ECONOMIC VALUATION OF CONSERVING AFRICAN ELEPHANT (*LOXODONTA AFRICANA*) IN CHEBERA-CHURCHURA NATIONAL PARK, ETHIOPIA

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ABSTRACT: The African elephant (*Loxodonta africana*) is one of the world's endangered species of large mammals. One of the main reasons for wild animals decline in Ethiopia is habitat destruction due to various human needs, insufficient budget allocation for managing protected areas, and other factors. In addition, incorporating economic valuation for conserving wild animal species from a total economic valuation perspective has been little studied. The present study was conducted to determine willingness to pay (WTP) using contingent valuation for the conservation of African elephant using a sample of rural residents (n = 183) living adjacent to Chebera-Churchura National Park (CCNP). Logit model was used to analyze variables that determine respondent's willingness to pay. The result showed that most of the households (83%) were willing to support the conservation of elephants in CCNP. Variables such as crop damage by elephant, awareness of respondents about the importance of elephant for present and future generations, the income of respondents, and location of residents from the park were the major determinant of respondents' willingness to pay. Residents were willing to pay up to 2.78 million birr which is equivalent to about 95 thousand USD (average exchange rate in the 2019 year; 1$ = 29.2 birr) annually for the conservation of African elephant in CCNP within four years. The result showed that commitment of local communities in support of the government in the conservation of African elephant is very promising and economic valuation in wild animal conservation has to be considered.

Keywords: African elephant, Chebera-Churchura National Park, Economic valuation, Willingness to pay.

INTRODUCTION

The African elephant (*Loxodonta africana*) belongs to the order Proboscidea and the family Elephantidae. It is the largest land mammal surviving on Earth. Elephants are a keystone species that their interactions with other species generate effects (Carignan and Villard, 2002). They are also umbrella or flagship species (Selier et al., 2016). Being an umbrella species, elephants require a vast home range and intact

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areas to maintain their population. Hence, conserving elephants means protecting many other species that share habitat with elephants. Similarly, elephants as a flagship species they can easily attract public support for conservation. This opportunity may help many other species which share the elephant's habitat or are vulnerable to the same threats to be conserved.

African elephant occurs in 37 countries in sub-Saharan Africa including Ethiopia (Selieret al., 2016). In Ethiopia, it was widely distributed throughout the country except in the most northern highlands and Denakil desert (Yaldenet al., 1986). However, currently, they are mainly found in few localities, including Babile Elephant Sanctuary, Chebra-Churchura, Omo, Mago, Kafta-shiraro, and Gambella National Parks. About 90% of elephant population has been lost since the 1980s. As a result, only an estimated 1500 to 2000 elephants are found in Ethiopia (Sintayehu, 2016). The major causes of a rapid decline are poaching for the illegal ivory trade, habitat fragmentation caused by human population expansion, and rapid land conversion (Meseret, 2006; Selieret al., 2016). These threats are also a case in Chebera-Churchura National Park (CCNP). The expansion of agricultural activities in this park resulted in intense human-elephant conflict. Elephants frequently come to agricultural lands, raid crops, destruct crop stores, and harass people in almost all parts of the CCNP (Meseret, 2006; Gizachew, 2016).

Scientists argue that economic criteria and local community involvement have to be part of the design and implementation of conservation policies (MEA, 2005; TEEB, 2009). Similarly, international agreements such as the Convention on Biological Diversity recognize the importance of understanding the economic value of biodiversity for conservation and policymaking (Martin-Lopez et al., 2008). This is because environmental economics can inform conservation biologists and policymakers about why species are endangered, the opportunity costs of conservation activities, and the economic incentives for conservation (Shogren et al., 1999).

