming to visit only one place.

*c. Hedonic pricing:* The method is based on the assumption that any difference in wage rates or property values between normal areas and degraded areas is due to the value of the environment (Khandke *et al.* 2001). It means the method can be used to measure the value of environmental change if the environment is seen as a complement to the private good. For example, a location of a house is capitalized in the value of the house. Suppose there are two similar houses except for differences in the quality of the environment. The difference in the value can be seen and technically identified as the implicit value attached to environmental change. The basic limitation of the method is that it requires large data and greater statistical competence. Furthermore, it has very little relevance for environmental resources located in remote areas and in developing countries where competitive markets do not exist (Genanew 1999).

*ii. Conventional Market Approach*

*a. Doze-response approach:* It is used to measure use value of an environmental change by establishing relationship between the cause and its environmental impacts. This implies that the technique can be used if the cause and impact are known.

*b. Replacement-cost approach:* It is used to estimate the benefits of restoring lost or damaged environment through costs of replacing the asset.

The CVM is preferred to estimate the total economic value of the park as it is the only method that measures the use and non-use value of the park. Also, it is a widely used method to value environmental assets that have no real market.

## 2.2 Empirical Studies

A number of studies have been undertaken in measuring the economic value of recreational sites, forest reserves and other environmental assets. For instance, Desaignes and Duingue (2001) estimated the social benefits of biodiversity in southwest France, along the Garonne River. Using open-ended and referendum approach, they estimated willingness-to-pay for the restoration program of the 70 km riparian forest. The survey covered 400 individuals living within 30 km of the Garonne River. They found that the social benefit of the program exceeded its protection cost.

The study, however, has some shortcomings. First, the payment vehicle chosen – an increase in local taxes – is not a viable choice. As indicated in the study, a number of respondents refused to pay because of the high taxes. Secondly, the respondents' WTP is not consistent with economic theory. For example, it fails the scope test in that estimates are not sensitive to changes in the quantity of the environmental good. Moreover, the non-response rate is very high, which partly has something to do with government wastage argument.

Cilia and Scarpa (2000) have undertaken a study to measure tourists WTP for rural landscape preservation of traditional Mediterranean agriculture in the Cilento National Park. The researchers believe that, on top of active use value, the traditional agricultural landscape has high existence value as store of cultural heritage and regional identity. Hence, they used referendum CV survey to measure the benefits of the landscape in the park for the year 1997. In the CV scenario, tourists were asked to pay a daily charge during their visits of the park, to be used to support those agricultural activities that preserve the landscape. Expected WTP were calculated from the sample response using various maximum likelihood estimators. Then, the researchers estimated environmental magnitude of benefits to tourist population estimated by the landscape. Using RUM based parameter estimates, they found that the aggregate estimated benefits of the park area under cultivation in 1997 amounted to Euro 5-5.6 million.

Scarpa *et al.* (1999) conducted a study to measure the effects of creating natural reserves on the recreational value of woodlands. The study is based on large CV data from 26 Irish forests, involving nearly 10,000 visitors. The researchers used an extended random utility model (RUM) to account for forest attributes. The result from single and double bounded CV estimates indicates that, in addition to other forest characteristics, the presence of a natural reserve has a significant positive effect on the WTP. According to the results of the study, the total welfare change emanates from a policy of establishing natural reserves exceeds 570 thousands pound per year.

CVM have also been used by Hall, Hall, and Murray (2001) to estimate the benefits of effective enforcement and management of Marine Protected Areas (MPAs) in southern California Rocky Intertidal ecosystems. Studies on MPAs indicate that protecting coastal ecosystems under MPA have not been effective in the areas under consideration. Using close-ended, double-bounded

CVM, the researchers estimate that the WTP for enacting polices to reduce illegal collecting and on site habitat disturbance to an average \$6 per family visit or to an annual WTP of 3.6-4.8 million dollars per mile of coastline. This suggests that regional visitors of the Rocky intertidal zone (RITZ) sites place considerable value on protecting and preserving RITZ biological reserves.

Kuriyama (1998) conducted a study on an internationally important national park in Hokkaido, Japan. The Kushiro Wetland National Park covers 26,861 ha and is endowed with thousands of animals, birds, and plant species. The researcher attempted to measure the environmental value of the ecosystem in the wetland using Choice Experiments (CEs) and Conjoint Analysis (CA). By talking 845 residents and visitors, the researcher shows that protecting the wetland and all lands including forests around the wetland has a significant economic value of 16,414 yen/year/household or an aggregate amount of 36 billion yen. An internal scope insensitivity test also shows that it is consistent with economic theory in that the WTP changes with the change in the quantity of the economic good under discussion.

