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Towards managing human-elephant conflicts in Sri Lanka: comparing tourists' willingness to pay and farmers' willingness to accept

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ABSTRACT

This paper assesses tourists' preferences for elephant conservation and the farmers preferences for compensation for the crop damage caused by wild elephants using dichotomous double bounded contingent valuation method. This study employs 218 international tourists to seek to estimate maximum willingness to pay for nature conservation. Besides, 439 farmers interviewed to seek their minimum will compensation for their crop damaged caused by wild elephants and coexistence with wildlife. We find that tourists would be willing to pay more on elephant conservation and farmers prefer compensation for their crop damage from tourism receipts. This study enlightened the coexistence and wildlife stewardship feasible from mutual agreed upon conservation via tourism receipts and willingness to accept compensation for the tolerance and coexistence with wildlife to achieve long-term conservation goal.

Keywords: human-elephant conflict, tourism receipt, conservation, contingent valuation, crop damage, Sri Lanka

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1. Introduction

Globally, Sri Lanka is one of the most popular destinations for nature-based tourism (NBT). According to Central Bank of Sri Lanka (CBSL) 2019, within the Sri Lankan economy, travel, tourism and hospitality have therefore become a relatively new dynamic growth sector (Suresh & Senthilnathan, 2014). By 2019, tourism had become the third largest foreign exchange earner with total earnings US$ 3.7 billion (SLTDA, 2019). In addition, the tourism sector employs more than 2 million people directly and over 1.5 million indirectly. According to the Sri Lanka tourism development authority (SLTDA) 2019, the government had targeted 4 million tourist arrivals by 2025 which would yield earnings of US$10 billion. However, the onset of COVID 19 has halting these expectations. Thus, the original target of achieving 2.5 million tourists with earnings of US$ 5 billion in 2020 will not be achieved (Suresh et al., 2020).

NBT sites such as national parks and wildlife reserves play important roles in attracting foreign tourists and the presence of rare and endangered species particularly attracts visitors to these areas (Kularatne et al., 2021). Elephants are one such flagship species in the Sri Lankan tourism context. However, Human-elephant conflict (HEC) in Sri Lanka has escalated in recent decades with farmers being the most direct victims. It is widely argued that there exist conflicts between traditional land-uses and the protection of endangered species.

Several studies have investigated human-wildlife conflict (HWC) and mitigation methods (Wagner et al., 1997; Gore & Kahler, 2012; Neupane et al., 2017; Sukumar, 1989). A number of these studies specifically focus on HEC (Bandara & Tisdell, 2004; Gore & Kahler, 2012; Neupane et al., 2017). Others have investigated wildlife tourism and its potential implications (Tisdell & Wilson, 2012; Burns & Howard 2003; Kruger, 2005). A further set of studies have investigated wildlife conservation and environmental valuation (Dybsand, 2020; McGowan et al., 2020). However, such studies have not focussed on how tourism-led nature conservation efforts can contribute to compensation for wildlife-crop damage and whether coexistence with wildlife can be achieved through monetary compensation. In this context, this study investigates to what extent the revenue generated through NBT can be utilized in compensating the damage caused to farming communities in Sri Lanka. In doing so, this study's objective is to estimate the maximum amount that tourists are willing to pay for the conservation of elephants and the minimum amount of compensation that farmers would accept for tolerancing elephant crop damage.

Over the past several decades, economists have developed various methods for estimating the non-market value of goods and services. The most widely used non-market valuation methods can be categorized as revealed preference (RP) and stated preference (SP) depending on whether they are based on existing markets or constructed hypothetical markets (Anciaes, 2020; Mitchell & Carson, 1989). Among the SP methods, the contingent valuation method (CVM) is the most widely used technique to value non-marketed goods and services (Hanemann, 1991; Wilson & Tisdell, 2003). Contingent valuation method (CVM) is a direct SP method where respondents are asked their willingness to pay (WTP) for the benefit received or their willingness to accept (WTA) compensation for their losses associated with welfare change. RP methods reveals the value of a non-market good and is estimated by studying actual (revealed) preferences (Atkinson et al., 2008). Although, RP methods have been popular in non-market valuations the method has a number of downsides, the major one being that RP is unable to quantify the non-use value of goods and services. Hence, we employ the SP method to estimate international tourists' WTP for nature conservation (elephants) in Sri Lankan national parks using the CVM technique. Furthermore, we use the same techniques to explore farmers' WTA compensation for wildlife crop damage and for coexistence with wildlife in the Wasgamuwa National Park, Sri Lanka. Hence, this study compares the outcome of both estimates of WTP and WTA for the welfare changes brought about by nature conservation and coexistence with wildlife.

This study contributes to the exiting literature by exploring the economic viability and mutual benefits of tourism and nature conservation by studying different perspectives of stakeholders (tourists and farmers). This study compiles the WTP of international tourists for nature conservation and WTA compensation by the affected farmers' preferences for conservation and coexistence through tourism receipts. Prior to eliciting such data, respondents have described to them various nature conservation strategies their contribution will be utilized for such as park enlargement, creation of wildlife corridors, improving habitat and compensation of farmers for HEC. Respondents are then asked to choose if they want to make a conservation payment (one-time payment). The study proposes a conservation fund raised from international tourists to meet biodiversity conservation and which will only be used for nature conservation activities and compensation for farmers for their elephant crop damage. We included a supplementary question in our surveys for people who replied yes to WTA/WTP: "why do you choose the WTP / WTA option" for validity and reliability purposes. This is designed to diminish the incidence of ‘‘yea saying’’, since respondents are not forced to make a definitive choice (Arrow et al., 1993).

This study contributes to a gap in the literature by comparing the welfare changes derived from WTP for nature conservation and WTA compensation for wildlife coexistence using tourism receipts. There are only a few studies which use a systematic approach to comparing the WTP and WTA in the framework of conflict resolution such as HEC. Limited systematic assessments have been carried out to determine a sustainable solution for HEC and how realistic the approach of using the tourism sector is. This study aims to resolve a

key issue in HEC: whether there exists a symbiotic relationship in this field of environmental economics. To do so, two independent DBD surveys of international tourists and local farmers are compared and which are designed to be used for future policy making in NBT development and nature conservation.