Failure to involve local communities contribution to wildlife conservation is one of the causes of species decline all over the world. Conversely, considering appropriate economic values to species enables to halt

the decline of wildlife species and reverse the situation (Plan, 1999; Land and Water Australia, 2005; Martin-Lopez et al., 2008). Thus, economic valuation needs to be appropriately interpreted and embedded in sound wildlife management processes. Valuation supports the use of cost-efficient compensation mechanisms in human-wildlife conflicting areas. When the costs of communities living around the protected areas cannot be met by alternative sources of income, a well-designed compensation program can fill the gap (TEEB, 2009).

People value wild animal species for different reasons and benefit from their conservation in different ways. The total benefits of conservation are generally partitioned between those arising from use or non-use values which together comprise a species total economic value (White et al., 1997; Pascual et al., 2010) (Figure 1). The use-values include direct, indirect and option-use while the non-use values are bequest, altruist and existence values (Pascual et al., 2010).

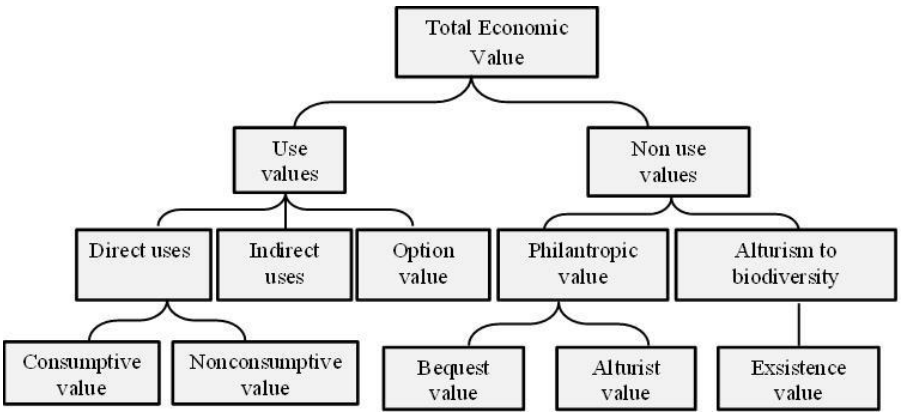

Figure 1. The economic value of biodiversity (De Groot et al., 2002).

Direct use values of wild animals are outputs that are directly consumable, such as food and recreations, while indirect-use values include activities such as observation and photography. Individuals may also benefit from indirect uses activities such as enjoyment gained by reading about or viewing photographs and motions pictures of species (Kotchen and Reiling, 1998).

The bequest value for a resource is the value of knowing the fact that future generations will also have access to the benefits from species. Altruist value refers to the fact that other people of the present generation have access to the benefits provided by species and the existence value refers to the value/satisfaction of knowing that it continues to exist. The direct and to less extent the indirect value may have a well-defined monetary component.

The option value and non-use value are typically far more difficult to define for the existing market since non-use values are related to moral, religious or aesthetic properties, for which markets usually do not exist (Pascual et al., 2010). However, these derived values for non-market benefits may be controversial, thus more efforts should be made to assess and incorporate them into the decision-making process (White et al., 1997).

Measuring non-market benefits using public willingness to pay is, therefore, an appropriate measurement and has been used in previous studies to give meaningful estimates of the anthropocentric benefits of conserving rare and endangered species (Loomis and White, 1996). Contingent valuation method using a willingness to pay is applied to determine direct use, non-use or passive use (existence and bequest values) and option use-values, but not indirect use values (Plan, 1999). Thus, the contingent valuation method differs from all other important economic valuation methods, which can only be used to determine one type of use-value (Plan, 1999). Therefore, this study aims to investigate the relative total economic values of the African elephant by evaluating public willingness to pay towards its conservation in Chebera-Churchura National Park.

