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Review Article

Willingness to Pay for Forest Protection in Vietnam, Case Study in Thai Nguyen City

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Abstract - *This study uses the contingent valuation method to evaluate the cost of natural forest protection and identify public perception regarding sustainable forest management in Vietnam. The study aims to determine the level of willingness to pay (WTP) for the protected forests and the factors that influence the willingness to protect forests in a case study in Thai Nguyen province, northern Vietnam. The results show that the residents are well aware of the importance of forests to their communities and perceive that the protection of natural forests is an efficient way to improve the quality of the environment. They are willing to pay VND 39,000 (US$ 1.7) per household as a one-time payment, which would raise a total fund of about VND 3.5 billion (US$ 154,000) for natural forests protection at a district scale. The WTP is influenced by the level of payment, the public awareness of benefits provided by forests to communities, previous visits to the forest, and household income. The study proved that WTP can be used as a proxy to identify economic incentives for local farmers to restore forest land and understand the underlying factors that influence the willingness to protect forest.*

Keywords - *Contingent valuation method, Forest protection, Sustainable forest management, WTP.*

I. INTRODUCTION

Forests, like many other natural resources, provide a variety of ecosystem services (ES) such as watershed, habitats for plants and animals, carbon sequestration, landscape beauty, which are considered public goods. There is no cost to the public for these valuable ES. ES users are free to enjoy their benefits and ES providers have no incentive to protect and maintain the continuous provision of ES. The market fails to value natural resources properly, and thus affects the sustainability of natural resources, particularly scarce resources.

Although the rate of deforestation slightly decreased in the 2000s compared to the 1990s, it is still alarming in many countries, especially in tropical regions where the loss of forest is the highest [1],[2]. Urbanization, agricultural activities, logging, mining, and fires are judged the direct causes of deforestation [3]. Subsistence and commercial agriculture are estimated to be the proximate drivers for approximately 80% of deforestation worldwide [4]. Effects of tropical deforestation on climate change, biodiversity conservation, and environment have been a serious global concern since the early 1990s. It is widely accepted that decreasing tropical deforestation is the key and most cost-effective way to fight against global warming.

Setting up protected areas such as national parks and reserves has been widely practiced to combat tropical deforestation and biodiversity loss since the 1990s. The area of forest where biodiversity conservation is designated as its primary function has increased by more than 95 million hectares (ha) since 1990 to 2020 [5]. The increasing trend of the expansion of protected areas and ever-growing demands for scarce land for subsistence agriculture to meet the requirements of food commodities and forest products for escalating populations and for commercial agriculture resulted in major conflicts in several parts of the world. In many areas, the livelihoods of the local and indigenous communities in the vicinity of the protected areas have been seriously affected [6].

In order to balance individual well-being and habitat preservation and encourage the involvement of local people in protecting natural resources, Ferraro suggested direct payment as an effective way to compensate the cost of resource maintenance [7]. The protection of natural forests will be effective if the compensated amount exceeds the costs of the natural forest protection incurred by the individuals or individual households [8], [9]. In other words, the payment, at minimum, should equal the opportunity costs of natural forest management. Payments for ecosystem services (also known as payments for environmental services or PES) are emerging as economic tools to provide income for landowners or farmers for management, conservation, protection, and restoration of natural resources [10]. These schemes provide incentives to improve environmental management and the livelihoods of landowners by rewarding people´s efforts of remaining and providing ES.

Located in Southeastern Asia, in 1943 Vietnam had a forest area of over 14 million ha, with a forest cover of 43% [11]. Due to the excessive reliance on slash-and-burn agriculture, agriculture land expansion, logging whether legal or illegal, and non-timber forest products (NTFPs) collection for subsistence needs, forest area declined from 55% in the 1960s to 17% in the late 1980s. The massive deforestation in Vietnam was even judged to be the most rapid among Southeast Asian countries [11], [12]. In an attempt to restore forest cover, reforestation programs such as "Program 327" and "Five Million Hectares Reforestation Program" (5MHRP, also known as Program 661) were launched in the 1990s to improve environmental services, promote the role of the forest sector in overall economic growth, and secure the livelihoods of the most vulnerable groups [13]. In Vietnam, forest land belongs to the state. Since the 1990s, the right to use barren land and planted forests was transferred to rural households and individuals to manage and protect, while the natural forest was under the management of State Forest Enterprises (SFEs) and Forest Management Boards (FMBs). The surrounding villages and households were also allocated natural forests for protection in terms of contract and regularly paid by the government [13]. The use-rights and obligations of households vary depending which forest type they are contracted.

The weak management system and the non-corporation of the local stakeholders are the main causes of deforestation and forest depletion in Vietnam. There is little evidence of administrative penalties or ownership withdraws for non-compliance with the forest protection contract [14]. The lack of adequate and justifiable payment and unclear use rights might discourage the individuals and individual households to follow the contract for the long term. Meanwhile, conversion of the natural forests into monoculture plantations and to agricultural crop cultivation has been noticed in several places of northern Vietnam.