2. Human-elephant conflict and Elephant tourism and in Sri Lanka

Elephant and wildlife tourism are highly popular in many parts of the world and particularly in Africa (Botswana) and East Asia (Thailand) including Sri Lanka. Sri Lanka is home to 10% of Asia's elephants. A majority of nature-based tourists (approximately 60%) visiting Sri Lanka come to see elephants (SLTDA, 2019). International tourists visiting national parks in Sri Lanka has increased overtime from 0.3 million in 2000 to 1.1 million in 2018. Minneriya and Kadulla, Udawalawa and Yala national parks are reserved for elephant sightseeing given their larger herds compared to other national parks. The Wasgamuwa national park also has a significant number of elephants which frequently migrate to nearby parks. Most of the national parks in Sri Lanka are popular for elephant sightseeing and generate a significant proportion of foreign revenue.

There is evidence that an expanding tourism sector is positively influencing economic outcomes in Sri Lanka. However, the sector is facing a number of threats including habitat losses corresponding with human population increases, subsistence farming and natural disasters (flood and drought). One of the single largest impacts is HEC which causes death and financial losses to farmers located in adjoining areas of Sri Lankan national parks. It is estimated that 35% of total agricultural output loss is due to HEC annually (Ministry of Agriculture, 2018). In addition, the elephant population has been declining over time, with approximately 50 per cent lost since 1930. On an annual basis it is estimated that around 250 elephants and 80 people die as a result of HEC in Sri Lanka (DWC, 2019; Dharmarathne et al., 2020). Elephants are the flagship/umbrella species of the Sri Lankan tourism sector. Therefore, if HEC continues, Sri Lankan tourism could be severely affected. Hence, this study seeks to explore the potential symbiosis between tourism and nature conservation (elephant conservation) using tourism receipts.

The long-term future of the elephants outside the protected areas in Sri Lanka is profoundly pivot on the tolerance of local farmers attributes towards elephant conservation. Failure to identify the significance of HEC would be result in negative attitude towards wildlife conservation particularly elephants. This conundrums emphasis by Webber et al., (2011) will have detrimental effects on the long-term success of conservation programs. As a flagship-species, umbrella-species, and socially and culturally important species, elephant conservation is of national importance in Sri Lanka. As one of only three island populations (Santiapillai & Jackson 1990), a population at the extreme of the species range, and a population with high genetic diversity and distinctiveness (Fernando et al., 2005; Ahlering et al., 2013), Sri Lankan elephants are a high priority for Asian elephant conservation. We seek to explore the potential symbiotic relationship between tourism receipts and nature conservation (elephant) using an optimal compensation amount for the tolerance of crop damage and coexistence and the maximum WTP form tourists. However, the existing compensation scheme in Sri Lanka only covers the human death, injury and property damage (see, Figure 1). Unfortunately, the scheme has not compensated crop damage in Sri Lanka where agriculture is a major contributor to GDP (7%) and employment in Sri Lanka.

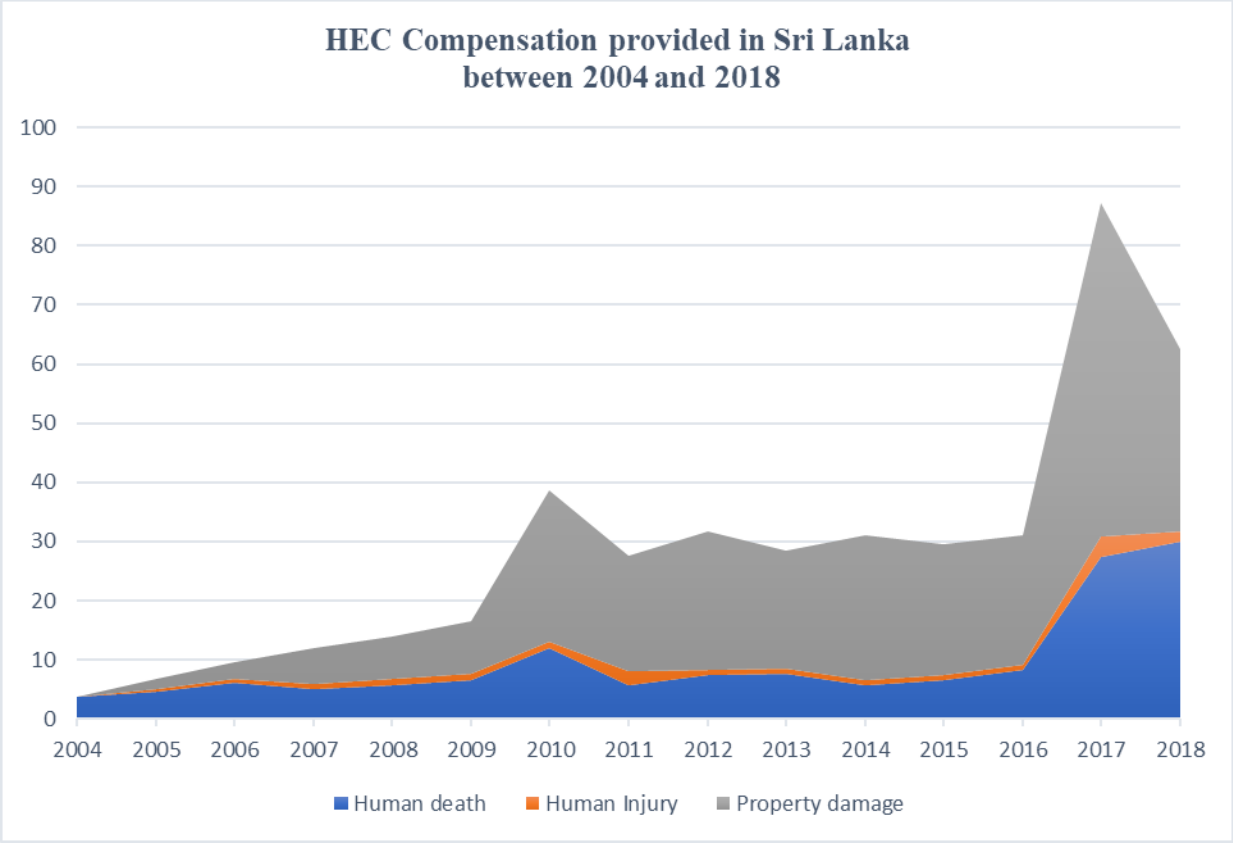

Figure 1. Compensation disbursement of HEC in Sri Lanka between 2004 and 2018.
Source; Author own compilation, 2021

