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Economic Valuation on Conservation of Rainforest in Eastern Sinharaja, Sri Lanka

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Abstract - **The value of goods and services is noticeable as the price is paid for those goods and services, but in environmental goods and services the real price or value is misrepresented in ordinary markets. Especially the forest benefits or non-market values are not normally exchanged in markets and are generally ignored in decision-making. Benefits obtained from environmental elements cannot be estimated and it causes continuous damage which can be a reason for long-term worldwide effects. Therefore, such values and damages need to be justified at least by ensuring that they can be identified and conserved for future generations. But conserving forest features, and improving or managing them is costly. Eastern Sinharaja - Sri Lanka is a world heritage rainforest that is represented with valuable resources for all living beings. However, the resources in Eastern Sinharaja are under continuous degradation and require conservation measures. The research problem focuses on what is the economic value of the conservation of the Eastern Sinharaja rainforest environment. This research is attempted to estimate the total value of conservation of the Eastern Sinharaja rainforest environment using the Contingent Valuation method (CVM). The information was gathered from a questionnaire survey under a random sampling method using a 234 sample size. The results have discovered, respectively socio-economic variables, general environmental attitudes, and willingness to pay sections designed have identified as key sections which derived the main features which are affecting the economic value of the conservation of the rainforest environment. Gender, employment, voter, and income are socioeconomic features that affect economic value. In general environmental attitudes for willingness to pay (WTP) and the respondents' attitudes are positive when considering the significance values of the features for Mean WTP of Rs. 257.30 from a household. This study indicated that despite Sri Lanka being a developing country, people are willing to contribute to the conservation of the resource. Those derived values may significantly contribute to the conservation of the rainforest environment and deliver materials to design applicable policies for future rainforest environment management.**
Keywords: **Rainforest, Contingent Valuation Method, Willingness to Pay, Non-Use Values, Rainforest Conservation**

I. INTRODUCTION

The forest ecosystem is a disproportionately important resource for the well-being of all living beings. It can be identified as a combination of procedures and settings which support and satisfy the species and human beings. Storage of Carbon, maintenance, and creation of habitats, transportation of sediments, nutrients, and organics, and connection of pathways to migrate and re-colonize animals are some physical, chemical, and biological functions of forests in different geographical scales (Authority M. D. B., 2018).

According to Food and Agriculture Organization (FAO), 650 million tons of carbon can be stored in forest cover of the world. Forests are a key concern in any strategy taken related to climate change. This ecosystem is a supportive hand for the development goals of rural livelihoods which are not captured in national statistics. Forests have evidence for food security, energy security, health, and safety of those livelihoods (Authority M. D. B., 2018). The values of forests are most important and affect the proximate communities. According to the World Bank, 90% of the poor community depend on forest eco systems and at least 60 million of the forest people are indigenous and have a strong social, cultural, and spiritual base link to forests (Corlett & Primack, 2008). 21% of worldwide households in and around forests averagely cover their income from wild products. (Norway R. F., 2014). So, forests contributed to the development of mankind mean while buffering threats against humans in direct and indirect ways.

The rate of damage the natural resources has increased due to rapid development trends of the world. Threatened activities on forests are fallen under the categories of deforestation and degradation; also, the common root for the disappearance of forests. The global demand for common commodities like agricultural products such as food, animal feeds, timber products, and minerals are some key reasons for deforestation and forest degradation.

According to FAO, 50% of tropical rainforest areas have been deforested and more than 80% of new agricultural lands have been born from forest areas in the past few decades in the world (Authority M. D. B., 2018). Infrastructure developments are both direct and indirect causes of deforestation and forest degradation. Other than the physical reimbursements, there can be influences from political, cultural, legal, and many other subjective causes which are reasons to damage the forest covers. Unclear tenure, weak property, and access rights increase the conflicts over the land, and it causes continuous encroachments towards the forest areas. It has seriously affected the proximate community who are depending on

forest resources (Norway R. F., 2014). The continuous environmental degradation and depletion activities of forests may aggravate poverty, and complications for indigenous people, especially in displacements and downsides in agricultural production (Kramer, Mercer, & Sharma, 1992). Therefore, it is important to identify the value of the forests to conserve while minimizing the disruption against forests.

It is difficult to find a market value because the forest is consisting of more nonuse values though the few use values like timber have a market value. As there's no market value for many environmental commodities, the damage cannot be precisely estimated that can be experienced by the ecosystem (Corlett & Primack, 2008).

Today Economic valuation of environmental resources has converted into an important matter due to the ever-increasing demand for assessed values to do policy-making and management activities in environmental assets like forests. Non-market valuation is a necessary condition for rational policy-making and decision-making on logging, management, and conservation of forest lands due to high natural resource damage with development in environment planning (Adger, Brown, Cervigni, & Moran, 2014). The economic valuation of an environmental asset can be more or less imperfect with the condition of the asset and the valuation context. But the explanations given by the valuation will accommodate the public and the policymakers in their observations. The contingent valuation method (CVM) is a non-market valuation method broadly used to value environmental amenities. (Kramer, Mercer, & Sharma, 1992) Most applications of CVM have been focused on assigning economic values to local, regional, or national-level environmental properties worldwide.

A. Research Objectives

The research objective is to estimate the economic value of the conservation of rainforests by evaluating individual preferences related to the selected case study area over,

1. Identifying measurable variables that reflect economic values connected with the conservation of rainforest environment.
2. Identifying the rates of payments that individuals are willing to pay (WTP) using the CV method.

This research attempt to,
1. Identify the conservation need of the particular environmental asset.
2. Determine the attitudes toward needs concerning rainforest preservation and management.

II. LITERATURE REVIEW

Economic Valuation is used in health, transportation, environment, and many other fields. The basic concept of economic valuation underlying all these techniques is an individual's willingness to pay (WTP) or willingness to accept (WTA). We consider that economic values start with the fundamental concept of a consumer's willingness to pay (WTP) for a specific good or service at a given time, in a given place, or a producer/supplier's willingness to accept (WTA) payment for parting with a good or service, in the case of a supplier.

Environmental asset use in evaluation can be identified as "the naturally occurring living and non-living components of the Earth, together constituting the bio-physical environment, which may provide benefits to humanity" (SEEA, 2013). Environmental assets can be seen from two perspectives as individual resources and ecosystems. The scope of individual resources can be identified as mineral and energy resources, timber, soil, aquatic resources, water resources, and other biological resources. The scope of ecosystems can be identified as forests, lakes, and agricultural lands which have a combination of individual resources as well as ecological processes and characteristics.

These assets have border monetary terms than physical terms. Also, most importantly a healthy environmental asset leads to the economic, environmental, cultural, and social well-being of the community while supporting the physical, chemical, and biological functions. The industries like eco-tourism and fishery, especially the elements for the existence of the indigenous community and the aesthetic appeal are some key concerns that can be recognized from environmental assets for the community (Authority M. D. B., 2018).

The heavy diversity and the volume of the components in a rainforest are the key drivers of this asset. In that sense, most of the rainforests have been nominated as world heritage or as an asset that must be preserved or conserved due to the highest level of significance and the threats to rainforests (Elias & Tobin, 2011). The value of rainforests all over the world has led to many anthropogenic threats. For example, on some occasions, the biogeography of a rainforest can be the key reason for deforestation of the rainforest. The effects of anthropogenic activities can be varying from location to location and occasion to occasion (Corlett & Primack, 2008).