There are also some attempts regarding valuation of changes in the environmental assets in Ethiopia. Among these studies, the works by Shimelis (1997) and Tegegne (1999) are worth reviewing. Shimelis (1997) aimed at testing the applicability of contingent valuation technique for evaluating the opportunity cost of deforestation in Walmera *Wereda*, in Ethiopia. The study indicates that the annual loss of deforestation to rural households in the area was estimated at Birr710,620.00. Moreover, households' income, size, education, fuel wood collection time, and respondents' understanding of willingness-to-pay were found to be statistically significant. The major limitation of the study is that it considered only the use value of the forest.

Tegegne (1999) applied a contingent valuation method to elicit people's valuation for environmental protection in terms of both cash and labour contribution in Sekota District, northern Ethiopia. The study revealed that farmers in the study region are less willing to pay for the environmental protection in cash while they are willing to pay a substantial amount of their time to protect the environment. Moreover, the study pointed out that wealth, education, sex, size and age are significant determinants of household labour contribution for protection of the environment. This study provided relevant policy implication for the conservation of the environmental asset. However, the researcher used quite broad environmental good in his analysis, which may create confusion for respondents.

In general, different techniques have been developed and tested in evaluating the economic value of an environmental asset. The choice of the method is dependent on the availability of data, the nature of the asset and the specific objective of the study under consideration.

### **2.3 Environmental Policy of Ethiopia**

The Ethiopian economy is basically an agrarian economy. Agriculture contributes on average to 51 percent of the GDP, is the main source of employment, generates the lion's share of foreign exchange earnings, and is the source of raw material and market to the domestic industries. However, the sector could not play its leading role due to various problems. Environmental degradation is a case in point. The population pressure augmented by inappropriate land use

system seriously hampers the development of the agricultural sector. The irrational use of forest resources, which has cut the country's forest resources from 40 percent at the beginning of the last century to less than 2 percent by the beginning of this century, adversely affects the hydrological cycle and the ground water potential of the country. It is estimated that the country is losing on average over 80,000-200,000 ha of forest per annum. This, on the other hand, is fostering soil degradation on the highlands of the country. It is reported that the country loses average grain production of 40,000 tones per annum due to soil erosion and over 1.1 million Tropical Livestock Unit (TLU) of livestock production. Moreover, inadequate and erratic rainfall together with the pressure on grazing land hinders the country's economic development. In effect the environmental degradation poses daunting challenge on the very existence of the society (Environmental Protection Authority and MEDaC 1997).

Recognizing the seriousness of environmental degradation in the country and the threat that it poses on future development of the country, the Federal Democratic Republic of Ethiopia issued an environmental policy in 1997 (Environmental Protection Authority and MEDaC 1997). Some of the guiding principles of the policy are:

- i. The environmental and social costs resulting from environmental degradations or pollutions should be taken into account in public and private sector planning;
- ii. Conducive situation will be created to support individual and community resource users to sustainable management of resources and the environment;
- iii. Social equity shall be maintained in resource use;
- iv. Continuing access to the same piece(s) of land and resources create conditions for natural resource management; and
- v. The biodiversity, which may have current or future use value, shall be protected.

The policy has the goal of improving the livelihood of the people by bringing sustainable development through sound management of natural resources and the environment. The specific objectives of the policy include: sustaining essential ecological process and life support systems; preserving biological diversity and renewable natural resources; extending the benefits of non-renewable resources as far into the future; identifying and developing natural resources that are currently under-utilised; incorporating the full costs and benefits of natural resources on development planning; preventing pollution of land, air and water in most cost effective way; conserving, developing, managing and supporting Ethiopian's rich and diverse cultural heritage; ensuring community involvement in the management of environmental amenities; and rising awareness about the linkages of environment and development.

To attain these objectives, the policy is designed to have sectoral as well as cross-sectoral policies. Within the sectoral policy framework, specific policies were formulated to address soil husbandry and sustainability of agriculture; forest, woodland and free resources; genetic, species and ecosystem biodiversity; water resources; energy resources; mineral resources; urban environment and environment health; pollution and development; and cultural and natural

heritage. The cross-sectoral policies, on the other hand, address population and environment; community participation and the environment; tenure and access rights to land and natural resources; land-use plan; social and gender issues; environmental economics; environmental information systems; and environmental education and awareness.