Successful coexistence between wildlife and the local community depends on how the issue is managed (Bajracharya et al., 2006; Jarungrattanapong & Boonmanunt, 2020). Such management practices typically involve a tradeoff in terms of access to protected areas for subsistence activities (e.g. farming), the availability of compensation, preventative community infrastructure and the extent to which it provides freedom from threat of injury and death (Heinen & Mehta, 2000; Brouwer, et al., 2010). Studies have found that local residents are willingness to accept compensation for wildlife damage when offered if it is guaranteed (Brouwer et al., 2010). However, in Sri Lanka such instruments are yet to be established due, amongst other factors, to lack of government finance. Therefore, it is vital to explore sustainable sources of income, such as that from tourism and viable modes of compensation in mitigating the HEC.

Conflict resolution takes place in a number of ways - such as community participation in planning, management and administration (see, for example forest conservation in New Zealand). An important principle of such inclusive methodology is a recognition that the future of protected areas' sustainability depends on improving the standard of living of the local community and understanding how the benefits should be shared (Ghoochani et al., 2020). If local people are subject to a high level of poverty, then they are unlikely to greatly value the aesthetic beauty and conservation attributes of their land. In contrast there is evidence to show that people have positive attitudes towards national parks and wildlife resources where they generate adequate benefits (Nepal & Weber, 1995). Western (1982) estimated that wildlife tourism could generate 18 times more than the annual income generated from beef production. Another study in Amboseli national park, Kenya shows that unsuitable agricultural land converted to a nature reserve would provide a net return of US$40 compared to US$ 80 cents per hectare (Hanks, 1984). Zambia's Luangwa valley and the Chirisa wildlife reserves have won the confidence of local people by providing adequate compensation from game reserves. If NBT can generate adequate funding/payments, then those funds could potentially be

utilized for the enlargement of national parks and provide adequate funding for compensation to farmers who have lost their livelihoods due to wildlife damage.

However, notwithstanding the growing concerns over HEC and its mitigation, the problem still remains unresolved. Hence, understanding different views about nature conservation especially stakeholder perspectives – that is, farmers and tourists (international) - and the monetary estimates for conservation and compensation, is vital. This study explores the elephant as an economic asset for Sri Lankan NBT and how tourism revenue can help to compensate farmers for HEC and promote nature conservation by using a double bounded dichotomous (DBD) technique in the valuation studies.

Overall, this study has twofold aimed; firstly, the financial suitability of nature conservation (elephants) in national parks is estimated through tourism receipts from international tourists (embarkation tax). Secondly, we seek to understand farmers' preferences for compensation payment for the crop damage caused by wild elephants. Many of the country's national parks and nature conservation efforts are impeded due to budget constraints and heavy dependence on state finance. As well, there is the dilemma of whether to prioritise conservation over a balanced budget. Hence, this study proposes tourism as an alternative source of income for conservation and coexistence with wildlife. In doing so, a symbiosis can be created between NBT and nature conservation by estimating tourists' maximum WTP for nature conservation and farmers' minimum WTA elephant crop damage.

3. Material and methods

3.1 Survey design and implementation

The study consists of two parts: the first survey examines tourists' views on nature conservation (particularly elephants). We conducted a face-to-face questionnaire survey interviewed with randomly selected 218 international tourists (simple random sampling techniques) who visited Yala National park during the months from July 2019 to February 2020 and asked their WTP for nature conservation (see, Figure 2). The data was collected after the visit of the park from the respondents to see their level of experience at the park. The enumerators distributed questionnaire in the park gate as they rest after their tours. Each interview took 30 minutes, and in the morning and evening shifts, a two-time period was to approach visitors.

The second survey was conducted from farmers whose crop damaged caused by elephants and asked them WTA for compensation for tolerance from crop damaged caused by elephants and coexistence with wildlife. This survey was executed from randomly selected 439 farmers who were affected by HEC in adjoining villages of Wasgamuawa national park in Sri Lanka (see, Figure 2). The data was collected two administrative districts namely Matale district (224 respondents) and Polonnaruwa district (215 respondents). These districts are mostly affected districts due to HEC in Sri Lanka over the last two decades. We selected sample villages from each district based on the secondary data collected from district secretariat. We asked respondents for compensation for crop damage per acre caused by wild elephant and for the coexistence to sharing their farmland with wildlife.

The survey instruments were developed through key-informant interviews and focus group discussions with relevant stakeholders (International tourists and farmers). The well-trained university undergraduates and the principal investigator were involved in the data collection process. The half-day workshop was conducted to the enumerators to make them aware the purposes and the background of the study DBD descriptions. WTP pilot study was pretested from 46 international tourists who visited Yala national park and the WTA survey was pretested with 62 HEC affected farm households in the Dimbulagala DS division in the Wasgamuawa study sites for ensuring that all survey question could be understood and did not contain any ambiguous questions. The CVM survey questionaries (WTP and WTA) was developed using DBD survey questions; upper and lower bound of WTP/WTA amount. Both survey questionnaires (WTP and WTA) included three sub sections. The section one, a brief note on the purpose and background of the study information. Section

two; captures DBD choice questions, section three covers socio-economic characteristics of the respondents. The respondents were verified using supplementary questions before executed the actual survey as we identified the right respondents.