In this situation, the message of conservation has arisen with the threats to the rainforests. Indication of biological changes and political and social factors provide additional motivation to conserve not only the particular rainforest but also other rainforests too because the issue is worldwide. Though there are many conservation methods, it is critical to identify the actual value of the resource first.

It leads to understanding and prediction of the effectiveness of the different methods of conservation. The innovations and importance related to the rainforests must distribute to the decision-makers for a better implementation of

conservation activity. The socio-economic and political complexity of the system, lack of governing and legal measures, inappropriate conservation measures, lack of finance for evaluation, and lack of understanding as well as the interest in the value of the rainforests in the community are key challenges in rain forest conservation activity (Burivalova, *et al.,* 2019).

Society is backward for an activity like conservation; until society identifies that there is a value for the particular asset. Forest conservation and the value of the forest ecosystem are important aspects of environmental planning. Understanding real forest value would help to compare forest conversion for development against conservation. Conservation of forests includes a considerable cost and effort because there are a lot of elements that need to be taken into the account. Since rainforest is more biased as a public good and the government is the key financial partner of this kind of conservation program (Corlett & Primack, 2008).

Therefore, it is important to identify the true value of this rainforest environment to explain the conservation. People have more focus on conservation activities to address the danger which has occurred from the trend of forest degradation due to anthropogenic activities. Countries must join for efficient long-term management programs to find solutions (Kramer, Mercer, & Sharma, 1992).

The environmental values are encouraging the consideration of environmental consequences in development projects. Identification of environmental values is very important in addressing the concerns of developing countries, donors, and non-government organizations. Forest benefits that are not identified as a market value are ignored in the decision-making process. The valuation is a necessary condition for rational policy making too (Adger, Brown, Cervigni, & Moran, 2014). Correct environmental values derive strong environmental policies for future preservation activities (M. Gunathilaka, 2003).

Key principles and methodologies can be derived for the formulation of environmental policies. The environment planning and ecological economy fields are directly connected to urban planning in policy-making and decision-making practices. Valuing environmental amenities is one way of exploring the international or national demand for environmental protection. It is a method to understand the actual value of the forest to justify conservative activities.

Some criticisms can be identified from philosophical attitudes under an eco-centric approach. All living beings have equal rights and there must not be any moral sense in valuing environmental amenities for self-interest only. Economists are rejecting eco-centric philosophies stance in dealing with environmental amenities. Economists are dealing with the anthropocentric approach to enhance human welfare. Some environmentalists are rejecting the anthropocentric stance with the argument of maximization of human needs leads to an increment in environment degradation. This argument has some truth because human needs are more focused on material well-being only. But economics in recent decades are defining human well-being as a combination of material well-being and bequest, existence values, and altruism to overcome critics (M. Gunathilaka, 2003).

A. Classification of Values in Rainforests

The total economic value (TEV) of a forest can be defined as the number of resources expressed in common units of currency that society would be inferior to if the forest was lost (Adger, Brown, Cervigni, & Moran, 2014). Use values can be defined as the benefits which can be gained from the physical use of environmental resources. E.g., Recreational, Tourism, Fishery, and Agriculture. Nonuse values or Passive values are the benefits that individuals gain without using environmental resources directly (Flatley & Bennell, 1996).

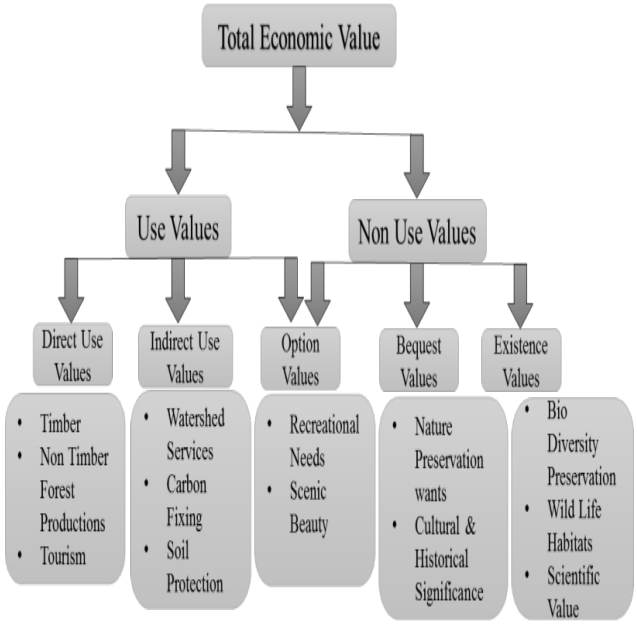


Fig. 1 Classification of the values in a forest environment

Neo-Classical Economic Theory provides normative and descriptive explanations of real-world decision-making. It is a logical interpretation of real-world situations on decision making and the behavior is explained by its deductive, logically defined theory. Utility Theory, Theory of Value, Theory of Random Utility, and Theory of Welfare Economics can be identified under the Neo-Classical Economic paradigm. (D. Pearce, 2002).

The theoretical framework of valuing environmental amenities has a relationship with the context of the Neoclassical Economic paradigm.

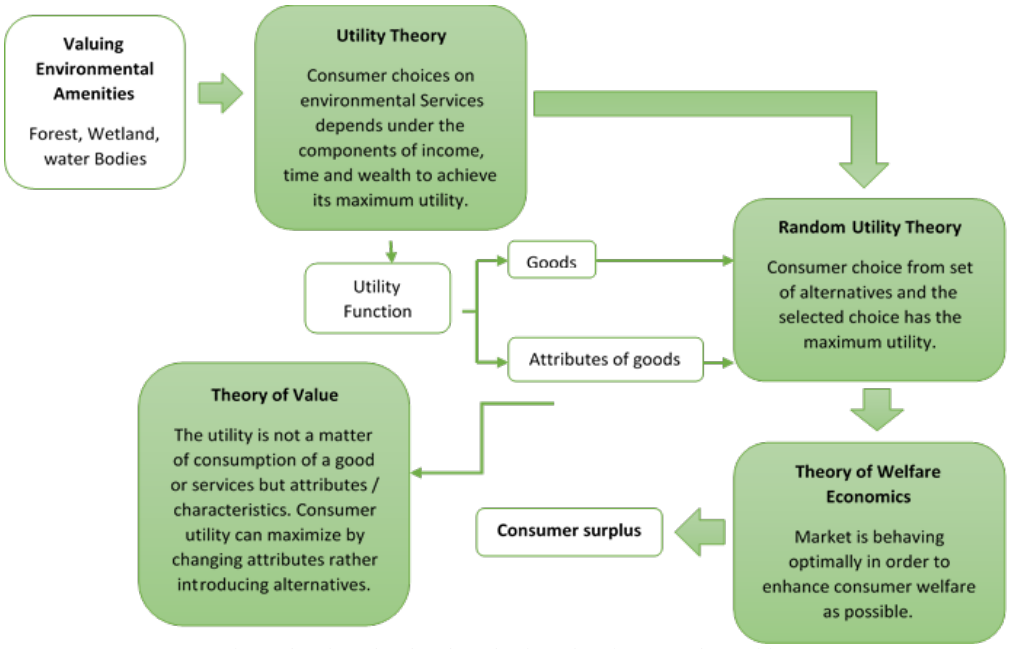


Fig. 2 Theories related to the valuation of environmental amenities

B. Different Approaches for Valuing Forest Environment

Non-market valuation techniques have to be used to value natural resources and environmental amenities due to the absence of adequate market prices (M. Gunathilaka, 2003). There are two methods for the non-market valuation as Revealed Preference Method (RPM) and the Stated Preference Method (SPM). The basic alteration between the two ways is, RPM is considering the actual choice of the individuals in the real world while SPM is considering the individuals' response in the hypothetical situation. The SP method has two standard methods as Willingness To Pay (WTP) and Willingness To Accept (WTA). The amounts of WTP and WTA are based on the individual's behavior on the changes that happen or do in the quality of the amenity. There are mostly used RP and SP methods in valuing forest environments as below