On the other hand, the Vietnamese government is limited in its payments for natural forest protection by other competing priorities. A clear understanding of public awareness and perception regarding natural forest protection and the diversification of financial resources to support these protection programs are necessary to ensure the sustainability of natural forest resources.

The study aims to assess the awareness and perception of residents in Thai Nguyen province towards natural forest protection, estimate the WTP of residents in Thai Nguyen province for natural forest protection, and identify factors influence their WTP.

II. MATERIALS AND METHODS

A. Study site

Thai Nguyen is a mountainous, midland province in the Northeast region of Vietnam and borders six provinces of which one is Hanoi capital to the south. The province covers an area of 353,000 ha and comprises of one city, one town, and seven districts. Thai Nguyen has a total population of 1.1 million people with 25% living in Thai Nguyen city, the capital of the province [15]. Thai Nguyen is a multiethnic province with 46 ethnic groups, and each ethnic has its own language, lifestyle, and cultural heritage. "Kinh" ethnic is the largest group representing of 73% of the total population, and populates mainly in the city, the towns, and the district centers [15]. Thai Nguyen is famous for its rich mineral resources and tea products and is recognized as an education center in the mountainous regions in the north of Vietnam.

In 2020, Thai Nguyen´s GDP, at current prices, was VND 125,220 billion, generating GDP per capital of VND 90 million/year [15]. Of the total, industrial and construction, service and agriculture contribute 51%, 31%, and 10% particularly. 4.4% of total households of the province are classified as poor and pro-poor households [16] .

The economy of the province is largely dictated by its capital city, Thai Nguyen, which is one the fastest growing cities in the North Vietnam. Located on the bank of the Cau river, the city has a geographical area of approximately and its population is 363 thousand [16].

B. Contingent valuation method

Contingent Valuation method (CVM) is a simple, flexible method which can be used to estimate economic values for all kinds of ecosystem and environmental services [17], [18]. CVM can be applied for both use and non-use values and is the most widely used method for estimating non-use values [19].

Forest ecosystems generate a wide variety of important use values, option values, and non-use values. While use values can be estimated by revealed preference methods, non-use values or passive values can be only measured by stated preference methods. CVM is an important tool for forest economists and is useful for evaluating particle attributes of forests. Forests provide a bundle of goods and services which cannot be easy to evaluate particularly. For example, forests with higher level of biodiversity might have better quality of wildlife habitat, higher watershed services, and aesthetic values. Hence, CVM is an appropriate tool to evaluate complex values of forest ecosystem as a whole rather than focusing on individual component of forest values.

In addition, one aim of this study is to examine paying for forest protection to gain non-use values, including existence value, option value, and bequest value. To evaluate welfare change for both gainers and losers, WTP measures fit the context.

C. Sample size

To conduct a contingent valuation survey, Mitchell and Carson provided a formula to calculate sample size based on the simple random sampling [20]. They suggested that sample sizes between 200 and 2,500 observations are

probably appropriate, assuming a coefficient of variation of 2.0. Calia and Strazzera classified 100 observations or less into the "small size sample", 250-400 observations into the "medium size sample", and more than 1,000 observations into the "large size sample" for a dichotomous contingent valuation model [21]. They came to conclusion that the medium size sample is efficient for both single-bounded dichotomous choice (SBDC) and double-bounded dichotomous choice (DBDC). Bateman et al. argued that researchers might design sample size by the expected number of non-respondents and protest responses, and hence, an open-end contingent valuation survey needs about 250-500 observations [22]. Many economists accept the sample size of 100-1,000 observations in a cost-benefit analysis.

Data collection costs and a project´s time frame also decide the sample size. Contingent valuation survey costs depend on survey modes: mail surveys, telephone interviews, web-based surveys, or in-person interviews. In-person interviews are the most effective for complex questions, the most time consuming, and the most expensive type of surveys.

D. Pre-test

In order to identify the perception and attitudes of residents in Thai Nguyen city towards forest protection, nine group discussions were made in April 2020 in Thai Nguyen city. Each group included five to seven participants. People were asked about their preferences towards environmental problems and forest protection. Maps, pictures, and description of forests in Thai Nguyen province were introduced to provide comprehensive background information.

Overall, people worried most about air and water quality, which directly affects their daily life. Although they were aware of deforestation, which was mentioned frequently on broadcast media, they found forest to be less important among environmental issues. More than half the participants visited Dinh Hoa Safety Zone, a historical tourism attraction in Dinh Hoa forest. They agreed that forests should be protected and they would pay if the state provides a transparent mechanism of distribution of the money. The payments suggested by participants ranged from VND 5,000 to VND 120,000 per household. Five initial bids were set up: VND 10,000, VND 20,000, VND 35,000, VND 50,000, and VND 80,000. People preferred a payment as a contribution rather than an increasing in income tax, electricity bill, or water bill. Eventually, cash was the optimum choice for payment.

