# An Application Of The Contingent Valuation Method: The Case Of One Horned Rhinos Of Kaziranga National Park, Assam

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ARTICLE INFO	ABSTRACT
	Kaziranga National Park (KNP) is a habitat of the one-horned Indian rhinos.
	About ninety percent of the total population of one-horned rhinos is found in
	KNP and Pobitora Wildlife Sanctuary of Assam. Poaching of wild animals
	especially rhinos has been a great challenge to the authority of KNP and it is
	continuously going on because of superstitious beliefs of people regarding
	aphrodisiac and medicinal value of rhino's horn and these are sold in the black
	international market at a very high rate. But, most of the tourists visiting the
	influence on economic value of the park. In the present study influence of the
	one horned rhines on according value of KNP is estimated by using dichetemous
	choice of contingent valuation method. In the present study, primary data is
	used to estimate economic value of the park and 300 visitors are interviewed
	randomly using a structured schedule with a single respondent from each group
	or family chosen in the sample. The study found that economic value of KNP will
	be reduced by INR 6.67 million, if the Government fails to conserve this unique
	wild animal of the national park and it also reflects the existence value of rhinos
	of the park. So, the Government should take various scientific steps towards the
	protection and conservation of one-horned rhinos of the national park to sustain
	eco-tourism in KNP.
	To a la Maill' a consta De (MATED) March Market Market (Deck) a formation
	<b>Keywords:</b> Willingness-to-Pay (WIP), Non-Market Valuation Techniques,
	Contingent valuation method, Economic value and Existence value

## 1. Introduction

Kaziranga National Park (KNP) is the pride of North-East India and is one of the resourceful national parks in the globe. It is not only the single habitat of the one-horned Indian rhinos, but also provides shelter to a variety of wild lives. The Brahmaputra River flows on the north and the range of Karbi Anglong Hills situates on the south of the park. Its unique geo-physical aspects facilitating rhino breeding promotes the Park to a world famous biological hot spot. About ninety percent of the total population of one-horned rhinos is found in KNP and Pobitora Wildlife Sanctuary of Assam. With passing of the Assam National Park Act of 1968, Kaziranga became a National Park with an area of 429.93 km<sup>2</sup> from 01 January, 1971 and in 1985, it is notified as a World Heritage Site by UNESCO. Kaziranga is also declared as the 29<sup>th</sup> Tiger Reserve in 1999. The Forest Department of KNP carries out census from time to time to calculate the total numbers of important and endangered wild animals of the park. The census report of KNP is shown in Table 1.

Speci es	Years														
	199	199	20	20	20	20	20	20	20	20	201	201	201	201	201
	7	9	00	01	02	05	06	07	08	09	0	2	3	5	6
Rhino	-	155 2	-	-	-	-	185 5	-	-	204 8	-	229 0	232 0	240 1	-

Table 1: Population of Important Wild Animals in KNP

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Eleph ant	945	-	-	-	104 8	124 6	-	-	129 3	-	-	-	-	-	-
Tiger	80	-	86	-	-	-	-	-	-	-	106	-	-	-	-
Swam p Deer	-	398	468	-	-	-	-	681	-	-	-	-	-	112 9	1148
Wild Buffal o	-	119 2	-	143 1	-	-	-	-	194 3	-	-	-	-	-	-

Source: Census Report of Wild Animals of Forest Department of KNP

When the status of wildlife population of the country as well as of the globe have declined due to destruction of habitat and indiscriminate killing, there has been at the same time a growing awareness amongst the people in general and some groups of wildlife activists and environmentalists in particular to plan and execute programmes for conservation and protection of the wide diversity of wild lives. As a part of this growing awareness, Kaziranga National Park has been able to attract the attention of a greater segment of people across the globe. Kaziranga was opened to the interested visitors in 1937 for viewing its unique wildlife. Kaziranga is one of the best spots for viewing wildlife and its related eco-system. Its popularity amongst the tourists has been growing since then. It is opened for the visitors only for six months, i.e., November to April in a particular year because the Brahmaputra and its tributaries over flow and inundate most of the areas of KNP during monsoon. Tourist's inflow pressure has increased from 52,336 in 2000-01 to 131,354 in 2014-15 and about five to six percent of the total tourists are foreigners (Forest Department, KNP). The tourists use elephant safari and Jeep (four wheelers vehicle) safari for viewing its unique wildlife and biodiversity.

