

# Valuing Conservation of Walia Ibex: An Application of Choice Experiment Valuation Method

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## Abstract

For the purpose of valuing conservation of Walia Ibex, in this paper choice experiment environmental valuation technique is employed. 200 residents from Addis Ababa and 94 foreign visitors have been randomly chosen to reply to a CE survey questionnaire. Hence, four attributes; change in population size, change in listing status, funding mechanism and employment opportunity were taken along with a monetary attribute to describe various conservation management options. Furthermore, Random Parameters Logit model has been used to estimate the choice data set generated from the survey.

The estimation result demonstrates that all the attributes are significant, except employment opportunity attribute in the case of visitors. Moreover, years of education and family size were found to significantly affect residents' utility with positive and negative impacts respectively. Age is found to positively and significantly affect visitors' utility for conservation improvements. The highest MWTP being accredited to change in listing status attribute for both the residents and visitors', conservation practitioners are advised to focus on conservation elements improving listing status of the species.

**Keywords:** Choice Experiment, Walia Ibex, Endangered, Conservation, non-use value, Ethiopia.

## 1. Introduction

Walia Ibex (*Capra Walie*<sup>1</sup>) is one of the most charismatic flagship species of Ethiopia confined to a small area in the SMNP and found nowhere else in the world. Ever since its establishment, conservation of Walia Ibex has been central to the Semien Mountains National Park (SMNP). The species notwithstanding its role for national tourism was described for many years as critically endangered under the IUCN red list report of endangered species, progressing only slightly to a down-list of being endangered at present. The major threat to the species continues to be habitat destruction due to human encroachment. Other threats include transmission of disease from domestic livestock, hybridization, competition from other species and predation by leopards (Gebremedhin et al. 2010).

There have been various efforts by the government of Ethiopia and different local and international organizations to protect species in jeopardy including Walia ibex. Nevertheless, all these endeavors though momentous could not bring sustainable panacea for the problems without proper participation of local communities in the process of conservation. For instance, the IUCN Red List report (2012) mentioned Ethiopia as a country with 10, 33 and 55 of its animals under the critically endangered, endangered and vulnerable categories respectively. Also, Tefera (2011) pointed out that, all endemic mammals in Ethiopia were in the endangered category. Furthermore, Ethiopian highlands along with other major mountain regions of Africa are predicted to be critically threatened in the next two decades (Burgess et al., 2006). Consequently, because policy makers have to know the attitudes of the community towards conservation programs community based conservation of wildlife is critical. Hence this paper will try to retrieve households' and tourists' perceptions towards preservation of Walia ibex.

Usually budget allocation by the government for public goods like endemic species at risk and biodiversity conservation must rely on information about the potential costs and benefits to be attributed to conservation. Lack of information will tend to mislead decision makers such that resources might be allocated in the wrong area or at an incorrect proportion. Hence by failing to consider the vitality of human action, policy makers could end up drafting fruitless conservation plans (Shogren et al., 1999). Moreover, the economic values of natural resources, like threatened endemic species, include non-use values which will not be directly reflected by the market mechanism unless we use environmental valuation techniques. So a valuation study like this would help narrow the information gap expected in the area thereby reducing any possible ruin of environmental resources like endemic species.

Since conservation of biodiversity benefits everyone in the planet except its variation in degree, it should not be an issue left entirely for the local people. The willingness to pay of foreigners to conservation is also assessed in this paper.

Many environmental studies have been conducted in Ethiopia so far, but are devoted to biological descriptions of species and/or the challenges facing those species (Evangelista et al., 2009; Yihune et al., 2008; Gebremedhin et al, 2009). Still others have been devoted to estimation of willingness to pay for endangered environments and

<sup>1</sup> Capra Walie is the scientific name of Walia Ibex.

ecology in general (Zewdu and Yemisrach, 2004; Yibrie, 2011; Fufa and Belete, 2009). Willingness to pay for conservation of endemic endangered species appears undiscovered as attempts to valuation of threatened species in Ethiopia are infrequent at least to the best of my knowledge. This study, being an application of CE to species valuation hence is a good penetration in-to the new and is expected to improve the knowledge gap on the issue under consideration.