TABLE I MOSTLY USES METHODS IN VALUING THE FOREST ENVIRONMENT

Stated Preference Method (Direct)		**Revealed Preference Method (Indirect)**	
Contingent Valuation Method (CVM)	Identification of the WTP for the particular non-market amenity to preserve or improve by the individuals under a hypothetical scenario.	Travel Cost Method (TCM)	Identification of the payment that the travelers are willing to pay to travel the particular environment good.
Choice Experiment (CE)	Choose between different alternatives related to a commodity by the individuals.	Hedonic Price Model(HPM)	Identification of the relationship between the market price and the various environmental attributes of conventional commodities.

It is impossible to use direct market information to value amenities related to environmental goods as they both consist of use and non-use values (M.Gunathilaka, 2003). According to Pearce (2002), only the SP method can cache TEV which has non-use values as well as use values. As above mentioned CVM and CE are covering vast areas of valuing environmental amenities. From these two methods, CVM is the only method to capture both use and non-use values. It has the capacity of addressing a wide range of valuation tasks and provides important information on the benefits and cost distribution related to the amenity when compared to the CE method (Flatley & Bennell, 1996). Comparatively to the CE method, the CVM has many advantages, and these advanced benefits and its suitability to the study objectives encourage this study to undertake the CVM.

C. Contingent Valuation Method

'Contingent Valuation has prompted the most serious investigation of individual preferences ever undertaken in economics '(Smith, 2000).

According to Jacobson and Dragnn (1996), the concept of CVM originated in the year 1947. The measurement of the benefits of environmental goods has immersed in the early 1970s. CVM aims to amount the compensating or equivalent variation for the amenity in question (Parajuli, 2016). Individuals will question a hypothetical market. There are two types of questions WTP and WTA and based on the property right. In the case of WTA, the respondent had the right to sell the property but in WTP the respondent had to buy it to enjoy it. According to the literature WTA is

preferred to use to value environmental losses due to the issues in property rights. But due to the absence of correct outputs from WTA, the WTP is used in cases. If the aspects and analysis in the survey are unclear, the best option is the underestimation of WTP. The use of the WTP format instead of compensation is needed in CVM as WTP is the conservative choice (M. Gunathilaka, 2003). Critics of the CV method are sampling, non-response and interviewer bias, decision-making and judgment bias, non-commitment bias, and hypotheticality, meaning and context problems can be checked and controlled by using top-down and bottom-up formats (Direct methods for valuation of environmental goods, 2004).

III. METHODOLOGY

A. Selection of the Case Study

Eastern Sinharaja is categorized under moist montane tropical forest and is located in the Rakwana mountain range of the Sabaragamuwa Mountains. A large part of the Eastern section falls to Rathnapura district and a smaller part to Matara district with an area of 30km^2 (surveys D. o., 2001). Eastern Sinharaja is home to many threatened endemic herpetofauna species. The reserve is well known as a site of point endemism (Surasinghe & Jayaratne, 2006). The most presumed and core part of Eastern Sinharaja is the Morningside Forest Reserve with an area of 10km^{2}approximately (Bahir & Surasinghe, 2005). It is one of the main entrances to the conservation center located in the reserve.

Threats to the reserve have been noted at a different level from anthropogenic activities such as deforestation, habitat destruction, land degradation, extraction of forest resources, and physical developments (Surasinghe & Jayaratne, 2006). The most recent recorded activity is a road development which was designed to build from Pothupitiya, Illukanda to Rakwana / Deniyaya adjacent to A17 road, near Sooriyakanda. It was a major project to connect Kalawana to Kolonna in the year 2011. This proposed road was planned to go through the lands of Morningside Sinharaja, however, due to the protest of local people, the project was interrupted. Continuous decrement of primary forest coverage spread in a small area leads to threats to the livelihood of the dependent community. In that sense, conservation actions must be introduced in the area (Surasinghe & Jayaratne, 2006). Near future, the area will disappear if not managed or conserve properly. So, prompt actions must be to pause the continuous degradation of this unique land.

The economic aspects of the overall services of the selected area are evaluated as a base for any management or conservation activity. It is important for environmental management and policy recommendations in the sustainable development of the area. Both use and non-use values should be measured in the selected area as there is a limitation in the evaluation of the uses in the policy frame and identification of the conservation need is important for the welfare of the locality.

CVM study requires a survey to collect required information using a sample selected from the study areas. The objective of the survey is to identify stakeholder preference for forest conservation of Eastern Sinharaja - Morningside reserve in terms of the total economic value (TEV) of the forest. Required data will be collected via a questionnaire survey. There are many sources to identify the relevant information to build the model from the secondary sources, however, the key part of the data sources are preliminary dependent on the information collected by the stakeholder survey.

Data collected will be analyzed using underlined economic theories, which depend on the literature review and understanding of the economic theory. Further participation can be gained from discussion meetings of focus groups or affected parties. It is also very important that the understanding of survey participants in the context of goods is in question mainly because of the hypothetical nature of the good that is being introduced. The information collected from the focus groups is important in designing the survey.

B. Survey Design

Making awareness among respondents about the contingent market by providing information as far as accurate will help to produce correct WTP measures (Tilahun, Mathijs, Muys, & Vranken, 2002). There is not any uniform format for designing a CV survey, however, after the introduction, it is better to complete the WTP part of the survey before the other sections. The questionnaire is, however, designed in four major parts. The questionnaire must be developed with minimum potential bias such as information bias, interviewer bias, hypothetical bias, and so on (Rupérez-Moreno, Pérez-Sánchez, Senent-Aparicio, & Flores-Asenjo, 2015).

Part 1: The introduction and the description of the hypothetical market designed to estimate WTP. Respondents were asked whether they are “paying” or “not” to conserve the forest by using a binary dichotomous choice format. If say yes, the respondent was asked for the maximum WTP in an open-ended format.

Part 2: The awareness of general environment attitudes in respondents. Questions are to identify respondents’ knowledge of the commodity and green commitment in question.

Part 3: Basically, the idea of the conservation need for any resource and the valuation questions are presented before the investigation of the socio-economic criteria.

Part 4: Demographic information about respondents appears at the end of the questions along with the thank you note for participating in the survey.

C. Data Collection and Sampling

Using a total population of 2256 of the sample area, and following equation, that was practiced in similar studies to estimate the sample size.

$$n = 2[Z_{(1-\alpha)} + Z_{(1-\beta)}]^2 \left(\frac{V}{\Delta}\right)^2$$

When n considers the sample size, Z is the usual standard normal variate, V is representing the coefficient of variation, and it is the percentage distribution between the true willingness to pay (TWTP). Around 242 representative sample size was selected with a 90% confidence level. Due to the time, limitation234 respondents only were interviewed.