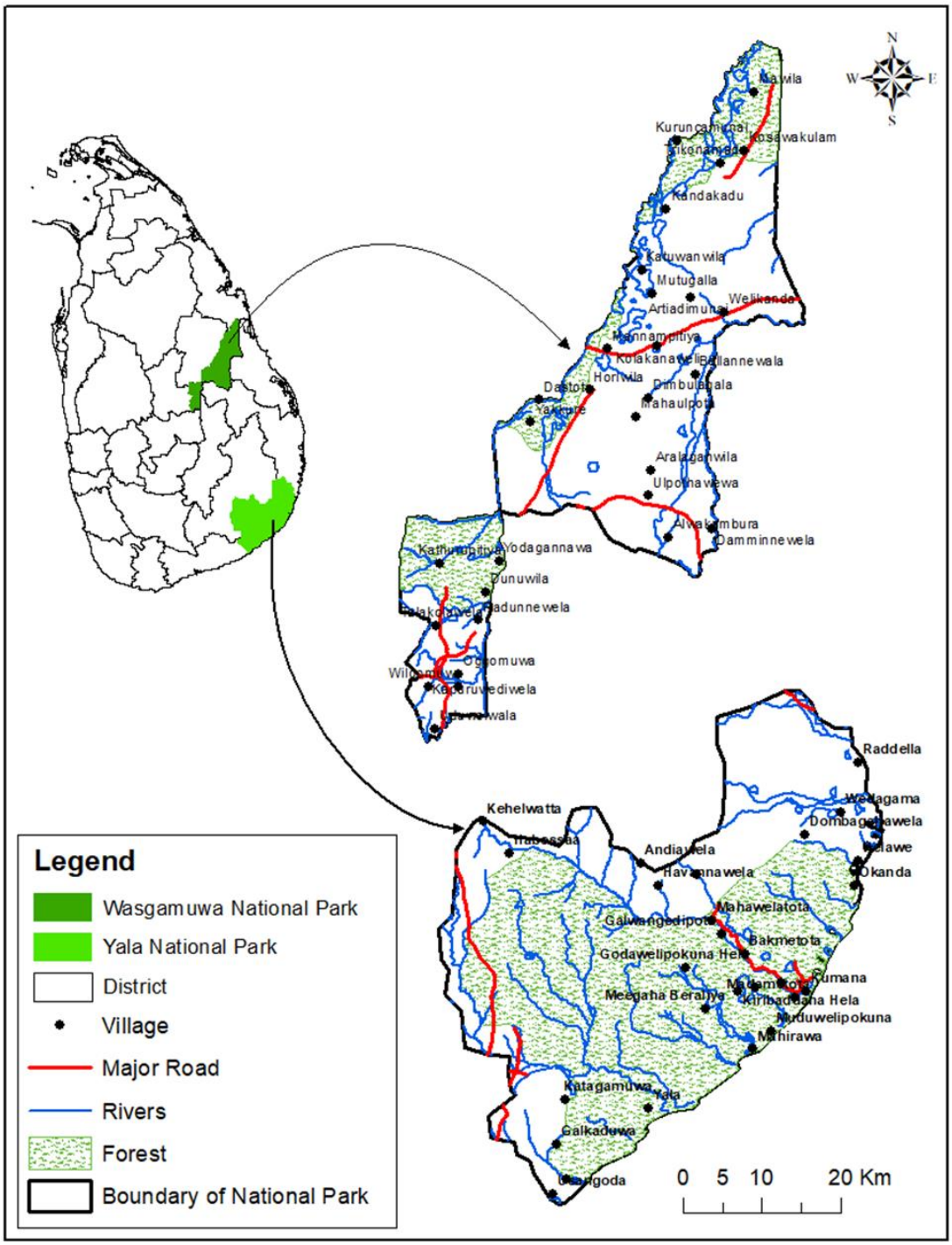

Figure 2 Study sites of Wasgamuwa national park range and Yala National park
Source; Author own compilation, 2021

3.2 Empirical model

3.2.1 Dichotomous double bounded CVM method

A CVM choice question was presented to respondent which directly asks what amount they are WTP/WTA for environmental goods or services (Hanemann, 1985). Hence, this study estimates tourists' maximum WTP for nature conservation (particularly elephant), as well as the minimum amount farmers are willing to accept for tolerating wildlife crop damage and coexistence with wildlife. The respondents are offered a change in the quantity or quality of an environmental good at a given cost, for which the respondent either accepts or rejects payment for such an environmental improvement. However, the single bounded CVM method is subject to criticism from scholars in terms of its ability to deliver reliable and accurate estimates (Hanemann,1994; Mitchell & Carson, 1989). This technique offers a monetary payment for a welfare change via a single question for example, "whether you would be WTP/WTA for a welfare change and how much an individual WTP/WTA" (Diamond & Hausman, 1994). Hence, we used a dichotomous double bounded (DBD) technique to measure WTP/WTA which is widely accepted in the present literature for non-marketed goods (Mitchell & Carson, 1989). This technique has a greater statistical power to measure estimates by double-checking the elicited amount of WTP/WTA via various subsequent repeated questions to the respondents (Gelo & Koch, 2015; Park, 2003). The DBD techniques is useful for policy makers who wish to identify user perspectives of nature conservation and the tolerance for wildlife crop damage. This study aims to estimate tourists' maximum WTP for nature conservation (elephant) and farmers' minimum WTA compensation for their elephant-crop damage.