The questionnaire of the WTP survey included three sections. In the first section, respondents were asked about their attitudes and opinions about general environmental interests. Then several questions about perceptions, opinions, and preferences towards forest protection were adopted. The second section debriefed the respondent's WTP. This section included a contingent valuation scenario, valuation elicitation questions, and follow-up questions to ensure the certainty of responses. The final section contained questions of demographic and socio-economic characteristics of respondents.

The scenario of the survey was formulated as

"Forests provide a range of environmental, social, and economic benefits that improve our quality of life. Healthy forests clean and improve our air, store carbon, and moderate the climate. Forests conserve and purify water, prevent flood and drought, prevent soil erosion, and preserve the integrity of topsoil. Forests serve as homes and support wildlife. Forests enhance the beauty of landscapes, create and provide recreational and educational opportunities. People can enjoy economic benefits such as revenue from the processing and trade of forest products, reduction of energy costs, and employment opportunities.

Suppose that a fund for forest protection was created to support natural forest management in Thai Nguyen. The money collected would be given directly to foresters and farmers involved in managing and protecting forests in Thai Nguyen. The money would be paid to them twice a year: at the end of the first six months and at the end of the last six months. Payments would only be made if all terms in the protection contract were met. The payment would be withdrawn, and a fine would be issued in the case of any forest loss. Suppose that this program was implemented in the next five years and needed the support of all households in Thai Nguyen province. We are now going to ask how much your household would be willing to pay as a one-time contribution to the forest development and protection program. There is no right or wrong answer. Please keep in mind your household incomes and living expenses. Suppose that your household, as well as all other households in Thai Nguyen city, were asked to contribute to the project as a one-time payment.

Would you be willing to pay VND…..thousand per household as maximum payment?

If Yes, would you be willing to pay VND….thousand per household?

If No, would you be willing to pay VND….thousand per household?"

E. WTP model

Double-bounded dichotomous choice format could have four possible outcomes:

- yes/yes: "yes" to $BID_{i;WTP}$ followed by "yes" to $BID_{h;WTP}$
- no/no: "no" to $BID_{i;WTP}$ followed by "no" to $BID_{l;WTP}$
- yes/no: "yes" to $BID_{i;WTP}$ followed by "No" to $BID_{h;WTP}$
- no/yes: "no" to $BID_{i;WTP}$ followed by "yes" to $BID_{l;WTP}$

Probability of four responses are: $P^{yy}_{i;WTP}$, $P^{nn}_{i;WTP}$, $P^{yn}_{i;WTP}$, $P^{ny}_{i;WTP}$

$$P_{i;WTP}^{yy} = \frac{1}{1+e^{-(\alpha+\beta BID_{h;WTP})}}$$

$$P_{i;WTP}^{nn} = 1 - \frac{1}{1+e^{-(\alpha+\beta BID_{l;WTP})}}$$

$$P_{i;WTP}^{yn} = \frac{1}{1+e^{-(\alpha+\beta BID_{h;WTP})}} - \frac{1}{1+e^{-(\alpha+\beta BID_{i;WTP})}}$$

$$P_{i;WTP}^{ny} = \frac{1}{1+e^{-(\alpha+\beta BID_{i;WTP})}} - \frac{1}{1+e^{-(\alpha+\beta BID_{l;WTP})}}$$

The double-bounded log-likelihood function (L^{DB}) now has four parts

$$L^{DB} = \sum_{i=1}^{n} I_{i;WTP}^{yy} \log P_{i;WTP}^{yy} + \sum_{i=1}^{n} I_{i;WTP}^{nn} \log P_{i;WTP}^{nn}$$

$$+ \sum_{i=1}^{n} I_{i;WTP}^{yn} \log P_{i;WTP}^{yn} + \sum_{i=1}^{n} I_{i;WTP}^{ny} \log P_{i;WTP}^{ny}$$

where $I_{i;WTP}^{yy}$, $I_{i;WTP}^{nn}$, $I_{i;WTP}^{yn}$, $I_{i;WTP}^{ny}$ are binary-valued indicator variables.

$I_{i;WTP}^{yy}$ $\begin{cases} = 1, \text{if the respondent i accepts both initial and the higher bids} \\ = 0, \text{otherwise} \end{cases}$

$I_{i;WTP}^{nn}$ $\begin{cases} = 1, \text{if the respondent i rejects both initial and lower bids} \\ = 0, \text{otherwise} \end{cases}$

$I_{i;WTP}^{yn}$ $\begin{cases} = 1, \text{if the respondent i accepts the initial but rejects the higher bid} \\ = 0, \text{otherwise} \end{cases}$

$I_{i;WTP}^{ny}$ $\begin{cases} = 1, \text{if the respondent i rejects the initial bid but accepts the lower bid} \\ = 0, \text{otherwise} \end{cases}$

The maximum amount of utility that respondent i, can get from his household income Y_{0i} regarding to socio-economic characteristic X_i is given by the assuming indirect utility function:

$$v(Y_{0i}, X_i)$$

It is assumed that a respondent will accept a proposed level of payment as a contribution to the forest protection program in the Dinh Hoa district and still maximize his utility under the following condition

$$v(Y_{0i}, X_i) + \varepsilon_{0i} \leq v(Y_{0i} - BID_{i;WTP}, X_i) + \varepsilon_{1i}$$

where $BID_{i;WTP}$ is the payment level offered to the respondent i, ε_i is the stochastic term that represents for the part of the true direct utility that cannot be captured.