TABLE II SAMPLE DATA

GN division	Village	Population
Poddana	Lordeilwatta	455
Buluthota	Sooriyakanda	120
	Kadamuduna	270
Iththakanda	Lankaberiyawatta	523
	Iththakanda	949
Ulinduwawa	Kasthanagahawatta	359
	Panilkandawatta	352
Total		2256

This study also used the Simple random sampling method, as a lower variation of the population was surveyed. The sample encompassed all the villagers of the rainforest within the case study area who are 18-65 aged. Each house will be selected with the simple random sampling technique from the list of households in each area.

The questionnaire survey was conducted using personal interviews, as it produces higher response rates at rainforest conservation enclosed within the area from Poddana, Buluthota, Iththakanda, Morningside and Ulinduwawa GN divisions are adjacent to the Sinharaja forest. (Fig. 3) Here basically main focus goes to the villages like lordailwatta, Sooriyakanda, Kadamuduna, Lankaberiyawatta, Iththakada, Kasthanagahawatta, Panilkandawatta and Iththakanda which have the closest proximity to the Sinharaja rainforest from above GN divisions within 2 km minimum distance according to the DS Office Kollonne. The survey has covered the community/villagers who habit these rainforests for diverse activities.

The acquired data has been coded as 0, 1 and the other demographic data and questionnaire data have been coded according to the above similar method as the data will be analyzed using a binary logit regression model. The other environmental attitudes and uses will be coded as categorical variables and they will analyze using the linear regression model.

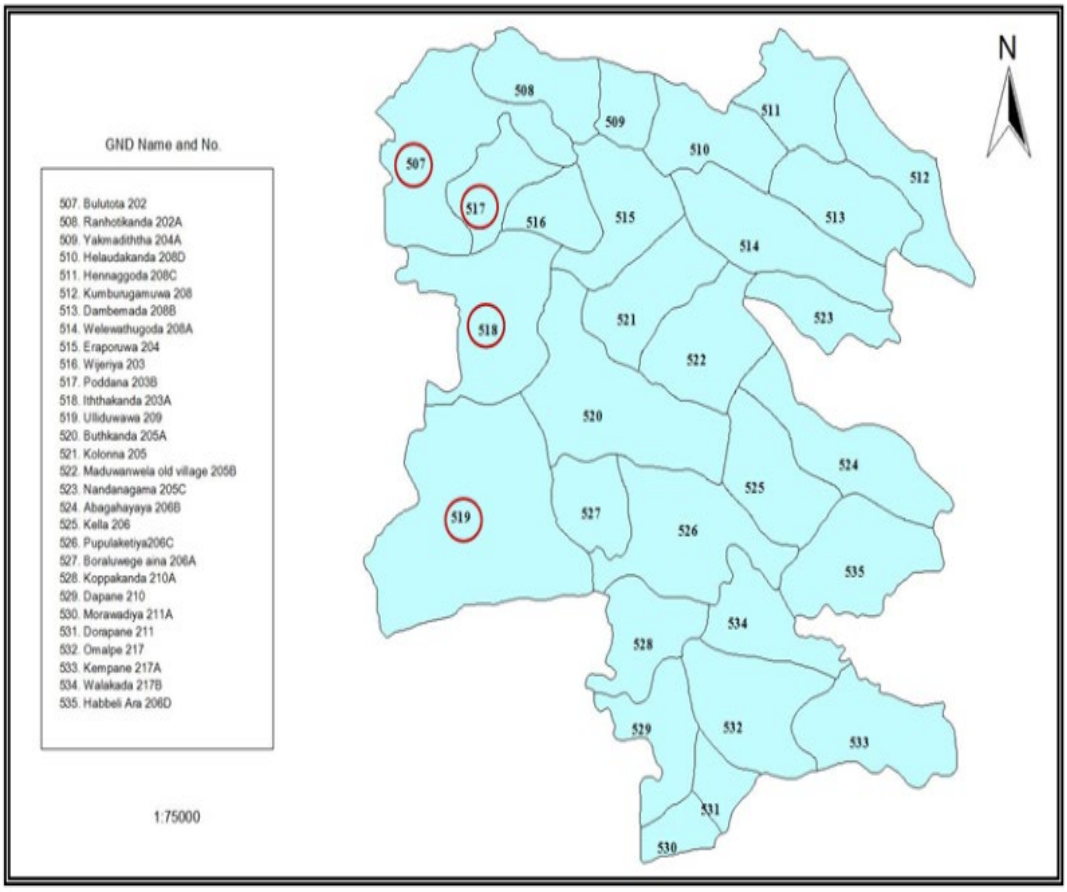


Fig. 3 Selected GNDs for the survey

D. Data Analysis

The CV approach attempts to identify the value that people originate from consuming an environmental benefit by inquiring a sample of individuals to obtain their maximum WTP to take the benefit or minimum compensation to go without it i.e., willingness to accept (WTA) a loss of benefit. WTP is considered as the amount that must be taken from the person's income while keeping utility constant.

U[x, q] - (Equation 1.1)

X indicates a vector of market goods and q indicates a vector of non-market goods, for example, public goods or services. Note that the individual maximizes utility by choosing a level of x but the level of provision of q is not under consumer control (Flatley & Bennell, Economic analysis and policy, 1996).

From the usual demand function, the indirect utility function that gives us the maximum utility possible at given prices and income can be derived as follows:

V (p, q, y) U [hi (p, q, y) q] - (Equation 1.2)

When the quality of good q varies from q0 to q1 (as a result of self-financing or part financing of good q to improve societal welfare), the individual's utility also changes to:

U1= V (p, q1, y)> U0 V (p, q0, y) - (Equation 1.3)

Where U1 > U0 and q0 stands for the status quo level while q1 is for a hypothetical improved scenario. From Equation 1.3, two well-known measures of utility changes can be deduced that is, the Hicksian Compensating Variation (CV) and Equivalent Variation (EV) measures of welfare changes (Hicks, 1939):

V (y-WTP, p, q1: **Z**) = V(y, p, q0: **Z**) – (Equation 1.4)

V indicates the direct utility function, y indicates the income, p indicates a vector of prices faced by the individual and q1 and q0 indicate alternative levels of the good or quality indexes and Z specifies a vector of individual characteristics. In equation (EV) (Equation 1.4), a significance is that WTP should, depend on the initial and final level of the good in question (q0 and q1); respondent income; all prices met by the respondent, including those of substitute goods or activities; and other respondent characteristics. Internal validity of the WTP responses can be checked by regressing WTP on these variables, and it can be revealed that WTP correlates in predictable ways with socio-economic variables (Hicks, 1939).

Basically, in data analysis, finding out the median or mean WTP and estimating the relationship of WTP to other selected variables is the purpose of equation 1.4. Analysis can be done by using multiple regression equations, but dichotomous choice data must be analyzed by using advanced methods like binary regression or multinomial logit model.