The DBD method is becoming widespread in the CVM literature as a reliable measure through repeated choice questions (Hanemann, 1985; Carson, et al., 1996; Hanemann et al., 1994). Through this technique, respondents are asked whether they are willing to pay some initial dollars bid amount, and then are offered a follow-up bid which is higher (or lower) if the response to the first bid is yes or no (this technique considers a responses to two bids, the second one being determined according to the response to the first). Open-ended CVM design gives lower WTP estimates than when using a dichotomous choice design (Bateman et al., 1995). Also, of note is that practice and repetition can take place not only in the marketplace but also in the actual survey situation as shown by Bateman et al. (1995) who find that respondents may learn about the institutional design by responding to several double-bounded CVM questions. There is also evidence that repeated behaviour reduces anomalies and, in particular, that more experienced respondents are less inconsistent (Kanninen et al., 1993). These findings have two key implications when looking at responses in SP surveys: (1) preferences might seem incoherent, but they are not, and (2) preferences elicited at a later stage in the survey instrument are less 'noisy' and better reflect the respondent's normative preferences. Hence, we choose DBD techniques to elicit tourists' WTP and farmers' WTA compensation.

The design of the survey instrument follows a study of influential pieces of literature such as that of Hanemann, et al. (1991), Mitchell and Carson (1989), Arrow et al. (1993), and Knapp et al. (2018). This literature helps to design the survey instruments of maximum WTP for conservation from tourists which could be offset by the cost borne by local farmers due to HEC and WTA compensation of farmers for wildlife tolerance and coexistence with wildlife. The model constructed relies on double bounded dichotomous choice (DBD) contingent valuation methodology, which is simple extension of the single-bound dichotomous choice (SBDC) model. Survey respondents are asked to state ("yes" or "no") if they would be willing to pay a single bid amount for a good or service. For each respondent, the probability of responding "yes" to a given bid amount is defined by

$$P_{i\ (b^k)}^{Y} = \Pr\ \{b^k \leq maxWTP\} \quad (1)$$

Where b^k is the offered bid amount, and the probability of a "no" response is $1 - P_i^Y(b^k)$ (Hanemann et al., 1991). Following (Hanemann et al., 1989) and Koss and Khawaja (2001), we restrict WTP to positive values and assume a logistic probability distribution. Then the probability that a respondent's WTP is greater than the offered bid amount is written as

$$\pi^Y = \frac{1}{1+e^{-(\propto +\beta b^k +\sum \delta_j z_j)}} \quad (2)$$

Where π^Y is the probability of a yes, β is the bid coefficient, and δ_j is the coefficient vector corresponding to the vector of j control variable, Z.

In contrast to the SBDC model, the DBDC model requires each respondent to answer "yes" or "no" to two sequential bids (Wang et al., 2020). If a respondent answered "yes" to the initial question, a corresponding higher bid value was proposed for WTP, while respondents who answered "no" to the initial question were asked a corresponding lower bid value. For WTA in the reverse direction the second bid amount would be lower if the respondent answered yes. Thus, each respondent falls in to one of four categories, yes/yes (YY), yes/no (YN), no/yes (NY), or no/no (NN). We denote the probability of each response sequence as $\pi^{YY}\pi^{YN}\pi^{NY}\ and\ \pi^{NN}$ such that

$$\pi^{YY}\left(b_i^I, b_i^U\right) = \Pr\ \{b_i^I \leq maxWTP\ and\ b_i^U \leq maxWTP\ \} \quad (3)$$

$$\pi^{YN}\left(b_i^I, b_i^U\right) = Pr\ \{b_i^I \leq maxWTP\ and\ b_i^U\ \geq maxWTP\} \quad (4)$$

$$\pi^{NY}(b_i^I, b_i^L) = \Pr\ \{b_i^I \geq maxWTP\ and\ b_i^L\ \leq maxWTP\} \quad (5)$$

$$\pi^{NN}(b_i^I, b_i^L) = \Pr\ \{b_i^I \geq maxWTP\ and\ b_i^L\ \geq maxWTP\} \quad (6)$$

Were the b_i^I, b_i^U and b_i^L correspond to the initial, upper and lower bid values, respectively, and í is the respondent index. In contrast to the SBDC model, which results in only one minimum or maximum value for each respondent's WTP, the DBDC methodology allows for the construction of a bounded interval (Eqs. (4) and (5)), or minimum or maximum bound (Eqs. (3) and (6), of each respondent's WTP, and improves the asymptotic efficiency of parameter estimates (Hanemann et al., 1991). Using Eqs. (3)- (6) are written as

$$\pi^{YY} = \frac{1}{1+e^{-(\alpha+\beta b_i^U+\sum \delta_j z_j)}} \quad (7)$$

$$\pi^{YN} = \frac{1}{1+e^{-(\alpha+\beta b_i^I+\sum \delta_j z_j)}} - \frac{1}{1+e^{-(\alpha+\beta b_i^U+\sum \delta_j z_j)}} \quad (8)$$

$$\pi^{NY} = \frac{1}{1+e^{-(\alpha+\beta b_i^L+\sum \delta_j z_j)}} - \frac{1}{1+e^{-(\alpha+\beta b_i^I+\sum \delta_j z_j)}} \quad (9)$$

$$\pi^{NN} = 1 - \frac{1}{1+e^{-(\alpha+\beta b_i^L+\sum \delta_j z_j)}} \quad (10)$$

The log-likelihood function for the DBDC model, L^{DB}, is defined as

$$L^{DB} = \sum_1 y_I^{YY} \log \pi_i^{YY} + \sum_1 y_I^{YN} \log \pi_i^{YN} + \sum_1 y_I^{NY} \log \pi_i^{NY} + \sum_1 y_I^{NN} \log \pi_i^{NN} \quad (11)$$

Where y_i^{xx} is an indicator variable of the ι[th] respondent (Hanemann et al., 1991; Koss & Khawaja, 2001). As shown in Koss and Khawaja (2001) using Eqs. (2) and the estimation results of the DBDC model, the mean WTP can be imputed as

$$\text{WTP} = (1+x)^n = \frac{ln\left(1+e^{(\alpha+\sum\delta_{ij}z_{ij}}\right)}{-\beta} \quad (12)$$

The survey intends to establish a nature conservation fund from the contribution of international tourist visiting Sri Lanka. Hence, we propose a small amount of contribution to seek the viability of the initiative of the fund. The survey asked international tourists to elicit their contribution through WTP using close-ended double bounded dichotomous choice for the nature conservation. The questionnaire included a follow-up question regarding the contribution of the WTP to nature conservation. The study used $1, $3, $5 as Bid amounts from tourists for improvement in the environmental quality and nature conservation (elephant). The initial Bid was $3 and upper Bid $5 and lower Bid $1. If the respondents agreed to pay the initial Bid ($3) we raised the Bid amount to $5, besides, if respondent disavowed to pay initial Bid amount, then we reduced the WTP amount to $1 (lower Bid).