The general objective of this study is to estimate the economic welfare gain resulting from various Walia Ibex conservation schemes using choice experiment environmental valuation technique. And specifically the paper tries to: assign monetary values to different attributes of conserving Walia Ibex; determine socioeconomic factors affecting respondents' willingness to pay for conservation; examine how willingness to pay is affected by conservation attributes and provide policy recommendations for the conservation of Walia Ibex in Ethiopia.

## 2. Review of related literatures

Hanley et al. (2003) tried to disclose the significance of choice experiment method in designing conservation related policies. They studied the behaviors of visitors, the general public and local residents<sup>1</sup> for conservation of wild goose in Scotland separately and have observed varied preferences among those population categories. For instance regarding the change in population of geese local residents demanded £29.67 for a 50% increment, while visitors were willing to pay £15.39 for a 25% rise goose numbers. Local residents choose the population to stay at the current level as is justified by their interest to pay £24.98 to prevent a 10% reduction in number of goose. Visitors and local residents preferred conservation to target on endangered species of wild goose whereas the general public did not discriminate between species. Place of conservation was also considered as one attribute in their study but indeed was significant only for visitors.

Yibrie (2011) has made an interesting attempt to use choice experiment and TCM to estimate the total value of the Semien Mountains National Park in Ethiopia. From the TCM interview conducted on both local and foreign visitors he inferred the total annual recreational value of the park to be Birr 48, 562, 086. Of the negligible studies conducted on valuation of species in Ethiopia this could be taken as the only effort which tried to value Walia Ibex, though not specifically. In this study the population change of Walia Ibex and Ethiopian wolf<sup>2</sup> together were taken as one attribute to the paper's CE exercise along with other attributes; afforestation, additional service to visitors and entrance fee. This study however failed to allot that particular amount of money which goes to those particular endemic endangered species. Hence, what is the value of Walia Ibex alone? Remains to be baffling in this study as it may have millions of answers ranging from zero to the mean willingness to pay values stated earlier above.

Zewdu and Yemesrach (2004) applied dichotomous choice contingent valuation method to estimate willingness to pay of the respondents living nearby Nechisar National Park in Ethiopia for the overall conservation of endangered environments. Their study shows that primary economic activity of the household, dependency ratio and distance from the park were considered as the main determinants of WTP for conservation by the local community. About 86% of the respondents in the study assured frequent visit to the park mainly for livestock grazing implying immense human encroachment problem to the park. Moreover, the estimation results obtained from two different models, one with mean WTP estimated by regression of the WTP variable against the offered bid amount and another by incorporating covariates besides the offered amount reflects mean WTP to be 28.34 Birr and 57.07 Birr per year per household respectively.

Nabangchang, et al. (2008) conducted a cross country research on mobilization of resources for the marine Turtle conservation in Asia. The multivariate Logit analysis employed by the study on 3680 households in four cities of four countries in Southeast Asia; Beijing of china, Davao city of Philippines, Bangkok of Thailand and Ho Chi Minh/Hanoi of Vietnam, has shown that bid values, income and years of schooling are significant determinants of peoples willingness to pay for conservation of marine Turtle in southeast Asia. They conducted a survey on randomly selected households to find out the mean WTP of respondents for a regional mandatory conservation program of protecting Turtle and the result was 0.17, 0.83, 1.16 and 1.41 USD/household/month for Davao, Ho Chi Minh and Hanoi, Beijing and Bangkok respectively. This in fact shows that better income countries (cities) have relatively higher level of mean WTP as one might expect.