The policy also indicates that the government will be committed to establish protected areas to conserve ecosystems and habitats. Moreover, it emphasizes the importance of involving local community participation in the planning and management of the protected areas. It indicates that the benefits from conservation of parks, forests and wildlife conservation and management programs should be shared with the local communities affected by such programs.

However, implementation of the policy seems very slow in that huge environmental resources are still in great danger. Surprisingly, most of the well-known parks, which were established in the early 1970s, have not yet been gazetted, which has made their management very difficult. Netchsar National park is a case in point.

As opposed to the policy document, which states that additional areas to be demarcated as protected areas, most of the existing national parks are in a serious danger from the local communities. Some of the reasons are confusion on the territorial demarcation of the parks, population pressure, overgrazing, landlessness, unemployment, and lack of awareness. These problems worsen the environmental degradation in general and the very existence of national parks in particular.

Despite what is stated in the policy guideline, the prevailing conservation strategy that the parks put in place is the traditional conservation strategy. The park management has not yet been institutionalised; community participation in the conservation endeavours is little; the benefits from the park are not trickled down to the community; and environmental education is still fragile. All of these have adverse impact on the sustainability of the park.

The national park should be able to generate sufficient revenue and share the benefits with the local community so that the latter can see the park as an asset than a burden. However, the park is not able to generate sufficient revenue due to lack of necessary infrastructures, institutions, and policies that need to be in place to harness the huge economic potentials of eco-tourism.

### **3. RESEARCH DESIGN**

## 3.1 Data and Sampling Frame

### 3.1.1 Study Area

Nechisar National Park is located 6°N 37°32'45"E in the Southern Nations, Nationalities and Peoples Region (SNNP) with an altitude range of 1,108-1,650 m ASL. The park was established in 1974 in the scenic part of the Rift Valley floor between two lakes. It covers 514 km<sup>2</sup> of which 78 km<sup>2</sup> is water. It is "a mosaic of forest, bush land, grassland and fresh water habitat" (Duckworth *et al.* 1992). The Arba Minch forest contains groundwater forest, Kulfo riverine forest, and it is rich in wild life and springs (Arba Minch Springs).

The park is one of the best national parks in the country in terms of its biodiversity. It contains 38 large mammal species including 9 leopard (*Panthera pardus*) sightings, and 22-23 species of small mammals. The park supports at least 315 species of birds and acts as the destination of many Palearctic and intra-Africa migrants (Duckworth *et al.* 1992). The Ethiopian endemic subspecies Swayne's hartebeest (*Alecelapus buselaphus swaynei*) is also found in the park.

The park is currently under severe threat due to human encroachment. The Guji Oromos have settled inside the park while the Kore community have settled adjacent to the park. The Guji Oromos are pastoralists and the Kore are farmers. Both use the park for grazing their livestock. During dry seasons, the Kore burn large areas and the Guji Oromos concentrate their livestock in the park. This leads to a high incidence of poaching in the park.

Currently, around 1500 Guji Oromo households have already settled inside the park. It is also a very common phenomenon to watch wild animals grazing together with the cattle of the settlers in the park. Moreover, as there is no other road linking the people who are living near the park area to Arba Minch town, people have to use the park area. We also witnessed a small market within the park for the people who are crossing the park. Some people visit and stay near the hot springs for health reasons with virtually no effect on the park. This, however, created difficulty for the park management to use its security guards. In addition, people who live in the vicinity of the park are dependent on the park for fuel wood collection and hunting. The number of people who encroach on the park has increased significantly over time despite the management's efforts to control this. .

### 3.1.2 Survey Design and Administration

Given the cost, time, and other factors that make the survey difficult (such as excessive travelling) on the one hand and the need for relative accuracy, on the other, the boundary for the sample survey was the Amaro Special *Wereda* and Netchsar Peasant Association. The former is located in the vicinity of the park while the later is inside the park. A total of three peasant associations were covered by the survey. The first two, Yero and Debre Menena, were selected from Amaro Special *Wereda*. They were selected based on their location and presumed dependency on the park. The Netchsar Peasant Association was also covered in the survey. The sample unit is household.