The WTP of respondent i can be expressed under the linear or logistic form as

$$Ln\left(\frac{WTP}{1-WTP}\right) = \beta_{0i} + \beta_{1i} BID_{i;WTP} + \beta_{2i} X_{2i} + \ldots + \beta_{ni} X_{ni} + u_i$$

where β_0 is the intercept, β_1 is the regression coefficient of the bid, $\beta_2, \ldots, \beta_{ni}$ represents the regression coefficients of motivation and socio-economic variables$X_2 \ldots, X_{ni}$,and u_i is disturbance term.

The general logit model used in the study is presented as:

$$Ln\left(\frac{WTP}{1-WTP}\right) = \beta_0 + \beta_1 BID + \beta_2 AGE + \beta_3 HHS + \beta_4 GEN + \beta_5 EDU + \beta_6 INC + \beta_7 EMP + \beta_8 SOC + \beta_9 FIN + \beta_{10} FBE + \beta_{11} FDE + \beta_{12} PVI + \beta_{13} FVI + u.$$

The model includes 13 independent variables, which are demographic, socio-economic, and motivation variables. The explanatory variables are defined in Table 1.

The payment level is hypothesized to be negative in relationship to WTP. The higher payment level offered, the less willing to pay the respondent would be.

The size of household is hypothesized to negatively influence WTP. The increasing household size can increase household consumption demand. As a result, the larger households are assumed to pay less than the smaller households.

Table 1. Definition of the variables influencing WTP

Variable	Definition	Hypothesized direction of influence
BID	Bid offered (VND thousand)	-
AGE	Age of respondent (years)	+/-
HHS	Household size (member)	-
GEN	Dummy: Respondent´s gender (male = 1, female = 0)	+
EDU	Respondent´s education level (none school = 1, primary school = 2, middle school = 3, secondary school = 4, college/university = 5, post graduate = 6)	+
INC	Annual household incomes level: (less than VND 12 million = 1, from VND 12 million to less than 24 million = 2, … from VND 228 million to less than 240 million = 20, more than VND 240 million = 21)	+
EMP	Dummy: Employment (get employed by state institutions and enterprises, private enterprises = 1, unemployed = 0)	+
SOC	Dummy: Member of socio organizations (yes = 1, no = 0)	+
FIN	Dummy: Had access of information of Dinh Hoa forest by communication media (yes = 1, no = 0)	+
FBE	Dummy: Awareness of benefits of forests to communities (yes = 1, no = 0)	+
FDE	Dummy: Awareness of forest degradation in Dinh Hoa (yes = 1, no = 0)	+
PVI	Dummy: Visited Dinh Hoa forest (yes = 1, no = 0)	+
FVI	Dummy: Plan to visit Dinh Hoa forest in the next 3 years (yes = 1, no = 0)	+

Older individuals may pay more attention to environmental issues than younger generations. However, older individuals have fewer opportunities to earn an income or gain employment compared to younger generations due to physical limitations. The influence of age of respondents to WTP, hence, is unpredictable.

The acceptance of payment offered may be different between men and women. As men typically earn higher incomes than women, men are expected to be more willing to pay than women. The gender of respondents is hypothesized to be positive in relationship to WTP.

Education level of respondents is hypothesized to be positive in relationship to WTP. Well-educated respondents are expected to have a higher awareness of and greater appreciation for natural resources. Higher educated respondents are expected to be more willing to pay than lower educated respondents.

Household incomes are expected to have positive relationship to WTP. The higher the incomes they earn, the higher the level payment they are willing to pay.

Respondents who are employed by state institutions, state enterprises, and private enterprises could be paid more regularly than those who are unemployed. The occupation of respondents is expected to have a positive relationship to WTP.

Members of social organizations typically join social activities. They interact with each other and share characteristics. They would be more flexible in behaviors to social and environmental issues. Respondents who are members of social organizations are hypothesized to pay higher than those who are not members of any social organization.

Respondents who have had access to information about forests through the media, have visited forest, are aware of the benefits provided by forests and are likewise aware of the degradation situation of forest, and plan to visit forest in the future have more motivation to pay for the protection of forests. They are, thus hypothesized to be more willing to pay.

The mean WTP and the median WTP can be estimated using the formulas suggested by Hanemann et al. (1991)

$$\text{Mean WTP} = \frac{1}{|B_{1i}|}\ln[1+e^{(\beta_{0i} + \beta_{2i}\overline{X_{2i}} + \cdots + \beta_{ni}\overline{X_{ni}})}]$$

$$\text{Median WTP} = \frac{1}{|B_{1i}|}[\beta_{0i} + \beta_{2i}\overline{X_{2i}} + \cdots + \beta_{ni}\overline{X_{ni}}]$$

where $\overline{X_{2i}}, \ldots, \overline{X_{ni}}$ are the mean values of socio-economic variables.