## 3. Data and methodology

### 3.1. Data source and sampling

The data for this study is collected from residents of Addis Ababa and foreign visitors of the SMNP. To address the objective of the research, investigating how distant beneficiaries contemplate about the conservation of Walia

<sup>1</sup> Refers to people who live in Islay ( an area in Scotland where wild goose lives )

<sup>2</sup> Ethiopian wolf (*canis simensis*) is another endangered endemic species in Ethiopia which is not confined to SMNP as Walia Ibex do. Ethiopian wolf is the world's rarest canid and is subjected to various challenges which caused decreasing trend in its population rabies being the main one (Evangelista, 2009; IUCN red list report, 2012).

Ibex, residents of Addis Ababa, are preferred in this research for the city’s diverse population structure and convenience to make efficient use of time and budget.

There are ten sub-city administrations in Addis Ababa which in turn are divided in to Woredas. Taking the time and budget in to consideration, in this study, Nefas Silk Lafto sub-city was randomly picked. The sub-city has ten Woredas (CSA, 2011) hence two Woredas (Woreda 2 and 9) were randomly selected. Finally, 200 households, 100 from each Woreda were selected using simple random sampling. The data was collected through a face-to-face interview with the chosen household heads. Regarding foreign visitors, 100 people were randomly chosen to be involved in the survey from SMNP during their visit. The survey was conducted from 8-25 April, 2013.

### 3.2. Definition of attributes and levels

In this research, specification of the relevant attributes of Walia Ibex conservation and potential ranges of levels is made through the use of literature review and discussion with experts. In addition, direct questioning (a kind of pilot survey) with household heads was used. Levels were specified so as to represent sufficient variation in an attribute favorable to the research’s objectives. Finally, five attributes including monetary cost were identified with levels intended to tradeoff between demonstrating all possible ranges of choices and providing lower cognitive difficulty to respondents. Brief descriptions of the selected attributes are given in Table 3.1.

Table 3.1 Description of attributes and levels

Attribute	Description and levels
<b>Change in population of Walia Ibex</b>	Refers to an increase in the quantity of Walia Ibex due to conservation measures. <i>Levels: Status quo (no change), 25% increase, 50% increase and 90% increase</i>
<b>Change in status</b>	Denotes the improvements in the IUCN red list status of the species. And ecological considerations such as status of distribution, diversity, habitat...etc. is also measured in addition to population size. <i>Levels: Status quo (Endangered), Vulnerable , and Not threatened</i>
<b>Employment opportunity</b>	Additional jobs generated because of conservation. <i>Levels: Status quo (no additional employment), 50 individuals, 150 individuals, 400 individuals</i>
<b>Funding mechanism</b>	This refers to the way of collecting the monetary commitment respondents are willing to make. <i>Levels for residents: Status quo, Additional tax, and Budget reallocation</i> <i>Levels for visitors: Status quo, Increase in gate fee and Donation to an environmental conservation organization</i>
<b>Annual cost</b>	The yearly amount of monetary cost that respondents are supposed to incur to realize conservation programs. <i>Levels: Status quo (no payment), 10, 30, 60 and 100 ETB for resident and USD for visitors.</i>

### 3.3. Model specification

Choice experiment involves a sample of respondents selecting their preferred option from a series of hypothetical environmental management plans. Stated CE is consistent with the Lancasterian consumer theory which states that a good per se does not create utility to consumers but the characteristics that make up a good do (Lancaster, 1996). The other behavioral foundation to the stated CE method is the random utility theory (RUT). Accordingly, the total indirect utility of a consumer pertaining to an alternative  $i$ , ( $U_i$ ), can be decomposed in to an objective or deterministic component ( $V_i$ ) and a stochastic or unexplainable element ( $\varepsilon_i$ ) (Adamowicz, et al., 1998a).

