Research on Ecosystem services of biodiversity conservation: A case study of Southwest China, Mekong Region

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Abstract. Tropical areas represent spaces of great environmental value. Their good ecosystem services can allow the protection of biodiversity. In southwest China, Mekong Region where ecological and socioeconomic context represent tropical regions of Southeast Asia that contain abundant biodiversity and are threatened with environmental degradation and deforestation. Transboundary eco-security has become an important and sensitive issue. The objective of this study is to evaluate the willingness of visitors to pay (WTP) to improve biodiversity and ecosystems across borders. After thinking about the importance of tropical regions, a survey analysis the local young people's willingness to protect the environment and their views on WTP.

1. Introduction
The rapid pace of human development has resulted in the loss of biodiversity and the degradation of ecosystem services. These changes in ecosystem structure and diversity threaten the dynamic supply of ecosystem services [1]. Governments around the world are beginning to factor ecosystem services into policy making. The economic valuation of ecosystem goods and services has advanced substantially in recent years (e.g. The Economics of Ecosystems and Biodiversity project).

Such valuation of nature makes the benefits of nature visible to the society and is thus a powerful tool for influencing policy [2]. Unless the value of nature is made visible, policy makers risk making policy decisions based on the assumption that nature has zero value or without knowing its value at all.

To quantify the value of cultural ecosystem services, economists typically measure willingness to pay (WTP), or the maximum amount of money they would sacrifice to obtain the service they desire [3]. WTP is used by U.S. government agencies as a measure of economic value for cost-benefit analyses.

Developmental pressures along national boundaries have become particularly important threats to tropical forest conservation globally. Transboundary eco-security has become an important and sensitive issue. Xishuangbanna Dai Autonomous Prefecture (hereafter Xishuangbanna) is representative of such eco-security issues and is the location of the present study. Xishuangbanna is located in the upper reaches of the Mekong River on the southwestern border of China, and its biodiversity and ecosystem services are of great importance in the region.
protection have become important factors affecting the transboundary ecological security of Southeast Asia and South Asia. Over the last three decades, Xishuangbanna has experienced widespread and dramatic changes, such as deforestation, urban expansion and the conversion of secondary vegetation into monocultures, especially rubber plantations [4]. In a transboundary environment, successful species conservation requires habitat protection across borders [5].

Many scholars have researched the nonmarket value of biodiversity and ecosystem protection in transboundary and other regions [6]. However WTP is less frequently measured, and no attention has been paid to the influence of religious affiliation and sense of place on WTP among local youth.

The objective of this research was therefore to shed light on two empirical research questions: What are the influences on WTP, especially in transboundary areas, and do religious affiliation and sense of place impact WTP behaviors?

Religion is a core cultural factor influencing perceptions, attitudes, values, and behaviors [7]. Religion has three functions: mental function, social function, and ecological function [8]. Previous research has identified a positive correlation between religion and prosocial behavior, and social affiliation is a core feature of most religions [9,10]. In China, the ethnic minority peoples of border areas have developed co-existence and adaptation to their local environment. These traditional relationships with nature can be characterized by respect for nature and practices that allow sustainable use of natural resources. Ecological anthropologists often search for solutions to environmental problems by studying religion, but one limitation of such studies may be the ignorance of the important roles that cultural diversity, especially indigenous or ethnic ecological cultural diversity, can play in biodiversity conservation [8].

Our research contributes a new perspective to existing literature. Few studies have examined the impact of RA on human behavior, especially environmental behavior [11]. Findings on the relationship between religion and the environment remain fragmented and contradictory [12]. Our study area is an ethnic minority area historically known as Xishuangbanna, which was a Southeast Asian principality ruled by Tai lords related to the Shan in Burma, the Laos, and the northern Thailand [13]. The Dai people believe in Hinayana Buddhism, and because religion affects many aspects of the daily life of its believers, religion also affects their attitudes toward environmental protection.

Over the past few decades, the bonding that connects individuals and their meaningful places has gained attention [14-15] and has been termed “sense of place” (SOP). SOP is a multidimensional concept that includes place identity, place attachment, place image and agency commitment [16]. SOP is composed of affective, cognitive, and behavioral components [17]. Affection consists of an emotional connection such as positive or negative feelings, to a specific place [18]. Cognition consists of the creation of place meaning, such as ‘place identity’, and enables closeness to a place [19]. Behavioral components consist of certain actions, such as paying for the conservation of natural areas and engaging in ecological behaviors [20]. We analyze SOP along with RA to understand local youth’s WTP.

There are other dimensions that may have an influence on RA and SOP, such as age, gender, income, minority status, the RA of family members, and occupation. These demographic data are used as control variables in the proposed model (Fig. 1).

Based on the above literature and taking advantage of the experimental case, we formed the following hypotheses:

H.1 RA has a significant impact on WTP.
H.2 SOP has a significant impact on WTP.
H.3 The control variables should not have a significant impact RA and SOP.