The Legislative Assembly of Assam passed the Assam (Rhinoceros) Bill in 1954 for giving legal protection to rhinos and imposed heavy penalties for killing any of them, but it does not give fruitful results till now. Poaching of wild animals especially rhinos has been a great challenge to the authority of KNP and it is continuously going on because of superstitious beliefs of people regarding aphrodisiac and medicinal value of rhino's horn and these are sold in the black international market at a very high rate. A kill may net the hunter the equivalent of \$2,200, and horn can sell for \$33,200 a kilogram (Anon, 2005). But most of the tourists visiting the park for viewing this unique endangered wild animal have an escalating influence on economic value of the park. Total numbers of rhinos poached during the period of 2006 to 2015 are one hundred http://www.kaziranga.assam.gov.in/wp/rhino-poaching-summary/). twenty-three (123)(Source: Unregulated tourism infrastructure, flood, establishment of tea gardens and stone quarries on the peripheral area of the park, extensive use of land for harvesting, human settlement, etc. help the poachers directly or indirectly in achieving their targets. During the last 50 years, surroundings of the Karbi plateau (i.e. the southern boundary of the park) are drastically changed - dense forests of the plateau are altered into tea gardens, inhabited areas and harvesting fields, which destroy the suitable habitat of wildlife of KNP. As a result, the gap between the park and the plateau has enlarged manifold and poaching has also gradually increased in these areas and several wild animals have lost their lives. It also faces the problem of river bank erosion on the northern part due to Brahmaputra River. River erosion and migration has resulted in the loss of some 5,000 hactors of the park between 1925 and 1986 (Kushwala & Unni, 1986). Accordingly, Government of Assam had notified a number of proposed Additions to the Kaziranga National Park since mid-1980s to preserve the ancient wild animal corridors and routes in case of high flooding, but poaching of rhinos is still continuously going on. In the present study, influence of the one-horned rhinos on economic value of KNP is estimated by using dichotomous choice of contingent valuation method, which is a direct method of non-market valuation method.

Highest numbers of rhinos are reported to be killed by poachers in KNP during the period of 1980s to late 1990s and a total of 524 rhinos have been killed for their horns in Assam between 1986 and 2011 (http://www.rediff.com/news/report/one-hundered-and-fifteen-rhinos-killed-in-assam-in-10-

<u>years/201209</u>). The numbers of rhinos poached in KNP during the period of 2006 to 2015 are shown in Figure 1. The rhino population growth rate was thought to have declined in the 1980's (Choudhury, 1987): since 1986 about 30 animals has been killed each year although numbers are now increasing despite losses from flooding and from the heavy poaching (Milne, 1997; IUCN, 2001; Anon, 2005).



Figure: 1: Number of Rhinos Poached in KNP

Source: http://kaziranga.assam.gov.in/wp/rhino-poaching-summary/

### 2. Review of Related Studies

Since 1970s a large number studies have been devoted to developing the literature on non-market valuation methods and its applications in various fields of environmental economic studies, especially in valuing environmental goods and services.

Bowker and Stoll (1988) estimated individuals' economic surplus associated with preservation of the whooping crane resource (Grus Americana), an endangered species using dichotomous choice of contingent valuation method. The authors got an annual estimate of willingness to pay from \$5 to \$149 for the preservation of this resource.

Cook and Cable (1990) have measured economic value of windbreaks for hunting in the state of Kansas using contingent valuation method. A windbreak is a row or rows of trees planted adjacent to a field to break the force of wind. Net economic value for windbreak hunting in Kansas was \$21.5 million per year and local economies also benefit when hunters spend money on their trips to windbreaks.

Regens (1991) estimated the environmental benefits of Norway's Kristiansand Fjord via Contingent Valuation Method. The Norwegian public was willing to pay, on average, approximately 963.3 million NOK.