A sample of 200 households was selected randomly. The error in sampling is calculated to check whether the sample taken is representative:

where,

e = standard sample error

n = sample size

N= total population (124,962) (CSA, 1999)

P= success for each PAs to be included in the sample (P=0.33)

1-P = failure for each PAs to be included in the sample (1-P=0.66)

$$=0.0329=3.29\%$$

The standard sample error is a statistically acceptable error. This implies that the sample taken in the study is fairly representative. The sample is distributed equally across the sampling sites, i.e., 50 households were interviewed from each peasant associations.

The survey included questions regarding the respondents' economic activity, the environment, respondents' attitude towards it, and different socio-economic and demographic characteristics. The survey also assessed villager's willingness-to-pay to protect the park using double-bounded contingent valuation questions.

Respondents were first asked some introductory questions such as age, sex, education, income and occupation. Then they were asked questions about their knowledge of Netchsar National Park and how they use the park. A brief introductory remark about the endowment of the park, its current situation (damage) and the costs of losing the endowment of the park for the country in general and the local community in particular was given. A hypothetical program (scenario) that will protect the park and benefit the local community was presented to the respondents. For that, we use experience from nearby national park (Mago National Park) where representatives from the government and members of the community living adjacent to the park agreed upon to protect the park and benefit the community.

The respondents were given an account of the Mago National Park experience as follows:

Public discussion has been held between government representatives, the park management and the local community, and it was pointed out that substantial amount of money could be raised if the wild animals, birds and vegetations of the park were conserved. However, if the park were



used sporadically, it would be of no use both to the community and to the wild animals living therein.

It was emphasized that currently the park is seriously damaged and needs conservation. Appreciating the severity of the problem, the community leaders and government representatives reached a consensus on two points:

- i. The community will abstain from such activities as grazing their livestock in the park, putting their beehives, etc. and will protect the park from any danger.
- ii. The government, in turn, will use part of the revenue generated from park to build roads and clinics and to carry out other development activities for the local community.

After the above information is given to the respondents, the WTP question is posed as follows:

Netchsar National Park is rich in wild life, birds and vegetation. However, the park is being severely damaged by human encroachments. The number of wild animals and birds is declining alarmingly, the forest is being eradicated and the number of springs is diminishing. If the situation continues, the local community would lose any benefit that it might obtain from the park resources (wild animals, plants and birds). The environment will reach to the point where it can't support the community and the wild animals.

If a programme similar to that of Mago National Park is designed to rescue the park, members of the community will participate in protecting the park in terms of money or labour. In turn, the community benefits from revenue generated from the park through building roads, clinics for livestock and humans, and supplying clean water, etc. If you were asked to raise money or contribute labour to this end, how much would you be willing to contribute monthly? Please, note that the objective of this study is to collect relevant information to rescue the park from the serious threats it faces. Above all, if this project were implemented, you would not be obliged to pay the amount you mentioned.

Respondents were then presented with the willingness-to-pay question that has any of the three different starting amounts. The initial bid amounts were Birr 8, 12, and 16. If the respondents answer the first question affirmatively, then the amount was increased (doubled) otherwise, it was decreased (halved). The payment vehicle used was monthly cash payment or labour contribution, whichever the respondent chooses.

Enumerators who can speak the native languages, Oromifa and Kore, were selected and trained. Then, a pilot survey was conducted and the questionnaire was revised accordingly. The final survey was conducted for 15 days. While the main survey was conducted, focus group discussion was held with representatives different members of the community and local administrators.

### 3.2 Methodology

Contingent valuation method was used to elicit the people's willingness-to-pay for the environmental change in the park. This method is particularly applicable in a situation where market information about people's preference is absent.

#### 3.2.1 Specification of the Model

This study adopts the model developed by Cameron and Quiggin (1994) and aims at identifying the true WTP of the local community to protect the endangered park and its determinants. It is assumed that each respondent has a true valuation for the environmental resources in question and that it will not be affected by the change and shift in the offered amount. However, the true WTP of the respondents is a latent variable.