MATERIALS AND METHODS

Description of the study area

Chebera-Churchura National Park is situated along the southwestern part of Ethiopia (Figure 2). It is located within Dawro zone and Konta special district of Southern Nation, Nationalities and Peoples Regional State, about 300 and 580 km southwest of Awassa and Addis Ababa, respectively. It was

established in 2005 and covers an area of 1215 km^2. The altitude ranges between 700 to 2450 m a.s.l (Gizachew, 2016). It lies between the coordinates 36°27'00"- 36°57'14"E longitude and 6°56'05"-7°08'02"N latitude. CCNP is bordered by Konta special district to the north, Omo River to the south, Dawro zone to the east and southeast, and Agare high mountains and Omo River to the west (Gizachew, 2016). The livelihoods of the community living around the park depend on traditional agriculture.

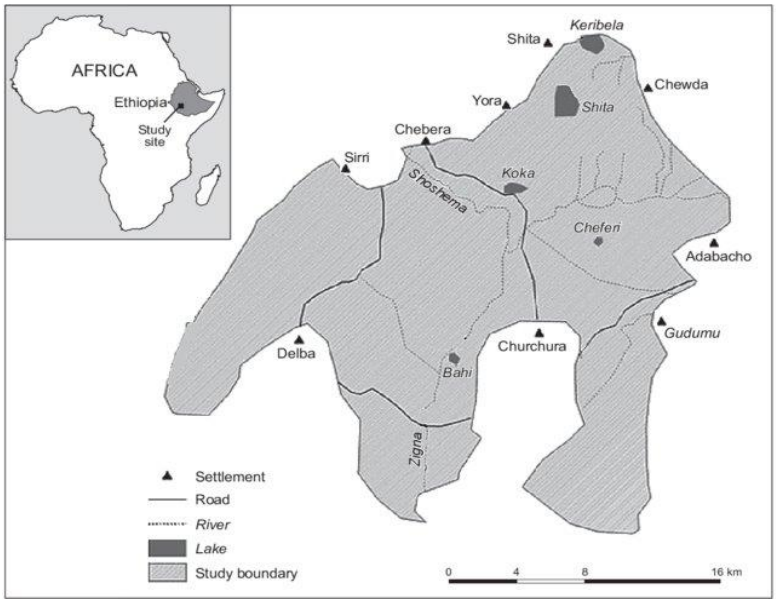

Figure 2. Map of CCNP and surrounding Kebeles (Aberham et al., 2017).

Methods

Sample size and data collection methods

Sampling and data collection was made in March 2019using households living in four rural Kebeles adjacent to CCNP as the target population (Figure 2) (Table 1). The four kebeles were selected purposely due to existing high human-wildlife conflict and their proximity to the park. The sample size was determined by using a rule-of-thumb N ≥50 + 8 m for the multiple correlations (Green, 1991). Where N =

minimum sample size and m = number of predictors. A total of 183 samples/individual households were selected randomly using proportional allocation methods from 2,133 target population.

Table 1. Rural kebeles and their respective house hold's population size.

Selected Kebeles	Population	Samples
Gudumu	953	82
Chawuda	477	41
Chebera	420	36
Siri	283	24
Total	2133	183

Data were collected through household interviews using a semi-structured questionnaire to elicit respondents' willingness to pay for the conservation of elephant in the park. The questionnaire consisted of perception of residents to elephant conservation, willingness to pay, demographic, and socioeconomic characteristics of residents (Rodgers, 2001; Bandara and Tisdell, 2003).

Elicitation method

Before the actual interview, the respondents were brainstormed about the decline of African elephant in particular and wildlife in general in CCNP due to anthropogenic threats. Rapid human population growth creates great pressure on elephant survival through habitat loss (settlement, farmland expansion, overgrazing and others), human-wildlife conflict, and poaching. In addition, weak institutional and park administration capacities (budget, manpower etc.), poor coordination of concerned bodies, and other factors greatly contributed to the rapid decline of elephant in the park. Therefore, socially acceptable strategies for an appropriate level of co-existence between farmers and elephants are needed; mainly such co-existence may be supported with compensation to farmers whose property lost to tolerate elephants' conflict (Bandara and Tisdell, 2003).