Cameron (1992) developed a new conceptual framework to estimate value of non-market goods by combining contingent valuation and travel cost data and it forms a prototype approach for a whole spectrum of non-market resource valuation tasks.

Jabarin and Damhoureyeh (2006) quantified recreational value of Dibeen National Park (DNP) in Jordan using contingent valuation and travel cost method. Using TCM estimates the average value of recreation in DNP was JD 71.55 (US\$ 100) per person per recreation day. The average willingness to pay for conserving and improving the services in DNP via open-ended willingness to pay approach was JD 5.53 (US\$ 7.8). The value of DNP to its users could be estimated at approximately JD 13.6 million (US\$ 19.2 million) in a year using TCM.

Chaudhary and Tewari (2006) estimated recreational benefits of urban forestry of Chandigarh in India via open-ended (OE) contingent valuation (CV) method and zonal travel cost method (ZTCM). The study found that consumer surplus estimated by ZTCM is around Rs. 308 and it is Rs. 6.73 by OE-CV format.

#### 3. Methodology

Contingent valuation method (CVM) is most widely used for estimating economic value of environmental resources and services since mid-1970s. In the present study, dichotomous choice of CVM is used to estimate economic value of KNP or to estimate willingness to pay for preservation of the park in two different hypothetical environmental situations of the national park and from these two estimates influence of the existence of rhinos on economic value of KNP is measured. Dichotomous choice (DC) or referendum approach is recommended by the NOAA (U.S. National Oceanic and Atmospheric Administration) Panel for a CV type study; because they thought it minimizes possible biases and also familiar to the respondents who

often vote yes/no in public decision-making process. In the CV method, at first a hypothetical market scenario is set up and records the behavior of the respondents in the hypothetical market. The hypothetical market is constructed in the present study according to the recommendations of the U.S. National Oceanic and Atmospheric Administration (NOAA).

In the present study, two different environmental situations or conditions of the park are put forward in front of the visitors: one situation is the present situation [question no (c) is asked to represent the present situation], i.e., rhinos are existing in KNP and another situation in which all the rhinos are killed by poachers, means this wild animal is missing in the park (question no (d) is asked to stand for the second situation). In these two different alternative situations, tourist's willingness to pay for preservation of KNP is calculated to estimate influence of existence of rhinos on economic value of the park. The hypothetical market scenario is designed as follows:

"Kaziranga National Park is suitable for the growth and survival of unique and diverse wildlife and forest biodiversity. For our economic benefit we are destroying all the natural resources like the forest resources and wildlife without thinking about the future. It creates many environmental problems. For this reason, Government has introduced various policies to preserve the quality of the park and introduced the instruments like income tax, property tax, entry fee, etc. to collect the necessary funds for implement these policies, but the Government do not achieve the objectives of these policies till date. Remember that you have limited income and you have to do many personal works with this limited income. Suppose at this time a private agency or NGO comes forward to preserve the park and giving their services very efficiently and after visiting the park, the members of this organization ask you

(where bid amount 'X' is larger than the bid amount 'Y', because it is assumed that tourists want to contribute larger amount money in a better environmental condition than in a worse situation.)

In the dichotomous choice of CV method, each respondent (i.e., visitor of the park) is offered with a randomly assigned price for conservation of KNP (question no (c) and (d) are asked to the respondents for DC type of CV method). There are ten (10) different offer prices, which starts from Rs. 10.00 to Rs. 100.00 with an equal interval of ten and these are fixed with the help of a pilot survey. In the pilot survey, twenty (20) different offer prices or bidding levels have been fixed, but in the final survey only ten different bidding levels have been kept by excluding the extreme offer prices. At first, all the 300 samples are equally divided into 10 different sets and each set has a common bid amount. With the help of this method, mean willingness to pay is calculated by estimating a statistical model for predicting the probability that an individual with specific characteristics will accept an offer of given size. Individuals know which choice maximizes their utility. It is assumed that individuals will accept or donate a specified donation amount to maximize their utility under the following condition (Hanemann, 1984):

$$v(1, Y - A, S) + \varepsilon_1 \ge v(0, Y, S) + \varepsilon_0$$

or, 
$$v(1, Y - A, S) - v(0, Y, S) \ge \varepsilon_{0} - \varepsilon_{1}$$

where v is the indirect utility, which is assumed here to equal the utility; Y is the individual's income; A is a donation amount to preserve the KNP; S is other socioeconomic characteristic vectors; and,  $\varepsilon_1$ ,  $\varepsilon_0$  are the identically, independently distributed random variables with zero means. If the condition does not hold, they will decline to donate.