Likewise, we propose a compensation amount based on the average cost of cultivated areas of major crops (for example paddy) in Sri Lanka. The survey asked farmers Rs 70,000 as the initial Bid amount to compensate for the damage caused to the elephant crop. If the respondent says yes, we reduce the compensation to Rs. 60,000. Suppose the respondent says no for the Bid one we increase the compensation amount as Rs. 80,000.

4. Results and discussions

4.1 Results WTP using dichotomous double bounded (DBD) CVM

This section of the study attempts to estimate the impact of various determinants of WTP for nature conservation using tourist preferences for nature conservation. Table 1 below indicates the variables used in the DBD choice survey for the WTP analysis.

Table 1 Variable used in the WTP for nature conservation

Name of the variable	Definition
bid 1	Initial Bid amount in US$ 3
bid 2	High Bid in US$ 5 to US$ 15
bid 3	Low Bid in US$ 1
Nn	=1 if the answer to the willingness to pay questions no, no
Ny	=1 if the answer to the willingness to pay questions no, yes
Yn	=1 if the answer to the willingness to pay questions yes, no
Yy	=1 if the answer to the willingness to pay questions yes, yes
age	Number years
Gend	=1 if the individual is a male otherwise 0

Source; Author own compilation, 2021

Almost 70% of respondents answered yes to the first DBD question suggesting that tourist have a WTP for nature conservation. When using DBD data, it is vital to verify that respondents make a sensible offer to contribute to nature conservation. That is, there is a popular assumption that WTP for nature conservation will decrease as the bid amount rises. We use equation 12 to calculate WTP without incorporating a demographic variable. If no control variable is used in the calculation, the mean WTP value is approximately $7 (see, Table 3). This suggests that tourists are likely to pay approximately $7 for nature conservation using a one-off payment through an embarkation tax. Even though this is a modest amount collectively, tourists' contributions would produce a substantial sum for conservation purposes. Table 4 depicts the WTP coefficient of the bid amount 1 that tourists are less likely to choose for the compensation amount as it rises.

Table 2 WTP constant only model

Log likelihood = -132.97695		Number of observations = 218 LR chi2 (1) = 1.39 Prob > chi ^{2} = 0.2381 Pseudo R^2 = 0.0052			
Answer 1	**Coef.**	**Std. Err.**	**Z**	**P > l z l**	**[95% Conf. Interval]**
Bid 1	-0.10611	0.09012	-1.18	0.239	-0.28276 0.07053
_cons	0.74138	0.21195	3.50	0.000	0.325963 1.15681

Source; Author own compilation, 2021

The similar finding was observed in the North York national park through a postal questionnaire, tourist would be willing to pay for nature conservation in Sterling Pound 3.10 per individual per year (White & Lovett, 1999). However, attitudes toward nature conservation depends on demographic attributes as well. Hence, we included interaction models with key attributes such as age and gender.

Table 3 WTP estimates without demographic variable interactions

Answer 1	**Coef.**	**Std. Err.**	**Z**	**P > l z l**	**[95% Conf. Interval]**
WTP	6.98651	4.20759	1.66	0.097	-1.26021 15.23325

Source; Author own compilation, 2021

Table 4 WTP extended Probit regression results

Log likelihood = -131.5398		Number of observations = 218 LR chi2 (1) = 4.27 Prob > chi ^{2} = 0.2341 Pseudo R^2 = 0.0160			
Answer 1	**Coef.**	**Std. Err.**	**Z**	**P > l z l**	**[95% Conf. Interval]**
Bid 1	-0.11307	0.09089	-1.24	0.213	-0.29121 0.06507
Age	0.01145	0.00765	1.50	0.135	-0.00355 0.02646
gend	-0.14142	0.18130	-0.78	0.435	-0.49677 0.21392
_cons	0.36035	0.39479	0.91	0.361	-0.41342 1.13414

Source; Author own compilation, 2021

The Probit regression findings of tourists' demographic characteristics are presented in Table 4. We then included the age and gender variable in our DBD model. The finding suggest that males are less likely to choose to fund nature conservation while older tourists are more likely to contribute to a nature conservation fund. The age of respondents has more influence - $ 3.4 in determining WTP for nature conservation than gender which was estimated at $2.2.

The following Tables 5, 6 and 7 show the estimated results of the demographic characteristics such as age, gender compared with Bid amount. The findings of the study clearly revelled that age and gender has positive and significant with willingness to pay for nature conservation.

Table 5 WTP estimates with age, gender Bid 1

Answer 1	Coef.	Std. Err.	Z	P > I z I	[95% Conf. Interval]
WTP	6.74225	3.78842	1.78	0.075	-0.68292 14.16744

Source; Author own compilation, 2021.

Table 6 WTP estimates with age, Bid 1

Answer 1	Coef.	Std. Err.	Z	P > I z I	[95% Conf. Interval]
WTP	3.49075	3.02056	1.16	0.248	-2.42943 9.41095

Source; Author own compilation, 2021

Table 7 WTP estimates with Gend, Bid 1

Answer 1	Coef.	Std. Err.	Z	P > I z I	[95% Conf. Interval]
WTP	2.24003	2.80580	0.80	0.425	-3.25924 7.73930

Source; Author own compilation, 2021

4.2 Results WTA using dichotomous double bounded CVM

This section of the analysis quantifies the effect on WTA compensation of various demographic characteristics. Similarly, we use a DBD choice question to assess farmers' WTA compensation for crop damage caused by wild elephants and coexistence with wildlife. The variable used in survey two is illustrated in Table 8.