IV. ANALYSIS AND FINDINGS

A. Characteristics of the Sample

TABLE III SOCIO-ECONOMIC CHARACTERISTICS OF THE SAMPLE

Category	Subcategory	Count	Percentage
Gender	Male	165	71.5
	Female	69	29.5
Age Group	18-24	56	23.9
	25-34	52	22.2
	35-44	36	15.4
	45-54	41	17.5
	55+	49	20.9
Marital Status	Unmarried	30	12.8
	Married	204	87.2
Education	No Schooling	40	17.1
	Primary	78	33.3
	Secondary	100	42.7
	University	16	6.8
Employment	Unemployed	47	20.1
	Employed	187	79.9
Monthly Income (Rs.)	Dependent	14	6.0
	Below 10000	100	42.7
	10000-25000	70	29.9
	25000-50000	15	6.4
	50000-75000	16	6.8
	Above 75000	19	8.1

B. CVM Results

Several tests such as; adjusted R, F statistics, and T statistics are assessed to find out the significance of the model and, adjusted R^2 is a measure of 'goodness of fit, and represents the proportion of total variation in Y explained by the model. Adjusted R^2 must come under the range of 0-1. ($0<R^2<1$)

$$Y_i = \beta_0 + \beta_1 + \beta_2 + \cdots \beta_n + \varepsilon \text{ (Equation.1.5)}$$

The above linear regression model has been used to estimate the above-mentioned statistics to find out the significance of the model used. Y represents the dependent variable (WTP) and β_0 is the constant term.β_1, β_2… represents the coefficients to be estimated and X_1, X_2 … represents the independent variables like income, gender, education, distance to forest, etc.

TABLE IV MODEL SUMMARY

R	R Square	Adjusted R^2	Std. Error of the Estimate
.993a	.987	.967	53.258

When considering the R^2 value, represents the simple correlation and is 0.987 which indicates a high degree of correlation. The R^2 value indicates how much of the total variation in the dependent variable, WTP, can be explained by independent variables like income, gender, distance, and other general environmental attitudes. The adjusted R^2 value is 96.7% under the range of 0 -1, and the model has a strong relationship with dependent and independent variables and high goodness of fit to the model. (Table IV)

TABLE V ANOVA RESULTS

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	4808766.85	13	145720.184	100.857	.000[b]
Residual	65237.424	221	2836.410		
Total	4874003.509	234			
a. Dependent Variable: WTP					

Table V indicates how well the regression equation fits the data (i.e., predicts the dependent variable) from the results of the F test. The F value is 100.857 and the entire model is significant at 1% as the significance of the model is 0.000. Here, $p < 0.0001$, which is less than $\alpha = 0.01$, and indicates that, overall, the regression model statistically significantly predicts the outcome variable, or it is a good fit for the data. The null hypothesis (H_0) is that there is no effect of WTP. The alternative hypothesis (H_1) is that this is not the case.

H_0: $\beta_1 = 0$
H_A: $\beta_1 \neq 0$

The H_0 can be rejected in favor of H_A (Sig. < 0.01). The overall model is significant ($F(13,221) = 100.857$, $p = 0.000$) as shown in Table V.

The t-test indicates how the dependent variable; WTP changes with the independent variables. If the t value is high it indicates that the model is significant. The significance test evaluates the null hypothesis that the regression coefficient is zero.

H_0: $\beta_1 = 0$
H_A: $\beta_1 \neq 0$

When taking the t statistic for the income variable (β_1) is associated with a p-value of 0.003 ("Sig.") and it is significant at the level of 1% which is less than $\alpha = 0.01$. This indicates that the null hypothesis can be rejected. Thus, the coefficient is significantly different from zero and also holds for the constant (β_0) with a Significance of 0.000. The variable (β_2) is associated with a p-value of 0.005 and it is significant at the level of 5% $p < 0.0005$, which is less than $\alpha = 0.05$. This also indicates that the null hypothesis can be rejected.

C. Significance of the Variables

Estimating values of the binary regression model creates a specific character in identifying the significance of the socio-economic variables and a few other variables related to the attitudes of the people as shown in Table VI.

TABLE VI SOCIO-ECONOMIC VARIABLES IN THE EQUATION

Variable	B	S.E	Wald	df	Sig.	Exp(B)
Gender	1.673	2.358	21.839	1	0.002	1.107
Primary	1.849	1.361	15.859	1	.001	1.068
Edusec	.462	168.165	47.111	1	.015	.232
Eduuni	.964	1.357	7.010	1	.007	2.871
Children	-.229	-253.432	.000	1	.998	1.257
Employment	2.230	5.459	25.938	1	.001	4.259
Voter	.260	246.877	43.546	1	.000	.190
Group	.187	558.269	.000	1	.860	.305
Visits	-214	472.143	.000	1	.010	1.239
Income	.120	123.042	37.234	1	.000	.200
Ync	.219	22.943	.822	1	.002	1.234
Yn	.117	11.658	30.000	1	.000	.124
Constant	-33.584	2228.313	.000	1	.999	.000

The statistics for the Step, Model, and Block are the same and the probability of obtaining this chi-square statistic (65.588) is if there is no effect of the independent variables, taken together, on the dependent variable. In this case, the model is statistically significant because the p-value is less than 0.000. As shown in Table VI, values for only CHILDREN (Children Have/Not) and GROUP (Member of an environmental Group) are not significant even at α = 0.10 level. Values for EDUUNI (University Education) and VISITS (Number of visits done to the forest) are significant at α = 0.10 level. EDUSEC (Secondary Education) is significant at $\alpha > 0.10$ level while rests are perfectly significant at $\alpha < 0.01$ level.

There are the values for the logistic regression equation for predicting the dependent variable from the independent variable. They consider log-odds units. Similar to OLS regression, the prediction equation is,

$$\text{Log } (p/1\text{-}p) = b_0 + b_1*x_1 + b_2*x_2 + b_3*x_3 + b_3*x_3 + b_4*x_4 \ldots..$$

These estimates tell you about the relationship between the dependent variable and the independent variables, where the dependent variable is on the logit scale. Considering the estimated coefficients of the model for GENDER as an example, relative to the reference level, is +1. On other hand for every one unit increase in GENDER, 1.673 increases in the log – odds of WTP can be expected.

The values for GENDER, PRIMARY (Primary Education), EMPLOYMENT, VOTER (Is the responder a registered voter in the area), YNC (Yes or No to conserve the rainforest), INCOME and YN (Yes or No to pay) are significant at α = 0.01 level. In that sense, those variables are comparatively higher in p-value when consider with other variables. Those can be identified as the main factors that influenced the economic values connected with the conservation of the forest environment.

When considering the general environmental attitudes of the respondents, the multiple linear regression model has been used to identify the significance of the general environmental attitudes about protecting natural resources including rainforests (see Table VII). In this case, the model is statistically significant. As shown in Table VII, values for only M-I (Moral issue) and E-R (Able to exploit resources) are not significant even at α = 0.10 level. V-E (Visit and enjoy natural resources) are significant at α = 0.10 level. W-B (To make the world better for our children and future generation) is significant at $\alpha > 0.10$ level.

C-W (Conserve wildlife and plants) is less favorable with +1.304 and U-F (Able to use natural resources in future) has recorded – 20.793 and indicates that those minus logs odd values are influenced by the decrement of the dependent variable – WTP, but highly significant at α = 0.01 level. These most significant environmental attitudes can be identified as the factors which are influencing the total economic value of the rainforest.