The utility difference ( $\Delta v$ ) can be expressed as follows:

$$\Delta v = v(1, Y - A, S) - v(0, Y, S) + (\varepsilon_1 - \varepsilon_0)$$

Most of the literature on dichotomous choice of CVM [Lee, Mjelde, Lee, Scott & Kim (2009)] assumed that the individual's WTP follows a logistic distribution and therefore in this study it is also assumed that WTP follows a logistic distribution, the probability ( $\pi_1$ ) that the individual will accept a donation bid (A) can be expressed as:

$$\pi_{1} = \Pr(i = 1)$$

$$= \Pr[v(1, Y - A, S) - v(0, Y, S) \ge \varepsilon_{0-} \varepsilon_{1}]$$

$$= \Pr(\Delta v \ge 0)$$

$$= F[A, Y, S: \beta, \gamma, \delta]$$

where Pr(-) is the probability function, F[-] is the cumulative density function, and  $\beta$ ,  $\gamma$  and  $\delta$  are the parameters to be estimated for donation bids, income and demographic variables, respectively. This relationship holds good because if  $\Delta v$  is assumed to have a logistic cumulative density function is equal to

$$P_i = Pr(i = 1) = \frac{1}{(1 + e^{-\Delta v})}$$

Where  $P_i$  is the probability of accepting the offered bid amount then the probability of not accepting the bid amount can be expressed as  $(1 - P_i)$ . So,

$$1 - P_i = \Pr(i = 0) = \frac{1}{(1 + e^{\Delta v})}$$
$$\frac{P_i}{1 - P_i} = \frac{(1 + e^{\Delta v})}{(1 + e^{-\Delta v})} = e^{\Delta v}$$

Therefore,

By taking natural log in both side of the equation

$$L_i = \ln(\frac{P_i}{1 - P_i}) = \Delta v$$

The natural-log of the odds ratio in favor of accepting the bid amount or the ratio of the probability that a visitor will accept a bid amount to the probability that it will not accept that particular bid amount (it is also called 'logit') is not only a linear function of the explanatory variables but also linear of the parameters, because  $\Delta v$  is a linear function of income level, bid amount and socio-economic characteristics of the visitors.

The estimated model is logit regression, which helps to sketch the relationship between offer price and probability of acceptance by individuals with specific socio-economic characteristics. Probability of acceptance of a certain amount of bid [which is coded as Yes (1) and no (0)] is considered as the dependent variable and particular amount of bid and socio-economic determinants of the tourists are recognized as the independent variables in the economic model developed for the study. The regression model designed for the present study to estimate economic value (i.e., use value) of KNP is formulated as

## Logit(Y) = f(BID, MHI, EDU, AGE, FAMSZ, SEX)

where, Logit (Y) = Probability of accepting the offered bid amount

BID = Offered bid amount

MHI = Monthly Household Income

EDU = Educational Level

AGE = Age in Years

FAMSZ = Family Size of the Respondent

SEX = Sex or Gender

The mean WTP will be calculated by dividing the intercept by coefficient of the bid level. Mathematical derivation of this method is given by Haneman in 1991. The mathematical derivation of the formula to calculate mean WTP from the econometric model is shown below:

Assume that an individual's utility depends on a compositing commodity, X and left over income that is kept for purchasing environmental goods. Utility has a deterministic component and a random component,  $\varepsilon$ . Utility of the individual before answering the CVM question is:

If the individual accepts the bid given to him, his utility is:

$$U_1 = X_1 \beta + \gamma (Y - WTP) + \varepsilon_1 \dots (2)$$

From (1) and (2):

$$U_0 - U_1 = X_0\beta - X_1\beta + \gamma WTP + \varepsilon_0 - \varepsilon_1$$
(3)  
Or 
$$U_0 - U_1 = \alpha + \gamma WTP + \varepsilon_0 - \varepsilon_1$$
(4)

Taking the expectation from both sides:

$$E(U_0 - U_1) = E(\alpha) + E(\gamma) \cdot E(WTP) + E(\varepsilon_0 - \varepsilon_1) \dots (5)$$

The individual accepts the bid if and only if  $U_0 \leq U_1$ . Assuming that the individual is indifferent between  $U_0$  and  $U_1$ ,

Then,

Or

 $MWTP = -\alpha/\gamma \dots (7)$ 

 $0 = \alpha + \gamma E(WTP)$ 

## 4. Survey Design and Sampling

In the present study, primary data is used to estimate economic value of the park and secondary information for sketching the present scenario of KNP. The study collects secondary data from the Forest Department and Tourism Department of KNP and primary data from the visitors of the park. The set of data collected from the visitors comprises of willingness to pay (WTP) for preservation of the park and other individual and household level information, which are collected in the month of December, 2015 and January, 2016 because these two months are considered as the peak season for visiting the park.

Sampling is a critical issue in this respect because tourist is a flow concept and there is no certainty for how long the park is opened for tourists because of the flood situations in Assam. While some researchers used stratified sampling from the total population (Choe, 1996; Rosenberger & Loomis, 1999), others prefer random sampling from user group only (Farber, 1988). The last year's (i.e., 2014-2015) visitors data revealed that average 718 numbers of tourists were visited the park per day during November, 2015 to April, 2016 (Table 2). In the present study, 300 visitors are interviewed randomly using a structured schedule with a single respondent from each group or family chosen in the sample.

Voan	Number o	f Visitors per	<b>Revenue</b> Collection				
Ical	Indian	Foreigner	Total	per annum in Rs.			
2001-02	44162	2144	46306	34,94,084.00			
2002-03	59811	2055	61866	53,60,425.00			
2003-04	57864	3773	61637	61,38,657.00			
2004-05	68412	5144	73559	66,75,037.00			
2005-06	49116	5210	54326	76,15,169.00			
2006-07	67968	5748	73716	79,80,949.00			
2007-08	53640	6106	59746	87,34,185.00			
2008-09	100284	5767	106051	1,12,20,698.00			
2009-10	105264	7580	112844	1,21,67,974.00			
2014-15	123360	7994	131354	2,86,10,134.00			

Table 2: No. of Visitors Visiting KNP and Revenue Collection

Source: Forest Department, KNP

The interview is conducted at the Jeep safari stand when the visitors are coming back after visiting or enjoying the esthetic pleasure of the park. Generally, one group or family or even a single person do not share the Jeep safari with another group or family or person for viewing the park. In order to ensure randomness in selection of samples, visitors of the first two returning jeeps in every hour of the visiting hours are selected and information is collected from the representative of these groups or families.

#### 5. Results and Discussions

Existence of the one-horned rhinos in the national park has an influence on the economic value of KNP, which is estimated by using dichotomous choice of contingent valuation method in the present study. The study has created two different alternative environmental situations or conditions of the park to quantify this particular influence: one situation is the present situation and another situation is in which all the rhinos are poached and this endangered wild animal is erased from the picture of the park. Consequently, in these two different hypothetical market scenarios, tourist's willingness to pay for preservation of KNP is calculated and the difference between these two estimates reflects the influence of existence of rhinos on economic value of the park.

When the average level of WTP is calculated in both the situations, only those visitors are considered who want to contribute some amount. And from Figure 2, it is found that 85 percent of the tourists want to pay some amount for the preservation purposes and for this reason only these tourists are taken as observations in this analysis (i.e., total sample size in regression analysis is 255). But, 15 percent of the total tourists do not want to pay any amount, because -

Firstly, they think that it is Government responsibility. The Government collects revenues from them through various fiscal measures every year and should allocate larger budgetary resources for preservation purposes.

