

# Assessment of the Forest Resources Non-Use Value in Qinling Mountain Area

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**Abstract.** The study is to use the Contingent Valuation Method (CVM), it is a direct interview approach that can be used to solicit the willingness to pay (WTP) for the non-use value of environment and resources. Questionnaire survey with a sampling size of 700 respondents was conducted in April 2016. The result indicated: Willingness to pay for the non-use value of forest resources in Qinling mountain area is 99.14 Yuan/person •a, the non-use value of forest resources in Qinling mountain area is  $37.80 \times 10^8$  Yuan/a, the existence value for  $13.98 \times 10^8$  Yuan/a, the inheritance value for  $12.86 \times 10^8$  Yuan/a, the choice value for  $10.96 \times 10^8$  Yuan/a. Cultural level and individual annual income cognition degree and the affection degree of forest resources in Qinling mountain area are to affect the important factor that resident WTP pays level.

## 1. Introduction

In 1992 by the U.S. National Oceanic and Atmospheric Administration (NOAA) appointed by the two Nobel Prize winners on the CVM in measuring non-use values of natural resources or the existence of value that can be applied for the assessment will be made, CVM proposed to be used to evaluate non-use values of natural resources or the value of some of the guiding principles [1-5]. After 40 years of development, according to statistics in the world with the CVM resource assessment study of non-use value of more than 2,000 cases [6]. In the 1990s, CVM only individual case studies in China. In 2000, Chinese scholars the value of forest resources and environment also assessed [7-10].

Qinling Mountains in central China, is boundaries of the natural climate between China's north and south, the Palaearctic and Oriental biogeographic convergence zone components. Qinling Mountains in Shaanxi Province in south-central, between the Weihe River and Han River, things rolling 400-500km, north-south width of 120-180km, within the mountain tall, overlapping mountains, ravines, with a typical Quaternary glacial landforms. The total area of  $484.9 \text{ km}^2$ , forest land area of 3, 835, 000  $\text{km}^2$ , accounting for the total area of forest land in Shaanxi 35.8%. Qinling forest resources in the basin of water conservation, soil conservation, air purification, climate regulation, biodiversity maintenance is irreplaceable ecological functions, and its non-use values of forests, namely the existence value of forest, heritage value, and option value. Existence value, there is one value of biodiversity to ensure the continued existence of the nature reserve' willingness to pay; Heritage value refers to the contemporary forest resources to be reserved for future generations will be willing to pay; Option value refers to the individual or community forest resources and biodiversity potential uses of future use.



In this paper, the Qinling Mountains of forest resources for the study, the use of contingent valuation method survey people on the Qinling Mountains of non-use values of forest resources, willingness to pay, and to assess the Qinling Mountains non-use values of forest resources, which for the government to make a scientific and rational decision-making.

## 2. CVM questionnaire design and survey

### 2.1. CVM questionnaire design

Questionnaire is divided into three sections: the first part of the Qinling Mountains for the respondents understanding of forest resource protection, so that respondents understand the value addition to the use of forest resources, but also provides many tangible and intangible non-use values, that is, with water conservation. Allowing the respondents to the questionnaire to better understand the topics to be investigated, and then for some issues related to forest resources, in order to understand the respondents to the awareness level of protection of forest resources. In the second part of the questionnaire, first to allow respondents to explain in simple to understand the existence value of forest resources, heritage value, option value of the true meaning, and guide the public on non-use values of forest resources is willing to pay the amount. The third part of the questionnaire, it is essential to collect personal information on the respondents, the respondents own background and economic conditions due to their willingness to pay a considerable amount of the value of the degree of impact. Questionnaire design process is a false market in the process, so to create a rating for respondents to understand the background. Questionnaire respondents include the level of awareness of mountain forest resources, like the degree of willingness to pay, and other aspects of the current policy evaluation.

### 2.2. Calculation of WTP

With the CVM of direct survey respondents from the largest open-ended WTP question format for the transfer to a closed question format, Contingent Valuation survey design and data analysis, statistics has become a CVM study of the key. The use of open-ended question format of the questionnaire survey, as respondents the survey data provide a direct measurement of the maximum WTP, but itself does not require further analysis, so the less demanding statistical techniques can be directly obtained using non-parametric method. In the non-parametric method, the sample should first characterization of the samples, and then draw a sample eigenvalue distribution of the frequency map willingness to pay, willingness to pay according to the frequency distribution graph, you can calculate the maximum willingness to pay of the average expectations. Maximum willingness to pay of the average expectation formula is:

$$E(WTP) = \sum_{i=1}^n A_i P_i \quad (1)$$

One,  $A_i$  is the bid amount,  $P_i$  for the respondents to select the amount of probability,  $n$  is the number of options for the amount.