Hypothetical Strategy

The respondents were informed of the importance of adopting a new strategy to ensure the survival of African elephant for the long-term and to address related issues. The new strategy was a hypothetical strategy (scenario) that protects the African elephant and benefits the local community (Loomis and White, 1996; Zewdu and Yemesrach, 2003). The new strategy implementation measures for the conservation of African elephant were explained to the respondents. The implemented measures include the provision of extra elephant conservation measures, improve tourist destination facilities such as elephant observation sites by organizing communities and promote communities to benefit from the income generated by these activities, establish compensation funding for farmers whose property or crop has been damaged by elephant, rewarding farmers who arrest poachers or inform to scouts, and others. As explained to the respondents, the new conservation strategy was based on active participation of interested households that have close contact with the elephant habitat along with the government.

The respondents were also informed about the need to finance and establish a 'Trust fund' to support the proposed African elephant conservation strategy (Land and Water Australia, 2005). The possible benefits that communities would gain such as employment and increase the income generated from tourism, compensation for crop or property damage by elephant, and others were explained to respondents.

Then, the respondents were subjected to the contingent market valuation questions as follows: "Are you willing to pay 5, 10 or 20 birr per year for the next four years (starting from January 1, 2020), towards the establishment of a trust fund by increasing your land use tax for the implementation of the proposed program to conserve African elephants in the park"?

Payment vehicle

The respondents were requested to choose payment options during focus group discussion among the given alternatives: payment with rural land use fee, annual donation form, and other forms of payment. Respondents prefer to pay their contribution along with their annual rural land use tax. Respondents'

capacity to the willingness to pay was determined by analyzing the pilot survey results. The capacity of respondents' willingness to pay a given bid (offer to pay a particular amount of money for something) of 5, 10, and 20 birr per year were offered to choose (Han et al., 2010; Andualem et al., 2017). The dichotomous choice format was used to assess respondents' willingness to pay (WTP) and a logistic regression model was used to determine the significant factor affecting the WTP dichotomous format (Hanemann et al., 1991; Kanninen and Khawaja, 1995; Han et al., 2010).

WTPi =α + βXi +vi Where,

WTPi is the willingness to pay of individual i

α is some constant

Xi is a vector of demographic variables, and

vi is a normally distributed random term with a mean of zero and a variance = σ2 (i.e. Vi ~ N (0, σ2)).

Let y represent a dichotomous variable that equals 1 if the respondent was willing to pay, and 0 otherwise. The model of the probability of WTP, P (yi= 1), was represented as:

In [yi=1/1-p (yi=1)]

$= ß_o + ß_1(Age) + ß_2 (Sex) + ß_3 (Income) + ß_4 (Distance) + ß_5 (Cropraid) + ß_6 (Attitude)$

Data analysis

Demographic and socioeconomic data were analyzed using descriptive statistics in the form of frequency, percentage, median, and mean. The logistic regression model was used to determine the association of dependent and independent variables. All statistics were analyzed using SPSS 20 software. P-value less than 0.05 at 95% confidence level was used to test significance value.

RESULTS

Respondents' socioeconomic and demographic characteristics

One-hundred eighty-three household heads with 58 (31.7%) females and 125 (68.3%) males, were interviewed from four different kebeles adjacent to CCNP. The majority of the respondents were between

31-45 years of age followed by 17-30 years, which accounts for 48.6% and 32.2%, respectively. Respondents with these age range were expected to have more experience with elephant and wildlife living in the park to respond to the questions reasonably. Seventy-nine of respondents (43.2%) were illiterate while 60 respondents (32.8%) have attended primary education. The majority of respondents 148 (80.9%) were living within 0.1-5 km away from the park border (Table 2). Nearly half of the respondents complained of crop damage caused by elephants. Most of the respondents 143 (78.1%) knew the importance of conserving elephant and other wildlife in the park while the remaining 21.9% did not have such attitudes.