Secondly, they have already paid entry fee, guard fee and road tax for visiting the National Park. If these amounts are properly used for preservation purposes then it should arguably be a sufficient amount.

Thirdly, visitors also thought that corruption is so much high in Assam and therefore their little contributions are also misused and does not help in preservation purposes of KNP.

## Figure 2: Willingness to Pay of the Tourists



Source: Author's Calculation based on selected sample of tourists in KNP, 2015-2016.

At the present scenario, tourist's WTP for conservation of the park is shown in Table 3. It is found that average WTP of the visitors is around INR 96.00 and economic value of the park is estimated as INR 12.61 million.

The estimates of WTP for conservation purposes in the second scenario of the park are also shown in Table 3. The table revealed that all the socio-economic variables of visitors affect in the same way as in the present condition regarding WTP for conservation purposes. In the second hypothetical situation, tourist's average level of WTP is around INR 45.27 when the entire population of one-horned rhinos in KNP is absent and economic value of the park is approximately INR 5.94 million.

Tuble J. Estimates of Toget Regi ession								
	Scenario I ( in KNP)	(Rhinos a	re found	Scenario II (Rhinos are absent in KNP)				
Prob. of WTP	Coefficient	Ζ	P> z	Coefficient	Z	P> z		
BID	-0.0402996	-6.08	0.000	-0.0540143	-6.11	0.000		
HHI	0.0000235	2.29	0.022	0.0000102	1.91	0.056		
EDU	0.5948792	2.53	0.011	0.4636653	1.91	0.056		
AGE	-0.0411431	-1.97	0.048	-0.0458379	-2.26	0.024		
FAMSZ	-0.1800624	-1.04	0.297	-0.1351869	-0.77	0.439		
SEX	0.3881598	0.88	0.380	0.6347869	1.42	0.154		
CONS	3.869111	0.77	0.440	2.445059	0.86	0.389		
No. of observation	255			255				
LR chi2(6)	93.00			89.17				
Prob > chi2	0.0000			0.0000				
Log likelihood	-86.78853			-90.574998				
Pseudo R <sup>2</sup>	0.3689			0.3499				

Table 3:	Estimates	of logit <b>R</b>	egression
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Source: Author's Calculation based on selected sample of tourists in KNP, 2015-2016

The difference between these two WTP amounts reflects the amount of contribution for protection and conservation of rhinos and it is about INR 50.73 per visitor per visit. By comparing these two alternative situations it can be concluded that value of KNP will be reduced by INR 6.67 million, if the Government fails to conserve this unique wild animal of the national park and it also reflects the existence value of rhinos of the park. So, the Government should take various scientific steps towards the protection and conservation of one-horned rhinos of the national park to sustain eco-tourism in KNP.

#### 6. Conclusion

Kaziranga National Park is a famous eco-tourist destination of North East India. Tourists from various parts of the globe visit the park for viewing its unique wildlife and biodiversity, especially one-horned Indian rhinos. But poaching of rhinos is a great threat in front of the management authority of KNP. The existence of this unique wild animal has an influence on economic value of KNP, which is estimated by using DC type of CV method, and it is found that mean WTP for protection of rhinos is around INR 50.73 per visitor per visit

and value of the park will be reduced from INR 12.61 million to INR 5.94 million, if poaching of this wild animal continues unabated on. So, the Government should develop and implement proper scientific management policy for preservation of this unique wild animal and as well as of the national park. The Park's management plan is being finalized, and improved management, financial and technical support and community strategy, awareness, education and involvement in planning are all still necessary (UNESCO, 2002). It should be mentioned that this endangered wild animal is not only a valuable resource for India only, but also for all SAARC countries. All SAARC nations should develop a scientific protection and conservation policy for rhinos through bilateral and/or multilateral talks among the members of SAARC. Without the cooperation and help of the neighbouring countries, India may not stop poaching of rhinos because its horns have an international black market. It will also help in developing co-operation among the members of the SAARC. It is hoped that this study will pave the way for future research work in the field of valuation of environmental resources, endangered species or animals and places of historic interest of SAARC nations.

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