Let this unobservable true WTP for the first question be  $y_{1i}$ , and the first offered threshold assigned arbitrarily to this individual be  $t_{1i}$ . The assumption is that the individual will be willing to pay the offered amount ( $I_{1i}=1$ ) if  $y_{1i} \geq t_{1i}$  and he/she will not be willing to pay the offered amount ( $I_{1i}=0$ ) if  $y_{1i} < t_{1i}$ .

$$(I_{1i}=1) \rightarrow y_{1i} \geq t_{1i}$$

$$(I_{1i}=0) \rightarrow y_{1i} < t_{1i} \dots \dots \dots (1)$$

The true willingness-to-pay is assumed to be determined by observable attributes of the respondent ( $x_1' \beta_1$ ) plus an unobservable random component,  $\xi_{1i}$  (distributed  $N(0, \sigma_1^2)$ ), which measures all unmeasured determinants of the value of the resources to the individual. Further,  $I_{1i}$  is an endogenous dependent variable and  $t_{1i}$  is assumed to have no correlation with the error term,  $\xi_{1i}$ . This can be written as:

$$Y_1 = x_1' \beta_1 + \xi_1 \dots \dots \dots (2)$$

Using the same notation for the data pertaining to the follow-up question,  $Y_{2i}$  will be the respondents' implicit underlying point valuation of the resource at the moment the follow-up question is posed.  $I_{2i}$  will take the value of 1 if  $y_{2i} \geq t_{2i}$  where  $t_{2i}$  is correlated with  $t_{1i}$ , and it will take the value of zero if  $y_{2i} < t_{2i}$ . That is:

$$(I_{2i}=1) \rightarrow y_{2i} \geq t_{2i}$$

$$(I_{2i}=0) \rightarrow y_{2i} < t_{2i} \dots \dots \dots (3)$$

Similar to the initial question, the point valuation will have systematic component  $X_i' \beta_2$  and error component as  $\xi_{2i}$  which is normally distributed with zero mean and variance  $\sigma_2^2$ .

$$Y_2 = x' \beta_2 + \xi_2 \dots \dots \dots (4)$$

As the second question is based on the first question response,  $\xi_{2i}$  is correlated with  $\xi_{1i}$ . Hence, the two equations should be estimated together. The model developed following Cameron and Quiggin (1994) assumes bivariate normal distribution for the two implicit valuations BVN ( $x_1'\beta_1, X_2'\beta_2, \sigma_1^2, \sigma_2^2, \rho$ ). The two questions have four possible pairs of response:  $(I_{1i}, I_{2i}) = (1,1), (1,0), (0,1)$  and  $(0,0)$ . Considering the case of “yes” response to the initial question, i.e.,  $I_1=1$  which implies  $Y_1 > t_1$ , equation one can be re-written as:

$$\xi_{1i} / \sigma_1 - (t_1 - x_1' \beta_1) / \sigma_1 \dots \dots \dots (5)$$

(Where  $\xi_{1i} / \sigma_1$  is a standard normal random variable.) The same transformation can be applied to  $Y_2, t_2$  and  $I_2$ . Denoting the standard normal error  $\xi_{1i} / \sigma_1$  as  $Z_1$  and  $\xi_{2i} / \sigma_2$  as  $Z_2$ , the analysis can proceed as  $(Z_1, Z_2)$  distributed BVN  $(0, 0, 1, 1, \rho)$ . Then the log-likelihood function of the model can take the following form:

$$+ \\ + \\ + \dots \dots \dots (6)$$

From this general model, the parameters to be estimated are,  $\beta_1, \beta_2, \sigma_1, \sigma_2$  and  $\rho$ . Using the estimates from this model, it is possible to get the variance covariance matrix and the mean willingness-to-pay of individuals to protect the park. The general model can be readily estimated using standard packaged bivariate probit algorithms using STATA software.

**3.2.2 Estimation Techniques**

Contingent valuation method is used to elicit the mean WTP of the respondents to changes in the environment under study. A dichotomous choice contingent valuation method with follow-up questions was used. As the dependent variable in the model is a dummy variable, which assumes either 0 or 1, it is appropriate to use limited dependent variable estimation techniques.

The use of dichotomous choice questions with follow-up bids implies that the response for the second question will be endogenous to that of the first. This means that the model cannot be estimated using the ordinary probit/logit model. Thus, bivariate probit model, which simultaneously estimate the two equations, was used in order to minimize the distortions that might be created due to the endogeneity of the second response.

**3.2.3 Variable Definitions and Expected Signs**

**Willingness-to-pay [WTP]:** The dependent variable in the model is the people's WTP, which is expressed as 0 and 1. Whenever a respondent answers "yes" to a threshold value, the value will be 1, and 0 otherwise.

**Household income:** One of the variables expected to influence an individual's willingness-to-pay for protecting the park is the level of household income. Other things remaining constant, the higher the respondent's income, the more he/she is willing to pay. The households are given options to undertake the payment in terms of money or labour contribution. If they prefer the latter, the labour-hour they are willing to contribute to the purpose would be converted into money. The implicit wage rate is Birr 5 per labour day, and it is the prevailing wage rate in the area during the survey period.