TABLE VII COEFFICIENT IN GENERAL ENVIRONMENT ATTITUDES

Model	B	Beta	t	Sig.
W-B	7.379	.025	.334	.009
V-E	-25.209	-.147	-1.930	.065
N-S	17.961	.113	1.494	.137
U-F	1.304	.009	.119	.005
C-W	-20.793	-.133	-1.747	.002
M-I	.409	.003	.045	.965
E-R	-6.098	-.040	-.532	.595

Under the conservation program of the Sinharaja rain forest (Table VIII), YNC (Yes or No to conserve rainforest) have less favorable (+0.219) but highly significant at α = 0.01 level. It indicates that there is a willingness of respondents to conserve the rainforest. In this section, the respondents have given to rank the importance of conservation of the Sinharaja rainforest and 6i (Purify air and environment), 6j (Cools the atmosphere), and 6l (Maintains biodiversity) variables have recorded the highest significance at α = 0.01 level.6i (Purify the air and environment) variable has recorded a +114.863 value as the estimated parameter for the relationship with the dependent variable WTP. 6j (Cools the atmosphere) – every 132.878 units increase in 6j, it affects positively the WTP value can be expected. 6l (Maintains biodiversity) has recorded +44.235 values with the WTP variable. The rest of the other variables are not significant even at α = 0.10 level instead of the 6e (Present wildlife habitat) component with a 0.021 significance level.

In the willingness to pay section the respondents have asked to respond to pay Rs.500 from a household for the rainforest conservation program. In this case, the model is statistically significant because the p-value is less than 0.000. The despondence values have been analyzed as YN in table VI. Few choices have been given according to the yes or no responses to pay Rs.500 for the program.

TABLE VIII COEFFICIENT RESULTS OF THE IMPORTANCE OF CONSERVATION

Model	B	Beta	t	Sig.
6a	48.421	.132	1.539	.126
6b	34.914	.113	1.327	.187
6c	-16.784	-.051	-.548	.584
6d	38.669	.125	1.150	.252
6e	71.993	.215	2.335	.021
6f	-20.289	-.061	-.657	.512
6g	-12.029	-.036	-.428	.670
6h	-13.740	-.038	-.393	.695
6i	114.863	.381	3.379	.001
6j	132.878	.443	3.875	.000
6k	5.359	.015	.147	.884
6l	44.253	.137	1.287	.000

As exposed in Table IX, 9c (I don't think this program would be effective) are significant at α = 0.05 level and the rest of the choices are not significant even at a level of 0.10. 9f is less favorable with +0.420 and indicates that those plus log odd values are influenced by the increment of the dependent variable – WTP, but highly significant at α = 0.01 level. These most significant choices under the category of "like to contribute to the program by giving Rs.500" can be recognized as the features which are affecting the total economic value of the rainforest.10c (I want to contribute to a good cause) has also recorded +0.914 in the estimated parameter and it has a significance value of 0.010. The highly significant 9b, 9f, 10a, and 10c variables can be identified as affected parties for the final total value of the rainforest.

TABLE XI VARIABLES IN CHOICES FOR WTP OR NOT RS.500 FROM HOUSEHOLD

	B	S.E	Wald	df	Sig.	Exp (B)
9a	.573	2.438	20.839	1	.234	.107
9b	1.569	1.301	13.889	1	.001	1.403
9c	.362	128.145	47.231	1	.005	.232
9d	.420	1.787	7.810	1	.233	2.871
9e	-.342	276.400	.000	1	.998	1.297
9f	.754	4.679	2.349	1	.001	3.219
10a	1.260	256.867	43.536	1	.000	.290
10b	-.187	558.269	.000	1	.860	.305
10c	.914	472.143	.000	1	.010	1.239

D. Validation of CV Results

Evaluating public sensitivities regarding conservation of rainforest environment directed towards proof of Contingent Valuation outcomes. The public perceptions will be taken into account under the topics of the use of the rainforest, general environmental attitudes, and the conservation program of the Eastern Sinharaja; especially considering their attitudes, ideas, and knowledge about the general world and environment protection.

When considering the 'what do the respondents mean by a rainforest '(Fig. 4), the category called 'has lots of trees present 'recorded nearly 30% of the share of respondents as the highest. Next 'has many species of animals present' category has 22% of the share of respondents. Generally, respondents have given a share to the categories of 'maintains biodiversity, has a good stock of timber and non-timber products, and rains very often 'respectively by consuming more than 10% of the portion of respondents.' Suitable for development work and plantation activities' categories have the least share of respondents. It indicates that the respondents have a considerable idea about the characteristics and real meaning of a rainforest.

"Uses that apply to the respondents during the past ten years (2010-2018) and for the future" is shown in Fig. 5. Use "Drinking water" has the highest percentage of respondents' share (18% and 22% respectively) for past and future respectively while "Firewood from trees" and "Medical plant use/collection" has same shares (15% and 13% respectively) in Past and Future respectively. Some uses like "Timber, Disposal of waste, and Land for plantation" have decreased the respondents' share in the future when compared to the past. i.e., "Disposal of waste "recorded 3% in the past use. But when comes to the future it has decreased to 2%. These inspections of public attitude on the way to diverse usages in two different time frames were sustained for the validation of CV results argued in the previous section. Also, it indicates the attachment and knowledge of the rainforest environment.

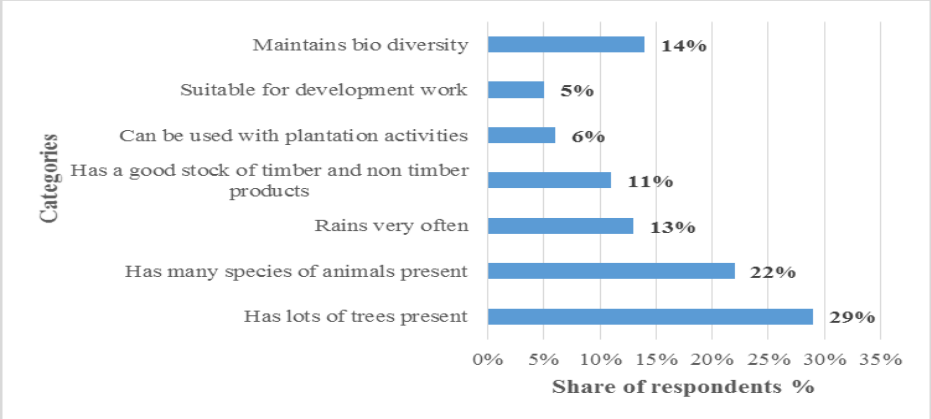
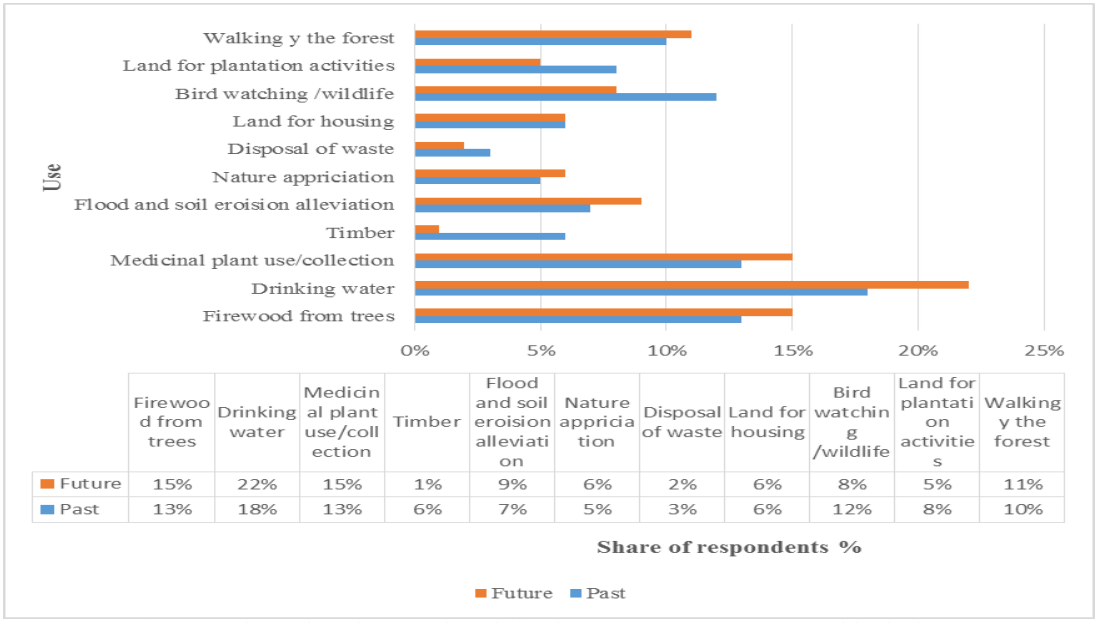