## 3. Statistical analysis of survey results

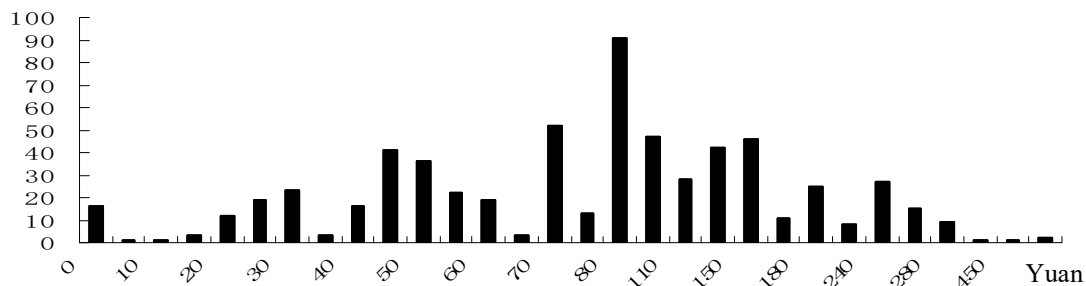
Preliminary design of the questionnaire is completed, the investigation in order to reduce design errors, to play the advantages of different survey methods, survey results to improve the accuracy of the sample used for this face to face interviews and e-mailing a combination of surveys. The survey questionnaires were distributed and 700 copies of the Shaanxi Province, a random survey by interviewer. Total 633 valid questionnaires were recovered, the sample response rate 90%. One face to face interviews with 500 questionnaires, 490 valid questionnaires, the sample response rate 98%; e-mailing 200 questionnaires, 143 valid questionnaires, the sample response rate 71.5%.

### 3.1. Willingness to pay rates and WTP frequency distribution of the number of results

Willing to protect the Qinling mountain forest resources and their sustainable existence to pay for the 617 samples, willingness to pay 97.5%. In the interview, who are willing to pay, the maximum willingness to pay in cash 600 yuan/year, the minimum willingness to pay cash for 5 yuan/year (see Figure 1). Through the willingness to pay the amount of frequency, percentage, etc. descriptive statistics, get statistical data

distribution, you can see the amount paid is 45 yuan, 50 yuan, 70 yuan, 80 yuan, 90 yuan, 130 yuan and 150 yuan of frequency is relatively large, respectively 41, 36, 52, 91, 47, 42 and 46 people. Resulting in an average willingness to pay is:

$$E(WTP) = \sum_{i=1}^n A_i P_i = 99.14$$



**Figure 1.** Frequency distribution diagram of WTP searcher.

### 3.2. To estimate the value of non-use forest resources in mountain areas (WTP)

According to the China Statistical Yearbook, the end of 2016, Shaanxi Province, the province's resident population of 38,126,200 people, if we adopt the mean survey WTP, that take the 99.14 yuan, the Qinling Mountains can be drawn non-use values of forest resources as follows:

non-use values of forest resources =  $99.14 \times 38126200 = 37.80 \times 10^8$  (yuan/year)

The survey (see Table 1), the value of the sample used for WTP, heritage value and option value using the ratio of motives were 37%, 34% and 29%, you can estimate the value of the Qinling mountain forests all types of non-use value. According to questionnaire results, the Qinling Mountains can be calculated the existence value of forest resources, heritage value, option value, they are:

Existence value =  $37.80 \times 10^8 \times 37\% = 13.98 \times 10^8$  (yuan/year)

Heritage value =  $37.80 \times 10^8 \times 34\% = 12.86 \times 10^8$  (yuan/year)

Option value =  $37.80 \times 10^8 \times 29\% = 10.96 \times 10^8$  (yuan/year)

Table 1 shows, there is existence value, heritage value and option value share of these three basic flat. It shows the public that the integrity of forest resources exist, bequeathed to future generations and future options to use are very important, three kinds of value should be given due attention and protection.

**Table 1.** Proportion of goal to pay.

Payment purposes	Proportion
For the protection of natural resources to ensure that the Qinling mountain forests of natural resources and their knowledge can cause long-term preservation	37%
Reservations for heritage, the Qinling mountain forest resources and related knowledge retention as a heritage to future generations	34%
By choice to use for themselves and their posterity, or for others in the future to have the choice to develop the use of forest resources in the Qinling Mountains	29%

## 4. Influencing factors of assessment of non-use value

### 4.1. Data and model

Through the survey, respondents received the statistics of forest resources of the Qinling mountain willingness to pay for non-use values as a basis, may further affect the willingness to pay of respondents selected factors do in-depth analysis. Table 2 is the willingness to pay for the selection of the seven main factors affecting the distribution of the sample.