The variance of WTP in the population as suggested by Bateman et al. (2002) is given by

$$\text{var(WTP)} = \sum_{j=0}^{J}(B_j - \overline{WTP})^2(\hat{S}(B_j) - \hat{S}(B_{j+1}))$$

where $\overline{WTP}$ is mean WTP; B_j are Bid level (j = 1 to J); $\hat{S}(B_j)$ and $\hat{S}(B_{j+1})$ are the proportion of respondents saying "Yes" to bids offered which called survivor curves; and it is assumed that $\hat{S}(B_0) = 1$ and $\hat{S}(B_{j+1}) = 0$.

The variance of mean WTP is given by

$$\text{var}(\overline{WTP}) = \frac{\text{var(WTP)}}{N}$$

where N is the sample size.

The 95% confidence interval will be defined by:

$$\overline{WTP} - 1.96\sqrt{\text{var}(\overline{WTP})} \text{ and } \overline{WTP} + 1.96\sqrt{\text{var}(\overline{WTP})}$$

Using similar estimation, it is possible to identify the variance and the 95% confidence interval of the median WTP.

The WTP aggregation can be calculated by multiplying the mean WTP by the size of population N. Total WTP for natural forest protection is given by

$$\text{Aggregate WTP} = N.\ \overline{WTP}$$

where N are the number of households in Thai Nguyen city.

To measure the goodness of fit for dichotomous choice model, McFadden's pseudo R^2 is widely used, which displays how well the variation in the dependent variable can be explained by the independent variables. R^2 can be written as:

$$R^2 = 1 - \frac{L_0}{L_{max}}$$

where L_0 is the log-likelihood in the null case (where all coefficients are assumed equal to 0) and L_{max} is the log-likelihood at convergence. Kanninen and Khawaja (1995) proved that the standard goodness of fit measures for discrete choice models is inappropriate in the case of the double-bounded logit model. The null hypothesis that all coefficients are equal to zero implies that the bid value has no impact on the response probability. But, the conditional nature of the follow-up bid value in the double-bounded format assumes a bid value effect. To deal with this problem, Herriges (1999) suggested the variant on McFadden's pseudo R^2

$$\widetilde{R}^2 = 1 - \frac{\tilde{L}_0}{L_{max}}$$

where $\tilde{L}_0$ corresponds to maximum value of L when all slope parameters, except the one on bid values, are constrained to zero. The restricted likelihood function then is well defined.

III. RESULTS

Among 300 responses of the WTP survey, 260 responses (80%) were useable for analysis, including 92 responses from center of the city, 80 from the North and 88 from the South. Three protest responses and 37 zero-responses were eliminated from the sample.

A. Socio-economic characteristics of respondents

Table 2 summarizes demographic and socio-economic characteristics of the whole sample.

Table 2. Demographic and socio-economic characteristics of respondents

Variable		Mean	SD
Age	Years	43.2	12.83
HHS	Member	4.20	1.76
		Number	**%**
GEN	Female	147	56.54
	Male	113	43.46
EDU	None school	0	0.00
	Primary school	15	5.77
	Middle school	30	11.54
	Secondary school	86	33.08
	College/University	126	48.46
	Post graduate	3	1.15
EMP	State institution/enterprise	57	21.92
	Private enterprise	12	4.62
	Self-employed	35	13.46
	Farmer	89	34.23
	Unemployed	67	25.77
SOC	Farmers' Union	39	15.00
	Women´s Union	86	33.08
	Veterans Association	30	11.54
	Youth Union	10	3.85
	Other organization	41	15.77
	No membership	54	20.77

The percentage of male (43%) and female (57%) of the whole sample reflects similar distribution of gender of the population in Thai Nguyen province. The average age is 43 years. 80% of respondents are in the working age from 20 to 60 years and 20% are older than 60 years. On average, households compose of four members which represents for the average household size in Thai Nguyen province and Vietnam. Respondents with college, university, and post graduate degrees account for 50% in Thai Nguyen city. The percentage of respondents with primary school and middle school education in Thai Nguyen city is significantly. In general, respondents in the WTP survey were found to be 100% literate. The distribution of occupations is remarkably. Employed respondents were found to be 75% and 80% respondents are members of at least one social organization.

The average household income and expenditure is displayed in Table 3. Households in Thai Nguyen city earn average incomes from VND 120 million to VND 132 million. On average, expenditure ranged from VND 84 million to VND 96 million. These findings are found to be similar to average household income in Thai Nguyen province which is VND 90 million VND (TSO, 2020). This similarity allows a reliable extrapolation of WTP from the sample to the population of interest. Regarding income changes, 59% households noticed that their incomes increased slightly compared to previous years, 11% indicated a decrease, and the remaining households experienced no change. 45% of households stated that their household incomes were sufficient for daily expenses; 20% expressed that it covered expenses for food only; and 11% had a surplus. 49% of the respondents contributed more than 50% of the total household incomes.