Table 2. Socioeconomic and demographic status of respondents.

Variables	Category	Frequency	Percentage
Age	17-30	59	32.2
	31-45	89	48.6
	46-60	30	16.4
	>60	5	2.7
Sex	F	58	31.7
	M	125	68.3
Education background	Illiterate	79	43.2
	Informal	31	16.9
	Primary	60	32.8
	Secondary	12	6.6
	College	1	0.5
Distance (Km)	0.1 - 5	148	80.9
	5.1- 10	0	0
	10.1- 15	2	1.1
	15.1- 20	33	18
Status of crop raid	Yes	90	49.2
	No	93	50.8
Attitude for the importance of elephant	Yes	143	78.1
	No	40	21.9

Estimation of willingness to pay

One-hundred fifty-one (82.5 %) of the respondents were willing to pay for the conservation of African elephant while the remaining 32 (17.5%) refused to pay anything at all (Table 3). Of those who were willing to pay, 41% were willing to pay the lower amount (five birr) followed by 10 birr which accounts

for 34% of respondents. The mean and the median of the willingness to pay were 10.5 birr and 10 birr, respectively. The median is lower than the mean, which means the distribution is negatively skewed. On average, each respondent was willing to pay 1,580 birr per year. Extrapolating this result into the target population, an aggregate (N = 1760) of nearly 2.78 million birr which is equivalent to about 95 thousand USD (the average exchange rate in the 2019 year; 1$ = 29.2 birr) was estimated annually willing to contribute to the conservation of African elephant in CCNP by excluding the proportion of population who refused the WTP.

Table 3. The frequency of Bid for WTP.

Bid value (Birr)	Frequency	Percent
0	32	17.5
5	62	33.9
10	51	27.9
20	38	20.7
Total	183	100

Note: Zero indicates respondents refused to pay for the conservation of elephant.

Respondents' reason for supporting or refusing WTP

Among respondents, 39.1% were willing to pay mainly because they believed that the elephants to be conserved. While the remaining 31.8% and 29.1% of respondents hoped to be benefited from a proposed project that would be implemented, and both to conserve and benefit, respectively. However, more than 50% of the respondents who refused to support elephant conservation were due to their poor economic status. The reasons why respondents support or refuse the conservation of elephant are given in tables 4 and 5.

Table 4. Reasons why respondents support the conservation of elephant (WTP).

Variables	Frequency	Percent
Elephant has to be conserved	59	39.1
To benefit from the conservation project	48	31.8
To conserve and benefit from the conservation program	44	29.1
Total	151	100

Table 5. Reasons why respondents refuse the conservation of elephant.

Variable	Frequency	Percent
Poverty	18	56.2
Elephant is not important	3	9.4
Conservation is government's responsibility	8	25
Other reasons	3	9.4
Total	32	100

Factors that influence WTP

The maximum likelihood estimates for the logistic regression model is presented in Table 6.

Table 6. Results of logistic regression analysis.

Variables	B	S.E.	Wald	df	Sig.	Exp (B)
Age	.008	.034	.049	1	.824	1.008
Sex	1.646	.793	4.307	1	.038*	5.184
Income	.008	.002	18.963	1	.000*	1.008
Distance (km)	-.159	.051	9.865	1	.002*	.853
Crop raid	3.644	1.011	12.990	1	.000*	38.242
Attitude	3.003	.871	11.891	1	.001*	20.143
Constant	-4.889	1.817	7.237	1	.007	.008
Model χ^2 value			102.226		.000	
-2Log likelihood			64.279			
Model percentage of correct prediction			92.9			

Respondents' sex, household income, crop raid and awareness of households about the elephant's importance to present and future generations (attitude) had a significant positive effect on respondents' WTP at 5% significant level. The average monthly income of the respondent was estimated to be 454 birr.

The residents' location from the park (distance in km) had a significant negative effect on respondents' WTP. Respondents are living on average about 4 km away from the park boundary. The age of respondents had no significant effect on respondents' WTP. Generally, the Logit model had nearly 93% prediction ability.