**Educational level of the household:** Education is supposed to have positive impact on an individual's willingness-to-pay. The reason is that the higher the educational attainment of the person, the higher his/her awareness about environmental degradation. It is measured by the extent of the formal education the individual attained in his/her lifetime. It is included in the model as a dummy variable. Three dummy variables were generated as: illiterate, primary school completed and secondary school and above.

**Dependency Ratio:** This variable is expected to be negatively related with WTP because the higher the number of dependents relative to the economically active members of the family, the less willing the household is to pay for protecting the environment, and vice versa. It is calculated as the ratio of the number of dependents (age less than 13 or above 60) to economically active members of the family (age between 14 and 59).

**Distance from the park:** Other things remaining constant; it is expected that the farther the respondent is from the park, the less willing he/she is to pay for protecting the park. The negative relation between the two variables is explained by the extent of dependency that the respondent will have on the park's resources. This variable is taken as a dummy variable.

**Primary activity of the households:** There are various types of activities in the survey area. Some of them are primarily engaged in production of cash crops while others are mainly pastoralists. Given the nature and marketability of the product, it is expected that respondents who are producing perennial crops such as coffee may generate better income, and hence may be willing to pay more than others.

**Offered amount:** Three threshold values are offered: Birr 8, Birr 12 and Birr 16. The higher the threshold value proposed, the less willing the respondent is to pay. So it is expected to have negative sign.

**Sex** The sex of the household head may assume either sign.

**Age:** The age of the household head is expected to have either sign.

## 4. RESULTS AND CONCLUSIONS

### 4.1 Descriptive Analysis

Information regarding socio-economic, demographic characteristics and knowledge and attitude of the community is important to appreciate their WTP to protect the endangered park. In this sub section descriptive analysis of these factors and their implication on conserving the park will be discussed.

In all, 200 households were interviewed with virtually no non-response rate. Out of these, 93% of the households are men-headed while 7% are women-headed. The respondents' age ranges from 19 to 90, and a significant proportion of them (83.24%) are within the active labour force (table 1). The average household head age is around 44.6 years. The sampled households are characterized by large family size. As indicated in table 2, more than 70% of the households have 6 to 15 household members leading to high dependency ratio of 0.75. The average household size of the sampled households is 7.47.

Table 1. Distribution of the respondents' age

Age group	Frequency	Relative frequency
19-29	25	13.51
30-40	75	40.54
41-51	40	21.62
52-62	14	7.57
63-73	16	8.65
74-84	13	7.03
85-95	2	1.08
Total	185	100.00

SOURCE: Survey result.

Table 2. Household size of the respondents

Household	Frequency	Relative frequency
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size		
1-5	49	26.49
6-10	102	55.14
11-15	28	15.14
16-20	6	3.24
Total	185	100.00

SOURCE: Survey result.

Most of the respondents have no formal education (66.5%). Only 29.19% and 4.32% attended primary and secondary school, respectively (table 3). The annual household income is highly skewed to the right. About 77.84% of the households earn annual incomes of less than Birr 10,000. Nearly 10% of them earn annual income ranging between Birr15,000 and 40,000 (table 4). The average annual income of respondents is Birr 7,307.

Table 3. Educational level of the respondents

Educational level	Frequency	Relative frequency
No formal education	123	66.50
Primary school (1-8)	54	29.19
Secondary school (9-12)	8	4.32
Total	185	100.00

SOURCE: Survey result

Table 4. Annual income of the respondents

Income range (in Birr)	No. of households	Percentage
Less than 5,000	85	45.95
5,001-10,000	59	31.89
10,001-15,000	21	11.35
15,001-20,000	9	4.86
20,001-25,000	5	2.70
25,001- 30,000	2	1.08

Greater than 30,000	4	2.16
Total	185	100.00

SOURCE: Survey result.

The major economic activities in the area are mixed farming and livestock rearing. The data shows that 75.5% of the respondents are primarily engaged in farming, about 14.3% earn a living from rearing livestock, and others are in the retail business and handicrafts. It seems that the household income level is highly correlated with the household's land size. Other things remaining constant, people with higher income also hold relatively large lands (see Fig. 3).

Fig. 3. Income groups versus mean farm area

Source: Survey result.