Table 8 WTA variable used for farmers' compensation

Name of the variable	Definition
bid 1	Initial bid amount in Rs.70,000
bid 2	Higher bid amount in Rs.80,000
bid 3	Lower bid amount in Rs.60,000 to Rs.50, 000
Nn	=1 if the answer to the willingness to pay questions no, no
Ny	=1 if the answer to the willingness to pay questions no, yes
Yn	=1 if the answer to the willingness to pay questions yes, no
Yy	=1 if the answer to the willingness to pay questions yes, yes
age	Number years
Gend	=1 if the individual is a male otherwise 0
edu	Number of years schooling
Income	Annual average income

Source; Author own compilation, 2021

The coefficient of WTA is positive and significant (see, Table 9) showing that farmers are more likely to choose compensation and the positive utility associated with their compensation for their elephant-crop damage. A similar finding is observed in the study by Bandara and Tisdell, (2004) where farmers perceived themselves to be better off givens sufficient compensation for HEC. The WTA compensation of the DBD results show that without the inclusion of a demographic variable the estimation of the average WTA amount is approximately Rs. 50780. This indicates that farmers would be willing to accept the suggested amount for elephant-crop damaged and coexistence with elephant.

Table 9 WTA full model

Log likelihood = -289.43425		Number of observations = 439 LR chi2 (1) = 12.36 Prob > chi ^{2} = 0.0004 Pseudo R^2 = 0.0209			
Answer 1	**Coef.**	**Std. Err.**	**Z**	**P > I z I**	**[95% Conf. Interval]**
Bid 1	0.00002	5.80e-06	3.51	0.000	9.00e-06 0.00003
_cons	-1.03453	0.37244	-2.78	0.005	-1.76451 -0.30455

Source; Author own compilation, 2021

Table 10 WTA estimates constant only model

Answer 1	**Coef.**	**Std. Err.**	**Z**	**P > I z I**	**[95% Conf. Interval]**
WTA	50779.85	4656.765	10.90	0.000	41652.76 59906.94

Source; Author own compilation, 2021

In the second stage of the analysis, we included demographic characteristics (age, gender, education, income) into our DBD model (see, Table 11). The findings show that older farmers are more likely to accept compensation for crop damage caused by wild elephants and coexistence with wildlife. The gender variable is negative suggesting that male farmers are less likely to accept compensation compared to female farmers. The education variable is positive and significant suggesting that farmers with high levels of education are more likely to accept compensation and coexistence with wildlife. This finding is consistent with Hadker et al. (1997) who found that an increase in the level of education was associated with a higher WTP for conservation. Farmers with high levels of income are shown to be more likely to accept compensation for crop damage and coexistence with wildlife. This finding is consistent with Bandara and Tisdell (2004) who found that higher income had a positive influence on the probability of a yes response to conservation concerns.

Table 11 WTA extended Probit regression results

Log likelihood = -288.00336		Number of observations = 439 LR chi2 (1) = 15.22 Prob > chi ^{2} = 0.0095 Pseudo R^2 = 0.0257			
Answer 1	**Coef.**	**Std. Err.**	**Z**	**P > I z I**	**[95% Conf. Interval]**
Bid 1	0.00002	5.84e-06	3.51	0.000	9.03e-06 0.00003
Age	0.00232	0.00489	0.47	0.635	-0.00727 0.01192
gend	0.16564	0.14913	-1.11	0.267	-0.45795 0.12665
Edu	0.14901	0.14813	1.01	0.314	-0.14132 0.43935
income	0.04354	0.08663	0.50	0.615	-0.12626 0.21335
_cons	-1.27741	0.48742	-2.62	0.009	-2.23275 - 0.32207

Source; Author own compilation, 2021

The following analysis seeks to explores the influence of socio-demographic variables on WTA compensation. The results suggest that the WTA amount changes considerably when socio demographic variables are included - that is Rs. 70, 000 compared Rs. 63,000 to the constant only model (see, Table 12). When the variables age and gender, were included the respondents' WTA compensation increased to Rs. 62,890 suggesting that farmers with experience and male farmers are asking for more compensation than farmers overall.

Table 12 WTA estimates constant only model

Answer 1	Coef.	Std. Err.	Z	P > I z I	[95% Conf. Interval]
WTA	62890.62	10660.54	5.90	0.000	41996.34 83784.90

Source; Author own compilation, 2021.

The age only model results show only slightly lower WTA compensation Rs. 62,044 (see, Table 13) than when compared to the previous model estimated. There is a clear hetrogenity of prefernces among older farmers who are more likely asked for more compmensation than younger farmers. This may be due the younger age group being able to find other part time jobs other than farming. Gender and the age factors are therefore key to determining the amount of compensation for elephant-crop damage. The results show that male and older farmers are more likely to choose a higher compensation amount (Rs. 70,134) compared to those in the female and younger age groups.

Table 13 WTA estimates with age only model

Answer 1	Coef.	Std. Err.	Z	P > I z I	[95% Conf. Interval]
WTA	62044.94	16131.77	3.85	0.000	30427.24 93662.63

Source; Author own compilation, 2021

Table 14 WTA estimates age and gender

Answer 1	Coef.	Std. Err.	Z	P > I z I	[95% Conf. Interval]
WTA	70134.74	16090.67	4.36	0.000	38597.61 101671.90

Source; Author own compilation, 2021

Theoretical validity of WTA and WTP estimates was further tested in our surveys by asking a supplementary question to the respondents why the respondents have chosen the WTP for conservation contribution/ WTA compensation payment.