Table 3. Average household income

	Unit	Inc./Exp. Range
Income:	VND (million)	120 - 132
	US$	5,700-6,300
Expenditure:	VND (million)	84 - 96
	US$	4,000-4,600

B. Attitudes and preferences towards forest protection

Figure 1 reports the respondents´ perception towards issues of general concern. Respondents were asked to rank the three most important issues among eight general issues: (1) the first most important issue, (2) the second most important issue, and (3) the third most important issue. As it can be seen, environment was voted the first and the second most important issue by 32% and 25% respondents and education was voted the third by 19% respondents. The issue with highest vote was ranked number 1, the second number 2, and so on, and issue with the lowest vote was ranked number 24.

On average, environment was identified as the most important issue with a ranking of 3.7, followed by health care, and income which were ranked second and third. Transportation, poverty, and employment were ranked last. Additionally, half of the respondents acknowledged that they had regular access to information about environmental issues by communication media, while one third obtained information occasionally. About 98% of respondents had donated at least once to support environmental incidents such as floods or storms. The results confirmed that the respondents in Thai Nguyen city were aware of the importance of environment issues.

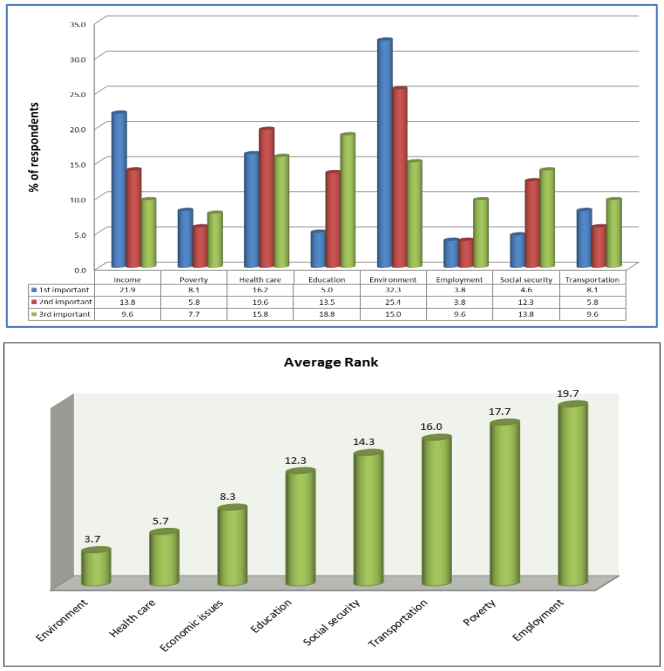
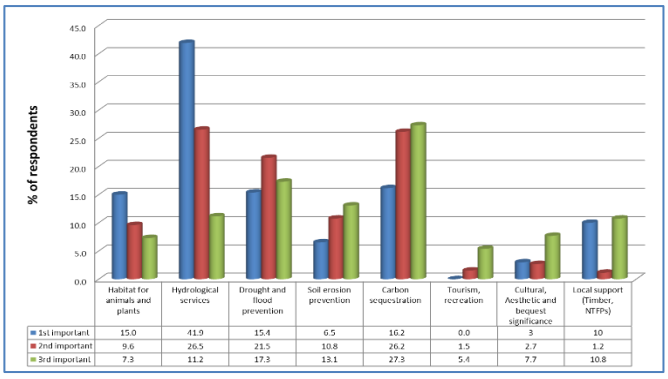


Fig. 1 Ranking of general issues

Half of respondents stated that everyone should protect the environment; one third mentioned that it was the government´s responsibility to take care of environmental issues; and one third claimed that enterprises which caused environmental problems, should be responsible for resolving environmental problems.

Regarding benefits provided by forests to humans, 41% of respondents voted hydrological services the first, 26% voted hydrological services and carbon sequestration the second, and 27% voted carbon sequestration the third most important functions. On average, carbon sequestration (ranked 4.3), hydrological services (ranked 5.0), and drought and flood prevention (ranked 6.3) were the first, second, and third most important functions (Figure 2).

Respondents´ motivation to protect forest was reflected through questions on how frequently they access information on forest. 85% of respondents got information on forest by communication media. Although 79% of respondents were aware of the benefits of forest to communities, just slightly more than half of the sample was aware of the degradation situation of forests the province. Approximately 70% of the respondents had visited forest, and about 87% planned a visit in the next three years.