$$U_i = V_i + \varepsilon_i \dots\dots\dots 3.1$$

The deterministic component of utility can be written like;

$$V_i = \beta' X_i \dots\dots\dots 3.2$$

Where,  $\beta$  is a vector of parameters to be estimated and X is a vector of explanatory variables including the attributes of the alternative. For individual n, equation (3.1) can be written as;

$$U_{in} = V_{in} + \varepsilon_{in} \dots\dots\dots 3.3$$

Because of the stochastic part of utility introduced, the researcher cannot exactly determine the alternative a respondent will choose. However, he/she can predict the probability that an individual will chose alternative  $i$  out of a given sum of alternatives in a particular choice set. Therefore, selection of an alternative, say  $i$ , over another, say  $j$ , implies that the utility ascribing to the former ( $U_i$ ) is greater than that attributable to the latter ( $U_j$ ). The probability of choosing alternative  $i$  can thus be expressed as;

$$Pr(i/C) = Pr(V_i + \varepsilon_i > V_j + \varepsilon_j) = Pr(V_i - V_j > \varepsilon_j - \varepsilon_i) \forall j \in C, i \neq j \dots\dots 3.4$$

Where C, is the set of all possible alternatives or choice set over which the individual makes choice. Assuming

the error terms are independently and identically distributed (IID) and follow Gumbel (extreme value type I) distribution, the probability of choosing alternative  $i$  becomes;

$$Pr(i) = \frac{\exp^{\mu V_i}}{\sum_{j \in C} \exp^{\mu V_j}} \dots \dots \dots 3.5$$

Where  $\mu$ , is a scale parameter which is usually normalized to take a value of one (Rolfe, et al., 2000; Wang et al., 2006). The above equation can be estimated using multinomial logit model (MNL) which presumes consistency of choices with the independence from irrelevant alternatives (IIA) property. The IIA property states that the ratio of choice probabilities between any two alternatives in a choice set is unaffected by changes in any other alternative in that choice set (Alpizar et al., 2001; Hanley et al., 1998). However, if the IIA assumption is violated then other alternative models like nested MNL, random parameters logit, or latent class models should be applied instead of multinomial logit which will be inappropriate in such circumstances.

**3.1.1. Random Parameters Logit**

Alpizar et al., (2001) explained that the standard multinomial logit model specification is bound to have two limitations. The first limitation is the result of the IID assumption used by the model. Error terms are assumed to have constant variance and alternatives are assumed independent which may not be the case in reality. The second drawback of the MNL specification arises because of lack of flexibility of the model to incorporate the variation in taste of respondents due to various causes. The random parameters logit (RPL) could thus provide an option with coefficients of observed variables varying randomly over people than being fixed. The random parameters logit can be specified as (Hynes and Hanley, 2005);

$$U_{in} = (\beta + \gamma_n) X_{in} + \varepsilon_{in} \dots \dots \dots 3.6$$

This is an extension of equation 3.3 where the indirect utility is now allowed to have coefficients varying in the population. Hence the probability of an individual choosing alternative  $i$  from a set of alternatives in a choice set is given by;

$$Pr = \frac{\exp^{X_{in}(\beta + \gamma_n)}}{\sum_j \exp^{X_{jn}(\beta + \gamma_n)}} \dots \dots \dots 3.7$$

The general form of the RPL model is presented as;

$$V_{in} = ASC + \sum \beta_k Z_k + \sum \beta_m S_m \dots \dots \dots 3.8$$

Where ASC, defined as alternative specific constant, captures the effect of unobserved attributes on choice and  $k$  and  $m$  represent the number of attributes and socioeconomic factors included in the model respectively (Kjaer, 2005).

**Specific Equation for Choice Experiment**

In this study, two types of model specifications are applied; basic and extended. The basic model specification works only with the attributes of Walia Ibex conservation included in this study while the extended model requires the interaction of socioeconomic variables with the ASCs in addition to the attributes for conservation. The basic model could hence be indicated as follows with the use of conservation attributes to explain respondents' willingness to pay for the improvement scenarios provided.

$$V_i = ASC_i + \beta_1 \text{change in population} + \beta_2 \text{change in status} + \beta_3 \text{employment opportunity} + \beta_4 \text{funding mechanism} + \beta_5 \text{annual cost} \dots \dots \dots 3.11$$

For  $i = 1, 2,$  and  $3$  and ASC takes a value of 0 for the status quo (option 3) and 1 for the rest of the alternatives (option 1 and option 2). And  $\beta_1, \beta_2, \beta_3, \beta_4$  and  $\beta_5$  are coefficients of change in Walia Ibex population, change in status, employment opportunity, funding mechanism and annual cost attributes respectively.