**Table 2.** The main characteristics of respondents.

Category	Variable	Number of people	Proportion
Gender	Male	339	53.6
	Female	294	46.4
Age	21-30	173	27.3
	31-40	201	31.8
	41-50	194	30.6
	>51	65	10.3
	Government administrators	37	5.8
Profession	University teachers and students	58	9.2
	Researchers of research institutes	12	1.9
	Employees of enterprises	323	51.0
	Farmers in the Qinling Mountains	66	10.4
	Laid off / unemployed	25	4.0
	Other	112	17.7
	No formal education	5	0.8
Level of education	Primary and below	53	8.4
	Junior high school	207	32.7
	High School	138	21.8
	College or technical school	60	9.5
	Non-undergraduate college or university	89	14.0
Qinling Mountains of understanding of forest resources	College or more	81	12.8
	Familiar	165	26.1
	Have some understanding of	272	43.0
	Nothing about	164	25.9
	Is not know	32	5.0
Forest resources of the Qinling mountain of love	Very like it, often to	211	33.3
	Prefer, and sometimes to	229	36.2
	Not to mention like it or not, rarely	127	20.1
	Hope to recent	47	7.4
	Do not like, do not go	19	3.0
Personal annual income	No income	23	3.6
	<5000	13	2.0
	5000-8000	27	4.3
	8000-10000	51	8.0
	10000-20000	193	30.5
	20000-30000	140	22.1
	30000-40000	69	11.0
	40000-50000	69	11.0
	>50000	37	5.8

Logit model of this study to handle the data. Unwilling to pay the model assignment is 0, willing to pay assigned to 1.

But in the actual survey, choose not to pay any fees, only 16 people, if only this part of the sample dummy variable set to 0, then it may be because the sample size is too small to affect model estimation results. Taking into account some of the selected respondents willingness to pay is very low (less than 60 yuan), when coupled with this part of the sample, due to variable sample size for the 0 ratio can be

accounted for 33.6%, to ensure that the model estimates. Thus, in data processing, the willingness to pay no more than 60 yuan, a sample of all variables as 0 and the remaining are set to 1.

#### 4.2. Analysis of results

As can be seen from Table 3, gender, age and occupation variable coefficient is not statistically significant. Level of education variable coefficient is positive, indicating the higher level of education, people's willingness to pay more. Because of the higher level of education, the protection of people's awareness of the ecological environment, the stronger their willingness to pay is all the more apparent. And a variable coefficient of 99% significance level, showing that the explanatory variables by level of education are a major factor in the level of willingness to pay. Income variable coefficient is positive, and also reached statistically significant level of 99%, indicating that as income grows, people's willingness to pay has also been improved. Awareness variable coefficient is positive, indicating the importance of mountain forests, the more understanding of people's willingness to pay even more strongly. Love of variable coefficient is positive, indicating that the more the feelings of mountain forests, people's willingness to pay is even more obvious.

**Table 3.** Regression result of Logit model.

Explanatory variables	Regression coefficient	Z statistics
Constant	- 1.956247***	- 3.854125
Gender (female as reference)	0.125489	1.156324
Age	- 0.010235	- 1.147965
Level of education	0.205641***	3.854123
Income levels	0.695412***	4.025478
Awareness	0.563254***	2.546321
Degree of love	0.432154*	1.453256
Profession	0.165874	0.601254

Note: \*, \*\*, \*\*\* represent significant statistical test level of 10%, 5%, 1%.

#### 5. Conclusion

(1) The results show that the Qinling mountain forest non-use values, the average willingness to pay is 99.14 yuan/year • people, CVM in the non-use values of forest resources has a validity of this basis the Qinling Mountains non-use values of forest resources, Qinling Mountains to get non-use values of forest resources for the  $37.80 \times 10^8$  yuan/year, of which the existence value is  $13.98 \times 10^8$  yuan/year, heritage value of  $12.86 \times 10^8$  yuan/year, option value of  $10.96 \times 10^8$  yuan/year.

(2) Willingness to pay factor analysis showed that the level of education, personal income levels, the Qinling mountain forest resources awareness and love of the four factors that affect the level of the residents to pay an important factor in WTP.

CVM using the conditions of non-use values of forest resources in terms of theory and practice is a useful discussion, but this method can only roughly estimate the value of non-use of forest resources, estimates may be low. As people's awareness of the protection of forest resources and the economy continues to grow, people's income level and education level are rising, people's willingness to pay for forest resources also showed dynamic growth trend.

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