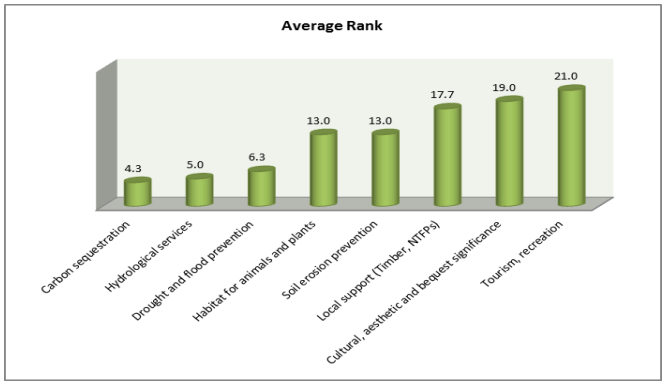


Fig. 2 Ranking of forest functions

Finally, a series of questions focused on respondents' preferences towards forest protection. As it can be seen, the proportion of respondents in support of forest protection and development programs was significantly high. For example, nearly 96% of respondents agreed to contribute to protection programs and the similar number agreed to offer money or labor as contribution.

In conclusion, the respondents in the survey are concerned about both environmental problems and the deforestation situation in Thai Nguyen province. Their perception towards the importance of forest protection is well recognized. Overall, the respondents agree that the forest should be protected. These positive preferences and attitude towards forest protection can be seen as a motivation for local residents to support the forest protection programs.

C. Regression results

Table 4 present results of binomial logistic regression. The estimated maximum likelihood coefficients indicate the effects of explanatory variables on the WTP, i.e., the probability of accepting a certain bid amount. According to the findings we can see that WTP has negative relationship to the levels of payment (BID) and previous visits; and positive relationship to education, household incomes and awareness of respondents of benefits of forests to communities.

At the 1% level, the coefficients of variable BID are statistically significant. The weak negative coefficients explain that the higher the payment levels offered, the less willingness of the respondents to pay. This result properly reflects the downward trend of the demand curve in line with economic theory. The coefficient of variable EDU is statistically significant at the 5% level. The positive relationship between WTP and education expresses that higher educated respondents are more willing to pay than lower educated respondents. The finding is in line with the hypothesis. At the 5% level, the coefficients of variable INC are statically significant. The strong positive relationship between WTP and incomes reflects the higher income the respondents earn, the more willing they are to accept the bids offered. The awareness of benefits of forests to communities, which has strong and positive relationship to WTP implies that respondents who are more aware of benefits of Dinh Hoa forest are willing to pay higher.

Table 4. Parameter estimated

Variables	Coefficient	S.E.	Sig.
INTERCEPT	3.094	2.857	0.279
BID	-0.539***	0.013	0.002
AGE	-0.026	0.025	0.298
HHS	-0.261	0.181	0.150
GEN	-0.505	0.581	0.384
ETH	0.118	1.232	0.924
EDU	0.081**	0.361	0.823
INC	0.907**	0.065	0.914
EMP	0.846	0.686	0.218
SOC	0.282	0.719	0.695
FIN	0.473	0.764	0.536
FBE	1.423**	0.688	0.039
FDE	0.509	0.556	0.360
PVI	0.155**	0.653	0.813

FVI	-0.860	0.712	0.228
χ^2		24.737	
Log likehood function		-50.332	
Restricted Log likehood		-62.700	
McFadden's Pseudo R^2		0.397	
Adjusted McFadden's Pseudo $\tilde{R}^2$		0.300	
N		260	

*** *significant at p ≤ 0.01*
** *significant at p ≤ 0.05*

The McFadden's Pseudo R^2 implies how well the independent variable can explain the variance of explanatory variables. The McFadden's Pseudo R^2 is estimated to be 0.397. To the double bounded dichotomous format, adjusted McFadden's Pseudo R^2 for Model is to be 0.3. The findings are adequately acceptable for cross-sectional data. The likelihood ratio χ^2 test is alternative test of goodness-of-fit. As the likelihood ratio χ^2 of the model is significant at the p_value ≤ 0.01 and ≤ 0.05, this offers evidence that there is a significant relationship between the WTP and the explanatory variables, i.e. the model adequately fits the data.

Figure 3 presents the probability of acceptance of respondents to the bids. The graphs show a downward trend from the left to the right, which illustrates the negative relationship between bid levels and the WTP of the respondents. In other words, the probability of acceptance decreases along with the increasing of the bid levels.

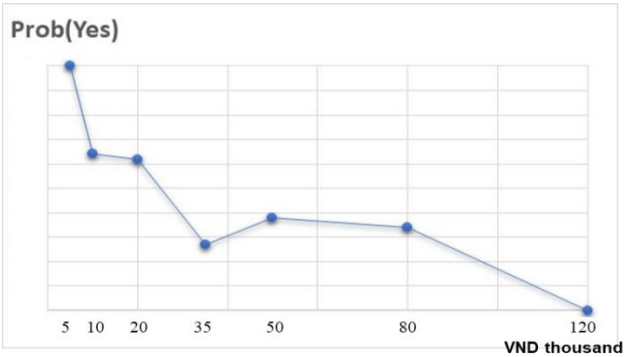


Fig. 3 WTP curve

D. Mean and median WTP

Table 5 shows the estimated mean and median WTP and their upper and lower values. The mean and median WTP are calculated by parametric approach, using logit model. The residents in Thai Nguyen city are willing to pay about VND 39,000 (US$ 1.7) per household as one-time payment for natural forest protection, ranging from VND 39,000 to VND 48,000 for a 95% confidence interval. The median WTP ranges between VND 33,000 and VND 43,000 for a 95% confidence interval. The mean WTP value is not significantly different between respondents of the survey. These findings show that respondents in Thai Nguyen city support payment for natural forest protection regardless of how far away the forests are or where the respondents live.