Capturing preference heterogeneity through allowing for interactions among socioeconomic variables with either attributes or ASCs is important. These interaction terms should be included as an explanatory variable in the utility functions. The extended model with the inclusion of socioeconomic variables (age, education, sex, family size) whose interaction with the ASCs will help capture the effect of the variables on the probability of respondents choice for either option 1 or 2 is specified as follows.

$$V_i = ASC + \beta_1 \text{change in population} + \beta_2 \text{change in status} + \beta_3 \text{employment opportunity} + \beta_4 \text{funding mechanism} + \beta_5 \text{annual cost} + \rho_1 ASC_i * AGE + \rho_3 ASC_i * GENDER + \rho_2 ASC_i * EDUY + \rho_4 ASC_i * INCOME + \rho_5 ASC_i * FAMSIZE \dots \dots \dots 3.12$$

#### 4. Discussion and analysis

##### 4.1. Descriptive statistics

Table 4.1 *Descriptive Statistics*

Variable	Mean	Standard deviation	Minimum	Maximum
<b>Residents of Addis Ababa</b>				
AGE	34.14	13.245	17	72
GENDER	.65	.478	0	1
EDUY	12.28	3.993	0	24
FAMSIZE	4.83	2.195	1	16
INCOME	44818.8	55046.244	1800	480,000
<b>Foreign visitors</b>				
AGE	43.92	13.703	22	75
GENDER	.58	.493	0	1
EDUY	19.49	3.843	9	28
INCOME	562570	353405	0	1296000

Source: computed from the survey data

##### Relative Ranks of Walia Ibex

There are six big mammals recognized by EWCA as endemic flagship species to the country and are exposed to various threats for survival. These are, Mountain Nyala, Swaynes Hartebeest, Ethiopian Wolf, Galada Baboon, Walia Ibex and Menellik's Bushbuck. In this study, an attempt is made to identify the relative ranks of the species depending on how respondents consider conservation priority among the mammals. Table 4.2 describes the relative ranks of Walia Ibex given by residents along with the other species.

From the 200 household heads who took part in this survey 16 were reluctant or unable to order the above mentioned species. Consequently, of the remaining household heads who were capable of ranking the six charismatic mammals, 45.7% ranked Walia Ibex as number one in terms of its need for conservation.

Table 4.2<sup>1</sup> *Species levels based on respondents opinion of protection priority*

Species	Rank of the species					
	First	Second	Third	Fourth	Fifth	Sixth
Mountain Nyala	29 (15.8)	41 (22.3)	35 (19.0)	36 (19.6)	16 (8.7)	27 (14.7)
Swaynes Hartebeest	14 (7.6)	26 (14.1)	39 (21.2)	38 (20.7)	41 (22.3)	26 (14.1)
Ethiopian wolf	32 (17.4)	36 (19.6)	37 (20.1)	15 (8.2)	35 (19.0)	29 (15.8)
Galada baboon	17 (9.2)	28 (15.2)	31 (16.8)	29 (15.8)	32 (17.4)	47 (25.5)
Walia Ibex	84 <b>(45.7)</b>	35 (19.0)	22 (12.0)	18 (9.8)	17 (9.2)	8 (4.3)
Menellik's bushbuck	8 (4.3)	18 (9.8)	20 (10.9)	48 (26.1)	43 (23.4)	47 (25.5)
Total	184 (100)	184 (100)	184 (100)	184 (100)	184 (100)	184 (100)

Source: computed from the survey data

##### RPL for Residents of Addis Ababa

After undertaking the proper coding, estimation of the choice data follows. However, we need to check for the appropriateness of the type of model to use; Multinomial Logit or RPL. Besides, the IIA property, an important assumption in the MNL models, must hold for the MNL models to be useful. Accordingly Hausman test could be carried out to check for the validity of the assumption. This could be completed by estimating the full model first and a restricted model with relatively lower number of alternatives. Hausman test when conservation alternative two is excluded results in the rejection of the IIA assumption (Chi Square [6] = 742.6993, Pr (C > c) = .000000). This indicates, the ratio of choice probabilities is not independent of the presence or absence of any other alternative in a choice set.