The findings of the two analyses show that tourist's average willingness to pay for nature conservation is approximately US$6 (elephants). The valuation preferences for nature conservation by tourists is consistent with other empirical findings. For example, according to the Wang & Jia, (2012), the survey conducted using tourists at the Dalai Lake protected area in China shows that a mean WTP for nature conservation of RMB 71.08 (US$ 10.72). Other studies at elephant conservation centers in Malaysia have revealed that more than 86% of the respondents would be willingness to pay for elephant conservation and that the mean WTP by international tourists was US$3.20 (Kaffashi et al., 2015). Bandara & Tisdell, 2004 estimated that urban residents in Sri Lanka would be willing to pay $1 for elephant conservation. Nature-based tourists at the marine protected area in Chile were shown to have a WTP of US$ 4.38. It is also found that the average farmers' WTA compensation for elephant crop damage per acre is Rs.62,890 (US$347). Similar findings were observed in Nepalese studies where WTA compensation for forgoing access to natural resources in the Koshi Tappu wildlife reserve was estimated at US$ 238 (Shrestha et al., 2007).

The WTP results show that tourists would be willing to pay an average of approximately US$6 to a conservation fund to protect nature conservation (elephants). One average about 2 million tourists are visiting Sri Lanka annually. Hence, the annual total conservation fund could be US$ 12 million (Rs.25745 million). At present the DWC Sri Lanka has been providing HEC compensation for human death, injury and the property damage estimated to average Rs. 29 million per year (2004 to 2018). This study's findings show that the

estimated total amount of WTP for nature conservation from international tourists could be 887 times greater than the actual amount of compensation disbursement by the DWC (2019) in Sri Lanka. Hence, in Sri Lanka there is a very great potential to promote nature conservation (particularly elephants) through tourism receipts.

The WTA compensation study findings suggest that farmers prefer compensation for their crop damage caused by wild elephants. This is estimated by our DBD choice question producing an average WTA amount of Rs.62,890 per acre for crop damage and for tolerance and coexistence with wild elephants. As per the budget proposal 2017, Sri Lanka has introduced a crop insurance compensation scheme whose maximum coverage is Rs. 25,000 per acre for crop damage caused by elephants (Ministry of Agriculture, 2018). This is dispersed through the Agricultural and Agrarian Insurance Board. However, the actual value of the damage is much greater than the insurance premium. Indeed, our findings clearly show that farmers' WTA per acre for crop damage is double that of the insurance amount. Moreover, the actual amount of compensation (insurance) paid represents only 39% of the total damage, covering just 15 % of the country 's farmers. Hence, there is a need for a holistic compensation scheme to accommodate all farmers and thereby substantially increase support for sustainable biodiversity conservation and NBT development.

5. Conclusion and policy implications

This study compares the WTP and WTA for nature conservation (elephants) using non-market valuation techniques for estimating a DDB CVM. The findings can assist policymakers' understanding of the potential for deriving contributions for nature conservation (elephants) from tourists and farmers' preferences for compensation for crop damage caused by wild elephants and for coexistence with wildlife. Once the purposes for conservation are known, then tourists' enthusiasm for making a financial contribution to conservation initiatives may increase. There is little known research which investigates the WTP for nature protection and WTA reimbursement for damage to the elephant crop using tourism receipts. This study therefore estimates the WTP for nature conservation (elephants) and WTA compensation for wildlife crop damage and coexistence with wildlife. From a conservation viewpoint this study's estimates support countries developing compensation schemes funded by tourists which can then fund sustainable mitigation measures. This study therefore aims to help create a roadmap for countries such as Sri Lanka taking advantage of the win-win situation which is evident for the development of both tourism and nature conservation.

HEC is a major conservation concern in countries with large elephant populations. A variety of management strategies have been developed and are practiced at different scales for preventing and mitigating HEC. However, HEC remains pervasive as the majority of existing prevention strategies are driven by site-specific factors that only offer short-term solutions, while mitigation strategies frequently transfer conflict risk from one place to another. Moreover, most mitigation methods focus on symptoms of the conflict rather than core drivers of the issue. This study thus investigates the potential causes of the conflict and explores mitigation methods which represent a holistic approach on a whole of country basis. Such HEC mitigation methods are based on the viability of using tourism receipts as a conservation tool.

Despite the fact that financial and livelihood safety motivations for killing elephants are still evident in Sri Lanka, the economic benefits of elephant conservation are clearly of far greater benefit. Naidoo et al. (2016) show that elephant conservation in savannah protected areas has net positive economic returns comparable to investments in sectors such as education and infrastructure. The potential contribution of this study is the possibility of realizing simultaneously the dual economic and ecological success of NBT. To enable this, considerable support is needed for community stewardship of nature conservation. That is, a community based micro-enterprise approach in support of NBT is likely to produce considerable benefits for the ecosystem on which it is based. Not only does this generate revenue for local inhabitants but it also supports

stewardship of biodiversity conservation. The underlying rationale for such an incentive-based approach is that protecting these resources from anthropocentric threats will best deliver benefits to biodiversity conservation with constant monitoring.

In Sri Lanka HEC governance is vertically integrated with the institutional linkages between national, provincial, and local institutions too broad and poorly organized to resolve the challenges of successful HEC mitigation. Over the past 70 years in Sri Lanka a single institution (Department of Wildlife Conservation) has looked after HEC safety and mitigation with limited administrative and manpower resources. The HEC governance put into practice has been a top-down approach. Therefore, community perception of and participation in long-term HEC mitigation has been less than desirable. In developing an effective HEC mitigation understanding the pulse of stakeholders regarding elephant survival and coexistence with wildlife outlook is timely. Accordingly, this study examines the seven decades of unresolved and growing problem faced by HEC in Sri Lanka and explores farmers' involvement in developing new solutions.

Overall, in Sri Lanka the interplay between humans and elephants and resulting confrontations are largely inevitable. The future of endangered mammals and their coexistence with humans will depend in large measure on a far higher level of tolerance and coexistence. The ultimate issue is likely to boil down to managing the shared rights of elephants and other such species to choose their habitat territory. This study illuminates a means for a mutually agreed conservation strategy in which WTA compensation for tolerance and coexistence with wildlife drives the achievement of a long-term conservation goal based on the involvement of both farmers and tourists.

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