Table 5. Mean and median WTP

		95% CI	
		Lower	**Upper**
Mean (VND)	39,000	28,000	48,000
Median (VND)	33,000	21,000	43,000

The total WTP is estimated by multiplying the mean WTP by the total number of households in Thai Nguyen city which amounts to 91,000 (TSO, 2020). If each household is willing to contribute VND 39,000 as one-time payment, Thai Nguyen city could raise VND 3.5 billion (US$ 154,000) to protect natural forests in Thai Nguyen as total benefits transfer.

IV. DISCUSSION

The perception and attitudes of the local residents towards the role of forests in communities and their WTP for forest protection show the possibility of increasing social and financial support, which play an important role in the success of a protected area. The study showed that the local residents are concerned about environmental quality in the area. They perceived that reducing deforestation and protection of natural forests could be efficient ways to improve environmental quality. They are willing to contribute finance to support the protection program. However, they are uncertain about the equity of the mechanism of incentives distribution and problems related to forest management could be resolved. The lack of a transparent, proper distribution mechanism and a sufficient control system makes it possible to misuse forest protection funds, generates corruption (Pham, 2014), and increases transaction costs, which raises the concern of donors. Without strict compliance to a protection contract and strong law enforcement, the forest services´ users become less willing to pay for the services.

The study results proved that understanding local perception and attitudes towards natural forest protection and using it as a starting point to develop economic tools to evaluate the WTP for environmental services is necessary to increase public support for forest protection at a local scale.
The local residents in Thai Nguyen city are willing to pay VND 39,000 (US$ 1.7) as a one-time payment for forest protection in Thai Nguyen province. This amount is equivalent to about 0.04% of annual income of households in Thai Nguyen province and 0.03% of annual income of households in Vietnam. The amount estimated by our study is slightly lower than the amount of recent studies in Southeast Asian related to payment for forest protection and conservation. Vincent et al. estimated the WTP of households in Malaysia for the protection of Belum-Temengo park to be about US$ 12 from logging and about US$ 8 from poaching (0.1% of annual household income) [23]. Yoeu and Pabuayon found the WTP of households in the Tonle Sap Biosphere reserve, Cambodia for the

conservation of flooded forest to be about US$ 7 (1% of annual household income) [24].

The payment estimated by our study seems low, but it is understandable in an area where there has never been any payment for forest protection or payment for environmental services in the past. Our study found similarity with Truong who estimated the WTP of households in Hanoi and Ho Chi Minh city for the conservation of Vietnamese Rihno to be US$ 2.5 (0.05% of annual household income in Vietnam) [25]. As Vietnamese are unfamiliar with payment for environmental services and biodiversity protection, the amount evaluated in our study is considered affordable. The payment for natural resources protection is expected to increase in the future when household incomes increase.

Several factors were found to be significant in the WTP study. Payment level, education, awareness of the forests´ public benefits, and household income are the factors which influence the WTP. Demographic characteristics such as age, gender, household size, and employment have no significant relationship to WTP. While payment level negatively affect WTP, education, the awareness of the forests´ public benefits and household income influence the WTP positively. It is clear that a lower payment level for forest protection, a higher education level, a higher awareness of the forests´ public benefits and a higher household income increases the probability of acceptance the payment offered.

The positive relationship between previous forest visits and the WTP reflects that the respondents, who visited forest before, tend to be more willing to pay than those had never visited. The findings is in line with the hypothesis that people who had visited forest might be aware of the forests´ situation and appreciate the forests´ public benefits, and thus be more willing to pay than those who had never visited.

V. CONCLUSION

The study shows possible applications of the contingent valuation method to identify economic incentives for forest protection in a developing country. The study reflects a theoretical approach that can be implemented in various contexts, paying attention to cultural dimension, complexity of local populations, and environmental systems. WTP is used as market-based approaches to measure the price of protection of natural resources and assess structure of households´ livelihoods to understand the underlying factors that influence the local behaviors. WTP is used as a proxy to develop incentive systems that are not only giving money but also building capacity through education and training skills.

Focusing on individual households provides a better fit to the diverse socio-economic, cultural, and geographic character of the region. Payments for forest protection motivate local households to the direction of PES (Payment for Ecosystem Service), provide additional income by compensating their protection efforts, create jobs, and contribute to the livelihoods of local communities. A good forest protection and management program would enhance the efficiency of natural resources conservation, contribute to poverty alleviation, enable community capacity building, and influence local decision making. This approach should be further developed focusing on creating economic incentives for the willingness to protect forests.

The study shows the possible estimation of WTP in a small-scale case study in Thai Nguyen city. Replication of a similar approach under different circumstances allows scaling up experience to address problems and understand payment system in general.

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