Moreover, when alternative one is excluded, Hausman test cannot be carried out because the difference matrix is not positive definite. Therefore, a more flexible model specification which provides reliable estimates even if the IIA assumption is violated, RPL model, is considered for estimation of the choice experiment data here in

<sup>1</sup> Numbers in parenthesis represent percentage share of a species from the respective ranks.

this particular study.

Table 4.4 reports the estimation results of a RPL model with attributes only (basic) and with attributes and socioeconomic variables included (extended). The RPL models were estimated assuming all the attributes except cost as random and then considering parameters with insignificant standard deviations as non-random (Hensher et al, 2005). The results of the RPL model (with attributes only), shows that all the attributes (i.e. change in population of Walia Ibex, change in status, employment opportunity, funding mechanism and annual cost) used in the model are significant at one percent. Besides, all the attributes have the expected signs.

Change in Walia Ibex population (POPU) attribute is found to positively and significantly influence the utility of respondents. This means, an improvement in the population number of Walia Ibex offers residents a better level of utility compared to the status quo.

The attribute of change in listing status (STATUS) of Walia Ibex in the IUCN red list of endangered species has positive influence on respondents' utility. This may be because an improvement in the listing status implies relatively lower probability of extinction other things remaining the same. The employment variable (EMP) is also positive and significant implying that generation of additional job opportunities will augment respondent's utility compared to the do nothing option. Another fact observable from Table 4.4 is that the annual cost attribute has negative and significant influence on the utility attached to conservation schemes. This means, increase in the annual monetary cost attributable to an enhancement in an environmental good tends reduce respondents' utility from improved conservation plans.

The standard deviations in Table 4.4 indicate that respondents have heterogeneous preferences over change in population and change in status attributes.

Table 4.4 Random Parameters Logit models for Residents

Variable	RPL (attributes only)		RPL (extended)	
	Coefficient (St. Error )	P[ Z >z]	Coefficient (St. Error)	P[ Z >z]
POPU	.515 (.088)	.0000***	.579 (.143)	.0001***
STATUS	1.427 (.207)	.0000***	1.531 (.313)	.0000***
ASC	1.775 (.729)	.0149**	3.077 (2.572)	.2316
EMP	.335 (.107)	.0018***	.367 (.127)	.0038***
FUM	.432 (.073)	.0000***	.415 (.082)	.0000***
COST	-.006 (.002)	.0003***	-.007 (.002)	.0012***
ASC*AGE			-.005 (.030)	.8488
ASC*GENDER			-1.469 (1.244)	.2377
ASC*INCOME			-.143 (.684 )	.8337
ASC*EDUY			.178 (.106)	.0928*
ASC*FAMSIZE			-.264 (.156)	.0918*
Standard deviations of parameter distributions				
POPU	.514 (.226)	.0231**	.697 (.398)	.0801*
STATUS	1.162 (.408)	.0044***	1.299 (.552)	.0187**
<b>Summary statistics</b>				
Number of observations	1200		1200	
Log likelihood	-750.3197		-746.9736	
Pseudo R <sup>2</sup>	.43086		.43340	

\*, \*\*, \*\*\* indicate significance at 10, 5 and 1 percent respectively.

Source: RPL estimation result

Next, an extended random parameters logit model is estimated. The estimation result of this model reveals that the coefficients of the attributes have similar signs as in the first model, and all are significant at one percent. Socioeconomic variables in use are the age of household heads (AGE), sex of the household head (GENDER), number of people in a household (FAMSIZE), income of the household (INCOME), and education level of household heads measured by the number of years spent in formal education (EDUY). All the interaction terms except years of education and family size interactions with ASC are statistically insignificant.