Fig. 4 Meaning of the rainforest

Fig. 6 will take to mean the "Opinions on protecting natural resources including rainforests". This might be important in identifying the level of general environment attitudes and in the validation of CV results. Conserve wildlife and plants feature has recorded the highest response (60%) in the extremely important category. This can be validated with the above multiple liner regression analysis that C-W (Conserve wildlife and plants) is favorable with +1.304 and highly significant at α = 0.01 level. Features; to make the world better and Use in the future which supports to justify the attitudes of the respondents to protect natural resources. W-B component is significant at α > 0.10 level.

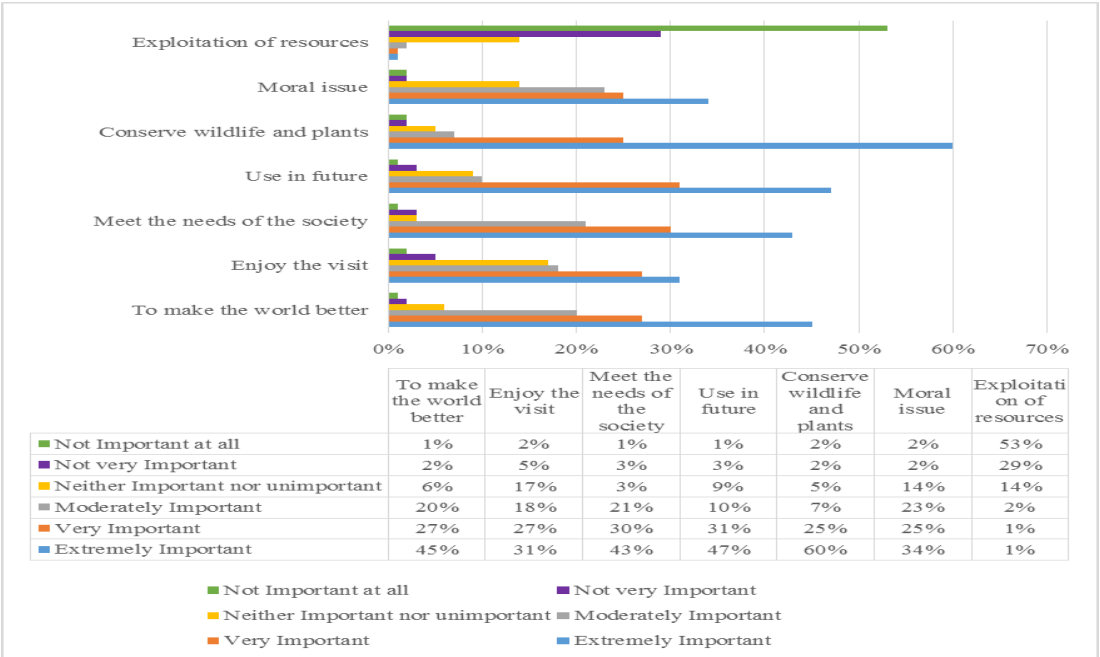
The feature; has noted the highest percentage of respondents' share (>50%) for extremely important in all categories and E-R (Able to exploit resources) is not significant even at α = 0.10 level which supports justify the positive attitudes to protect natural resources. Use in the future has been noted as the feature that takes the highest percentage of respondents' share (>30%) for the Important category and it validates the U-F by recording highly significant at α = 0.01 level. The feature, Enjoying the visit, as it displays a satisfactory public attitude (>30% for the Very important category), giving more devotion to improving the protection of natural resources is worthy for the benefit of future management and decision-making processes by validating the feature V-E with 0.065 significance.



	Firewood from trees	Drinking water	Medicinal plant use/collection	Timber	Flood and soil eroision alleviation	Nature appriciation	Disposal of waste	Land for housing	Bird watching /wildlife	Land for plantation activities	Walking y the forest
Future	15%	22%	15%	1%	9%	6%	2%	6%	8%	5%	11%
Past	13%	18%	13%	6%	7%	5%	3%	6%	12%	8%	10%

Fig. 5 Uses that apply to the respondents during the past ten years (2010-2018) and for the future

Under the conservation of the Sinharaja rainforest, the perceptions on the conservation have been addressed. Under that, the importance of the conservation Sinharaja rainforest has been asked from the respondents, and the parameter; YNC which scored an estimated coefficient (+0.219) at α < 0.01 significant level can be considered. The level response for the importance of the conservation of rainforests can be valued as 64% for "Yes to conserve" and 36% for "No to conserve".



	To make the world better	Enjoy the visit	Meet the needs of the society	Use in future	Conserve wildlife and plants	Moral issue	Exploitation of resources
Not Important at all	1%	2%	1%	1%	2%	2%	53%
Not very Important	2%	5%	3%	3%	2%	2%	29%
Neither Important nor unimportant	6%	17%	3%	9%	5%	14%	14%
Moderately Important	20%	18%	21%	10%	7%	23%	2%
Very Important	27%	27%	30%	31%	25%	25%	1%
Extremely Important	45%	31%	43%	47%	60%	34%	1%

Fig. 6 Opinions on protecting natural resources including rainforests

The willingness to conserve can be influenced by several features. Fig.7 will interpret the importance of the conservation Sinharaja rainforest by the public and will be vital in the future management of rainforests and validation of CV results. This estimated coefficient is confirmed as Fig. 4 shows that maintaining biodiversity is the highest response feature. Further, as 6i includes the estimated coefficient (+114.863) is validated because purifying air and environment has been identified with 43% of respondents share. Parameter; 6j which recorded the secondly highest respondents share (42%), estimated coefficient (+132.878) at $\alpha < 0.01$ significant level, and this estimated coefficient is validated because cools the atmosphere is the secondly recorded despondence rate as to the Fig. 7.