In order to assess the extent of the dependency of villagers on the park, the participants of the survey were asked to list for what purpose they visit the park. The result partly indicates the extent to which human encroachment affects the environment. Around 86% of the respondents use the park for grazing their livestock. This is not surprising since around 1500 pastoralists have already settled inside the park. But the results show that it is not only the pastoralists but also the Kore, who practice mixed farming activities, which are using the park for this purpose. Nearly half of the respondents (48.7%) mentioned that they use the park for farming. About 20.3% of the respondents indicated that they hunt in the park. This is particularly threatening the very existence of wild animals and the Swayne's hartebeest in particular. About 29.9% of the respondents fetch water for themselves and their livestock from the park and about 2.0% visit the park for fishing (table 5).

Table 5. Dependency of the local community  
on the park resources

Resources	Households
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	<i>Number</i>	<i>Percentage</i>
Water	59	29.9
Grazing	170	86.3
Faming	96	48.7
Hunting	40	20.3
Fishing	4	2.0

SOURCE: Survey result.

To see their awareness regarding the endowment of the park and the changes therein, respondents were asked to list down the flora and fauna they know. Most of the respondents listed down various types of wild animals, birds and vegetation. They also managed to point out some of the extinct species, which they knew during their lifespan such as the giraffe, elephant and buffalo. The same view was shared by the focus group discussion participants. Despite the escalating human encroachments and associated destruction, little has been done to educate the local community on the issue. The survey indicated that only 10.9% of the respondents have environment-related education.

The respondents also mentioned some of their most pressing socio-economic problems that may have an important implication in minimizing the human pressure on the park. The most important problem stated was lack of roads (by 57.5% of the respondents. About 17% of the respondents ranked transport service as second most severe problem while hospitals, schools and pure water were mentioned as the third, fourth and fifth most pressing problems, respectively.

There was also some confusion about the park territory, arising from the fact that the park not being gazetted. Some of the respondents mentioned that they were asked to leave from areas such as Walo, Corde, Checha, Talke, etc., which were and are used for farming activities. The problem is further intensified due to the current federal system of the country. The park is located in the Southern Nations and Nationalities Peoples region but the Guji Oromos, which settled inside the park, are administered by the Oromia Region, making the management of the park very difficult.

Despite all these problems, many of the respondents are willing to pay to protect the park. About 73% of the respondents answered “yes” to the initial and follow-up bid amounts, 15% answered positively to the initial payment question and negatively to the follow-up, less than 1% answered “no” to the first question and “yes” to the second, and 7% answered “no” to both questions.

## **4.2 Econometric Results**

Double-bounded contingent valuation model is used to estimate the mean willingness-to-pay and its determinants. To estimate the mean WTP, two independent models were run:

- i. A model with no covariates (WTP against the offered amount); and



- ii. A model with covariates (WTP against age, education, income, gender, household size, offered amount, dependency ratio and distance from the park)

The results from the two models were compared and the results from the second model were preferred (see tables 6 and 7). The reason for this preference is that results obtained from the second model with covariates will increase the accuracy of the marginal value of changes in amenity levels associated with the environment (Cameron and Quiggin 1994).

Model one is the most general model where WTP variable is regressed against the offered amount to obtain the mean WTP. The point estimate of the mean willingness-to-pay (WTP) for the first question is Birr 33.09, while for the second question is Birr 82.56 per household per year. Overall, the model is significant at 5% as indicated by the log likelihood ratio (see table 6).

Table 6. Results of the model with no covariates

Equation I		<i>Equation II</i>	
Variable Name	Coefficients	Variable Name	Coefficients
Offered amount I	-0.0050 (0.0302)	Offered amount II	-0.0259 (0.0121)**
Mean WTP (Birr)	33.09	Mean WTP (Birr)	82.56
Log likelihood = -127.0652**			

SOURCE: Own computations.

The second model is estimated by including a number of covariates in addition to the offered amounts. The result indicates that the means of willingness-to-pay for protecting the endangered park for the two equations is Birr 28.34 and Birr 57.07 per household per year, respectively. Note that the contributions can be either in money or labour. As indicated by the log likelihood ratio, the model is significant at 5% significance level (table 7). The result implies that the local community is willing to pay to protect the park despite the various pressing problems they face. This further suggests that acceptable programs, which accommodate the interest of the local community and the government, may play a positive role in protecting the park. However, settling the structural problem of the park, i.e., gazetting the park and solving the conflict between the two regional states over the park ownership, is vital. Of course, designing appropriate program is not enough by itself. To implement the program, building the capacity of the park management is indispensable. Currently, the park is poorly equipped and understaffed especially in terms of skilled manpower. Developing the park management's capacity is very useful not only to generate sufficient revenue but also to closely study the biodiversity and the changes occurring therein.