One of the interaction variables with significant coefficient, years of education (EDUY), is positive in its impact. This means, the greater the years a household head spends in formal education the higher is the probability of selecting an improvement conservation scenario, *ceteris paribus*.

Because majority of the included socioeconomic variables are insignificant the use of the additional variables seems to have no efficiency gains in terms of providing good model fit. Although the pseudo R<sup>2</sup> shows slight improvement a formal likelihood ratio test fails to support that the extended model is superior to the basic. The calculated likelihood ratio statistic equals 6.6922, much lower than the critical Chi-square value (with five degrees of freedom and 0.05 probability = 11.0705). Hence the marginal willingness to pay and welfare measure

estimations rely on the first model, RPL estimated with attributes only.

#### 4.1.1. RPL for Foreign Visitors

Table 4.5 shows the estimation results of the RPL model coefficients together with standard errors and z values. Standard deviations of parameters imply that visitors have heterogeneous preferences over change in status and funding mechanism attributes.

Table 4.5 *Random Parameters Logit models for foreign visitors*

Variable	RPL (attributes only)		RPL (extended)	
	Coefficient (St. Error)	P[ Z >z]	Coefficient (St. Error)	P[ Z >z]
STATUS	1.305 (.391)	.0009***	1.094 (.391)	.0052***
EMP	.258 (.210)	.2191	.172 (.205)	.4025
FUM	.609 (.175)	.0005***	.533 (.176)	.0025***
ASC	4.305 (1.185)	.0003***	.379 (3.845)	.9215
POPU	.534 (.173)	.0021***	.500 (.175)	.0044***
COST	-.032 (.005)	.0000***	-.031 (.006)	.0000***
ASC*AGE			.113 (.051)	.0280**
ASC*GENDER			-.190 (1.019)	.8516
ASC*INCOME			.246 (.219)	.2616
ASC*EDUY			-.070 (.214)	.7428
Standard deviations of parameter distributions				
STATUS	1.436 (.614)	.0193**	1.556 (.606)	.0103**
EMP	.628 (.395)	.1120	.638 (.538)	.2355
FUM	1.589 (.495)	.0013***	1.057 (.486)	.0298**
<b>Summary statistics</b>				
Number of observation	564		564	
Log likelihood	-339.6709		-335.0536	
Pseudo R <sup>2</sup>	.45181		.45926	

\*, \*\*, \*\*\* indicate significance at 10, 5 and 1 percent respectively.

Source: RPL estimation result

Unlike in the case of residents, employment attribute is insignificant for foreign visitors. Meaning, the change in the employment generating capacity of proposed conservation options does not influence the visitors' utility from conservation improvement. This is analogous to the result obtained by Adamowicz et al. (1998a). The rest of the attributes are all significant and have expected signs. The age interaction term has significant and positive coefficient indicating that older people have higher probability of choosing an improved conservation option, *ceteris paribus*.

#### 4.1.2. Marginal Willingness to Pay Estimates

The marginal willingness to pay (MWTP) of an attribute describes 'implicit price'; amounts of money respondents are prepared to pay in order an attribute of conservation to improve, *ceteris paribus*.

The estimation result in Table 4.6 shows positive and significant coefficients for all the attributes except employment opportunity for the visitors. This suggests that improvements in the attributes lean towards boosting respondents' utility. The marginal willingness to pay result for the change in status attribute exceeds those of the other attributes'. This shows household heads and visitors' preference for the attribute over other counterpart attributes. Hence other things kept the same, for an increase in the level of change in status attribute, household heads are willing to pay about 219.85 Birr per year while visitors are willing to pay 39.75 USD per year.