DISCUSSION

In this study, most of the respondents were willing to pay for the conservation of African elephant. Higher positive responses recorded on WTP may be attributed to regular community awareness creation activities conducted for wildlife conservation by scouts and district environmental experts. The result is slightly lower than 88.7% reported by Bandard and Tisdell (2003) on Siri Lanka elephant but higher than what has been reported by Han et al., (2010) and Andualem et al. (2017) which were 73% and 69%, respectively. A slightly lower positive response in the current study compared to that of Siri Lanka is attributed to the educational status of respondents. In the present study, respondents were from rural communities with high illiteracy status (43%) while in Siri Lanka they were urban people with minimum illiteracy status.

In this study, respondents agreed to pay about 2.78 million birr annually (equivalent to about 95 thousand USD). This is a great contribution to the conservation of African elephant in CCNP for the next four years. Such a commitment from local communities in support of the government in the conservation of African elephant is very promising. However, the finding revealed the incidence of crop damage by elephant significantly affecting the respondent' WTP. Keeping other variables constant, one unit increase in crop damage caused 38 times more increase in the respondents' WTP for the conservation of African elephant. Crop damage caused by elephant increased communitys' negative attitudes towards elephant existence in their vicinity. However, the response of respondents was contrary to this idea, may be because respondents believed that implementation of the newly proposed activity may minimize the negative impact of crop damage through compensation mechanisms and other income-generating activities.

The second major factor with a significant positive effect on respondents' willingness to support the conservation of elephant was awareness of respondents about the importance of elephant and other wildlife resources for the future generation. One unit change in attitudes of respondents resulted in 20 times more increase in respondents' WTP for the conservation of African elephant. The current positive result is consistent with other similar studies conducted in Ethiopia and elsewhere (Bandara and Tisdell, 2003; Han et al., 2010; Andualemet al., 2017). The reason why respondents' attitude has a positive impact towards WTP in the present study could be associated with continuous formal and informal awareness creation programs of communities by district biodiversity experts and scouts that enable respondents to develop a positive attitude towards elephant and be willing to pay for their conservation.

The third dummy variable that significantly affected respondents' WTP was the sex of respondents. Males were five times more likely willing to pay than females. This could be attributed to that males have more exposure to environmental concerns and other training activities than females. A similar result was reported by Andualem et al. (2017).

The other variable which significantly affected respondents' WTP was households' income. This result agrees with the study by Andualem et al. (2017) and Tadesse (2014). For every one-unit increase in households' income, respondents' WTP doubled. This is because as household income increases, communities will have some money left from goods, clothing, and other expenditures to contribute to elephant conservation.

The last variable that significantly affected the respondents' WTP was residents' distance from the park. For every one kilometer away from the park, the respondent's WTP decreased by 0.85 times. The reason why respondents living near the park were interested to pay more may be attributed to the anticipated compensation from the conservation program to crop damage caused by elephant. However, the age of respondents did not affect respondents WTP. Similar results were reported by Zewdu and Yemesrach

(2003) and Han et al. (2010). This may show that local communities living around the park have a similar understanding of wildlife conservation.

CONCLUSION AND RECOMMENDATIONS

Currently, proliferating anthropogenic and natural factors threatened the survival of African elephant in Ethiopia. A well-coordinated engagement of all stakeholders and exploiting all possible conservation options is crucial for the effective conservation of African elephant. One of the options which have been neglected by policy-makers is the lack of incorporating the economic valuation for wildlife conservation including African elephant. Therefore, the finding of this study indicated that there is good economic support from the local communities for the conservation of African elephant in CCNP. As a result, incorporating economic valuation programs that mobilizing resources and proper implemention could alleviate the financial problem facing CCNP conservation activities. It is also important to scale up these findings to other National Parks for effective management of wildlife in the country.

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