The respondent's mean willingness-to-pay is influenced by a number of socio-economic and demographic factors. The results show that the coefficient for the dummy variable that represented farming as a primary activity of the household was positive and significant in both equations, indicating that individuals who are engaged in farming were willing to pay more than those individuals who were engaged in livestock raising and other activities. The result is not surprising because farmers in the area are engaged in cultivating cash crops such as coffee and other perennial crops. The dependency ratio has been found to have negative and significant coefficients in both equations. This indicates that the higher the number of dependents, the lower the household's WTP. The coefficient for the offered amount was negative in both equations and only significant in the second equation, indicating that as the magnitude of the offered amount increases, it is less likely that individuals will be willing to pay the offered amount. Also, the coefficient for the dummy variable that represents distance from the park was found to be negative and significant for the second equation indicating that the farther the households from the park, the less willing they are to pay to protect the park. This may be explained by the extent of dependency of the individuals on the park. However, education, age, and gender were found to be insignificant (see table 7). It is not surprising to find that education is not an influential variable in the model since most of the respondents are illiterate.

Table 7. Results from the model with covariates

<i>Variable</i>	Equation I coefficients	Equation II coefficients
<i>Offered amount</i>	-0.0067 (0.0353)	-0.0288 (0.1752) *
Educational level of household head	-0.1597 (0.4165)	0.2242 (0.2840)
Farming as a primary activity	0.5255 (0.3098) *	0.5940 (0.2544) ***
Age of household head	-0.0127 (0.0099)	-0.0043 (0.0079)
Sex of household head	-0.2260 (0.6531)	-0.6743 (0.5006)
Dependency ratio	-0.3872 (0.2384) *	-0.4265 (0.1650) ***
Distance from the park	-0.2305	-0.5473

	(0.4074)	(0.2879) *
Constant	2.5336	2.4790
	(0.8815) ***	(0.6993) ***
Log likelihood	-117.6174**	

SOURCE: Own computations.

### 4.3 Conclusions

Ethiopia is known for its rich biodiversity and natural resources. Most of the endemic animals and other habitats are found in its national parks, wild life sanctuaries and reserves. However, they are under critical conditions due to sordid rural poverty, increasing demand for grazing and cultivable lands, population growth, urbanization, high unemployment levels, lack of awareness and other factors. Netchsar National Park is one of the endangered national parks in the country.

Netchsar National Park is under severe threat due to human encroachment. About 1500 Guji Oromo households have settled inside the park and the Kore community is living adjacent to the park. The two communities are dependent on the park for farming, grazing their livestock, hunting, fishing and fetching water for themselves and their livestock. Due to these and other reasons, the human pressure on the park is increasing tremendously.

To protect the park, the current conservation strategy implemented by the regional state is not consistent with the environmental policy of the Federal Government. Despite what is stated in the policy guideline, the prevailing conservation strategy that the park puts in place is the traditional conservation strategy. The park management has not yet institutionalised community participation in the conservation endeavours, the benefits from the park are not trickled down to the community and environmental education is still fragile. Implementing appropriate conservation strategy, however, presupposes proper valuation of the environment under consideration.

In this study, it was tried to estimate people's willingness-to-pay to protect the park and identify its determinants. The study used dichotomous choice contingent valuation method. Using a bivariate probit model, it was found that the local community is willing to protect the park by contributing either in terms of money or labour. It was also found that the respondents' mean willingness-to-pay is significantly influenced by the nature of their primary activity, dependency ratio and distance from the park. However, age, gender and the level of education of the respondents were found to be insignificant.

The result implies that the local community is willing to protect the park despite the various problems it faces. This further suggests that programs which accommodate the interest of the local community and the government may contribute positively in protecting the park. However, the success of any effort to rescue the park depends on strengthening the legal backing of the park by gazetting it, settling the dispute between the two regional states over the park, providing aggressive environmental education and building the capacity of the park management. In

addition, consistent to the environmental policy, the park management should involve the local community in the conservation endeavour and share the benefits with them so that they will consider the park as an asset than a burden.

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