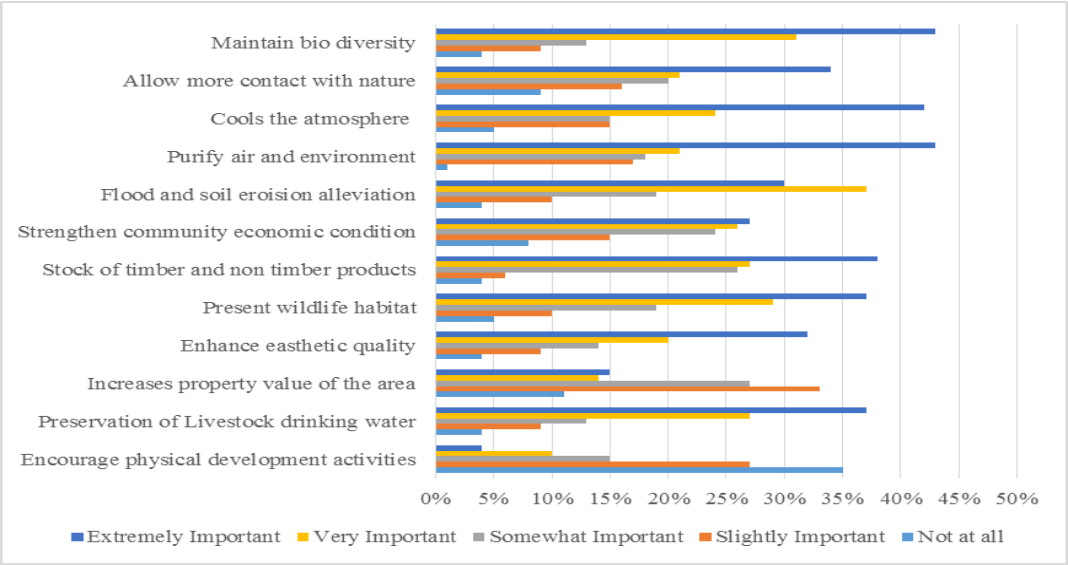


Fig. 7 Importance of conservation Sinharaja rainforest

Public attitude to "like to contribute to the program by giving Rs.500" is shown in Fig. 8. Attribute; 10a (This program is important to me) and 10 c (I want to contribute to a good cause) have the highest respondents' share (54%% & 44% respectively) while 10b (I think it is our responsibility to protect Sinharaja rainforest) has the lowest (2%). These pieces of evidence are critical in validating the results of the CV. I.e. As "This program is important to me" and "I want to contribute to a good cause" have the highest percentage of respondents' share, their records taken in CV (10a and 10c) have estimated the highest coefficients; +1.260, +0.914, respectively.

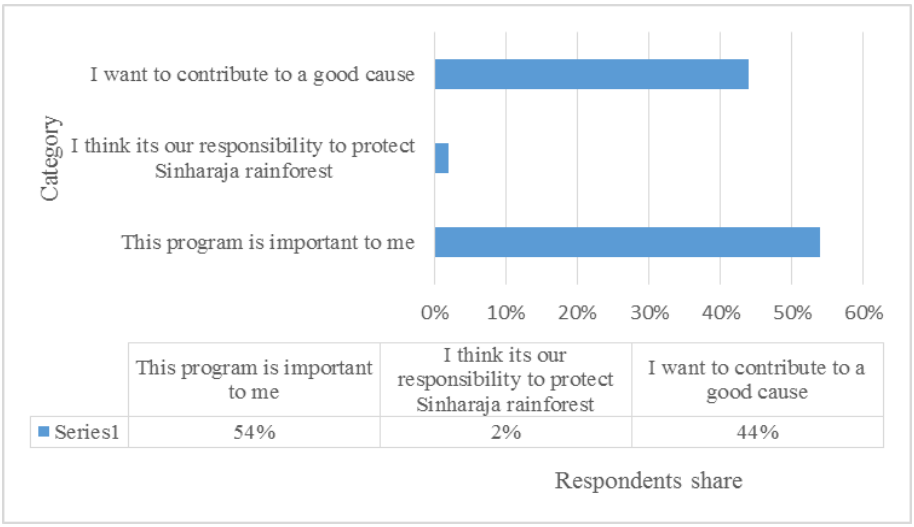


Fig. 8 Responses from the "like to contribute to the program by giving Rs.500" category

The equation V (y-WTP, p, q1: **Z**) = V(y, p, q0: **Z**) has been used to calculate the WTP value that respondents will pay for the conservation program of the Sinharaja rainforest. Finding out the median WTP value will fulfill objective 2: Identifying the rates of payments that individuals are willing to pay (WTP) using the CV method.

The number of respondents = 234

Sum of the total maximum WTP to pay per month = Rs.60210

$$\text{Median WTP value} = \frac{\text{Sum of the total maximum WTP to pay per month}}{\text{The number of respondents}}$$

$$= \frac{\text{Rs.60210}}{234}$$

$$= \text{Rs. } 257.30$$

The median WTP value that respondents will pay for the conservation program of the Sinharaja rainforest will be Rs. 257.30 from a household.

V. DISCUSSION AND CONCLUSION

The foremost purpose of this research is to estimate the economic value of the conservation of the Sinharaja rainforest over, identifying the economic value on conservation of rain forest through evaluating individual preferences over selected case study areas that individuals are willing to make. This measurable variable reflects economic values connected with the conservation of the rainforest environment. A contingent valuation method (CVM) was used to accomplish the above objectives and the composed data were analyzed using the Binary and linear regression models.

The conclusion and a few recommendations derived from the results can be brief as follows. The main purpose of the study was to recognize the measurable variables. According to the results, under the first category - Socioeconomic variables," INCOME and VOTER" are recognized as the most important features of the study. The feature EMPLOYMENT and PRIMARY noted the most important coefficients, which means the employment variable has more ability to enhance the value of the conservation program. The general environment attitudes category indicates the respondents' overall knowledge about the surrounding. " C-W" (Conserve wildlife and plants) was recorded as the most important feature with the highest significance value. U-F (Able to use natural resources in the future) has the second identified most important feature under general environment attitudes. As highlighted in the results of the attitude questions people mentioned that they have basic knowledge of the importance of this kind of natural resources.

Under the outlooks on conservation program, respondents have been asked to respond on their willingness to conserve the rainforest (YNC). YNC (Yes or no to conserve) feature is one of the most important features of the study. The 6j (cooling the atmosphere) and 6l (maintaining biodiversity) have been recorded as the other most important features than the other features which provide a basic idea of the importance of the conservation of the Sinharaja rainforest. When considering the willingness to pay for the conservation program of the Sinharaja rainforest, the will to pay Rs. 500 from each household to the program has been recorded as the most important feature under this category (YN – Yes or no to pay). In terms of conservation, the study showed that 10a (This program is important to me) features that support conservation has the highest capability to enhance value by being willing to pay Rs. 500 for the conservation program.

The study has created information about the WTP value of the conservation of the Sinharaja rainforest by locals. If particularly responsible parties contribute to public ideas valued and interpreted results, those parties can be clear on making effective resource management decisions. Finally, locals have decided the payments that individuals are willing to pay (WTP) for the conservation as Rs.257.30 from a household. Further, this study will help to identify the conservation need of the particular environmental asset and help to determine the attitudes toward issues concerning rainforest preservation and management.

The study proved that the CV method is preferable in indicating public identities related to the conservation of the rainforest environment because it delivers a deep knowledge about different levels of management features that will sustain the scope of effective environmental management choices related to the rainforest environment.

VI. LIMITATIONS OF THE STUDY

As the selected case study has its sorts, the results of the study cannot be generalized. Accordingly, when applying the CV method to a different rainforest/place must originate factors by understanding their attitudes or practices. Although contingent valuation may be useful in decision-making in developing countries, researchers should be conscious to use them. The case study area is only limited to Eastern Sinharaja and can be further studied in other parts of the rainforest or any other rainforest environment. The study was only focused on the local people of the area and the visitors' attitudes also can be analyzed in further studies.

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