Table 4.6 *Marginal willingness to pay (MWTP) for each attribute*

Attribute	Residents		Foreign visitors	
	MWTP per year in ETB	P[ Z >z]	MWTP per year in USD	P[ Z >z]
Change in Walia Ibex population	79.35 (21.829)	.0003***	16.27 (4.07)	.0001***
Change in status	219.85 (62.983)	.0005***	39.75 (8.81)	.0000***
Employment opportunity	51.68 (15.943)	.0012***	7.85 (5.89)	.1822
Funding mechanism	66.59 (21.644)	.0021***	18.55 (4.71)	.0001***

Standard error (SE) in parenthesis and \*, \*\*, \*\*\* indicate significance at 10, 5 and 1 percent respectively.

Source: MWTP estimation results

The second important attribute for residents is the change in population attribute with an annual marginal willingness to pay of 79.35 Birr per year. However, visitors value funding mechanism more than change in population attribute. They are willing to pay about 18.50 USD per year for an increase in the level of the

attribute from the status quo, *ceteris paribus*. In addition visitors are also willing to pay 16.27 USD per year for an increase in the level of change in population of Walia Ibex attribute. For an increase in the level of funding mechanism attribute of conservation plans, *ceteris paribus*, household heads are willing to pay 66.60 Birr per year. Lastly, 51.70 Birr per annum is the implicit price attributable to the employment opportunity attribute by residents. That is respondents are willing to make a payment of 51.70 Birr for an enhancement in the level of employment opportunity attribute from the status quo, other things remaining the same.

### 5.1. Conclusion

Faced with mounting human encroachment, Walia Ibex, a rare and endemic species, lives in the spectacular mountain systems of Semien Park in Ethiopia. Unless a comprehensive conservation action is taken, the species may remain susceptible to natural and man-made disaster or cease to exist at the extreme situation. In this study, an attempt to value the conservation of the species, especially among distant users is made. Fortunately, it is found that a great deal of fund could be generated from both distant residents and foreign visitors, showing a promising community interest in conservation efforts for the species.

Five attributes were used in a stated choice experiment exercise, employed in this study. These include change in the population size of Walia Ibex, change in listing status, employment opportunity, funding mechanism and annual monetary cost. All the attributes, with the exception of employment opportunity attribute in the case of foreign visitors' sample, are found to significantly influence the respondents' utility for conservation. Furthermore, all the attributes excluding annual cost possess positive coefficient suggesting that an improvement in the attributes increases the utility of respondents for conservation strategies. Most of the socioeconomic variables interacting with ASC failed to meaningfully affect the respondents' probability of choosing an environmental management option. Only years of education and family size were marginally significant when interacted with ASC for the case of residents. Besides, of the four interacting variables employed for the RPL model of visitors choice data age is the one with significant coefficient.

The marginal willingness to pay estimates evidenced that change in listing status of Walia Ibex attribute which represents the position of the species in the IUCN red list of endangered species is the most important attribute among other attributes used here. Besides, the compensating surplus measure exhibited that residents and visitors are willing to pay up to 1340.5 Birr and USD 304.20 per year, respectively.

### 5.2. Policy Implications

After careful inspection of the implications obtained from the survey data analysis, the following policy interventions are forwarded for various stakeholders to look at.

- ✓ Inefficient allocation of conservation budget could possibly be minimized through rigorous prioritization exercise among various endangered species. Hence organizations like EWCA need to be cautious about which species should be given more weight in their conservation endeavors. Furthermore, prioritization effort should integrate society's economic valuation of the species in addition to ecological, biological and political essentials.
- ✓ The results obtained in this study confirm that people who are not direct beneficiaries are willing to pay for conservation proposals. Thus, the government could use this vow to develop compensation schemes which can pay damages on people in or around SMNP triggered by conservation activities.
- ✓ Another attention-grabbing conclusion of this study is the fact that, of all the attributes used to describe conservation options the change in the species' listing status has received the greatest marginal willingness to pay. Hence policy makers or conservation practitioners need to pay attention to conservation elements of Walia Ibex which could tend to upgrade its listing condition, besides population increment. These conservation elements include improving the species diversity, distribution, and habitat, among others.

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