Our theoretical framework is built on the premise that local youth’s WTP for biodiversity and ecosystem services is affected by RA, SOP and some control variables. We attempted to identify the factors influencing WTP. Through the influence of RA and SOP, we studied the intention of WTP for biodiversity and ecosystem services among local youth. Because the behavior of protecting biodiversity is also linked to RA and SOP, the proposed model can allow greater insight into WTP behavior. An experimental research design is adopted to test these hypotheses (Fig. 1).
2. Methods

2.1. Study Area
We chose Xishuangbanna, which is located in the southwest of Yunnan Province in the southwest of China in the Mekong Region, as the study area (Fig. 2). It is bordered by Burma, Laos, and Vietnam and lies at 99°55′–101°50′E and 21°10′–22°40′N. It has an area of 19,124.5 km² (Fig. 2) and is the southernmost political unit in Yunnan. It has one of the only major tropical forests in China, with high biodiversity, high academic value, and relatively high vulnerability. Additionally, Xishuangbanna lies in the Indo-Burma global biodiversity hotspot within the scope of Norman Myers' hotspot areas.

The area contains a remarkable diversity of species – while it covers only 0.2% of the land area of China, it harbors some 16% of the vascular flora, 21.7% of mammals, and 36.2% of birds found in the country. Xishuangbanna also has diverse cultures. More than two-thirds of the population belongs to one of 12 ethnic minorities, including the Dai, Hani, Bulang, Jinuo, Miao and Yao. Historically, it was known as Sipsongpanna, a Southeast Asian principality ruled by Tai lords related to the Shan in Burma, the Laos, and Northern Thailand [13]. The Dai people believe in Hinayana Buddhism, and their lifestyle, as well as their arts and literature, has historically been influenced by Hinayana Buddhism. Most minority nationalities nationwide fell behind the Han in production modes and level of social development. For centuries, the Han have been situated at the height of civilization, in contrast to the primitive peoples on China’s southwest frontier.

2.1.1. A subsubsection. The paragraph text follows on from the subsubsection heading but should not be in italic. When receiving the paper, we assume that the corresponding authors grant us the copyright to use the paper for the book or journal in question. Should authors use tables or figures from other Publications, they must ask the corresponding publishers to grant them the right to publish this material in their paper.

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2.2. Sampling Design
This research used a snowball sampling online survey to collect data within the study area from July to August 2018. We distributed the survey questionnaire to local workers and designed the subject matter to distinguish between locally-born people and recent immigrants to the region. According to the definition of the age of youth by the National Bureau of Statistics of China, we asked respondents between 15-34 years old. Our final sample consists of 126 ethnic minority youth whose responses were used to test hypotheses and assess the adequacy of the proposed theoretical model. In addition, the survey included questions about the demographic and socioeconomic characteristics of the respondents.

2.3. Questionnaire Design
The questionnaire used in our research consisted of two basic sections. The first was used to collect demographic and socioeconomic characteristics of local respondents, such as age, gender, and income. The second part consisted of 33 items, which measured RA, SOP and WTP. These variables are latent constructs that cannot be directly observed but can be inferred from five-point Likert scales. Most of the survey items in the questionnaire used a five-point Likert-type scale with "1" indicating "strongly disagree" and "5" indicating "strongly agree."

As a well-developed scale measuring RA was not available, we tried to identify appropriate measurement items through several approaches. We converted the RA to a self-perception survey, which could be used for correlation and regression analyses. Specifically, RA was measured through a layered framework. We used three consecutive elements to measure RA, including the RA’s mental functions (e.g., “I believe everything in the world has life and a soul”), social functions (e.g., “Helping people always makes me happier”), and biological functions (e.g., “I believe nature has a close relationship with human beings”). Each item used to measure RA included eight questions.

SOP was assessed with three items. SOP is composed of affective, cognitive and behavioral components [19]. We measured SOP from responses to questions of a cognitive, affective or behavioral nature. Place attachment (e.g., “I feel proud of my hometown”), place identity (e.g., “I know everything about my hometown”), and place dependence (e.g., “I will do my best to contribute to my hometown’s development”) can be regarded as being mediated by these three distinct constructs [15].

WTP was the only construct assessed with attitude scales (e.g., willingness to pay for biodiversity and ecosystem services: “1” means “strong unwillingness” and “5” means “strong willingness”).

In summary, we used 33 items to assess 5 variables in this study (Table 1).
### Table 1. Initial items

| Item | Description | Item | Description |
|------|-------------|------|-------------|
| H1 Gender | EF1 I believe that nature creates natural cycles for everything. | H5 Occupation | EF5 I believe that nature has a close relationship with human beings. |
| H2 Age | EF2 Forests have been shown to act as a key factor in the ecological balance. | H6 Household monthly income (RMB) | EF6 I believe that humans can control nature. |
| H3 Minority | EF3 I don’t mind if trees are cut down or flowers are picked. | H7 Family members’ religious affiliation | EF7 Humans are equal to all the animate things and inanimate things in the environment. |
| H4 Educational status | RA’s biological function | MF1 I believe that saving one life is better than building a seven-story pagoda. | EF8 I care about the environment. |
| H5 Occupation | SOP1 I know everything about my hometown. | MF2 I believe everything in the world has life and a soul. | SOP2 I do not know the customs or culture of my hometown. |
| H6 Household monthly income (RMB) | SOP3 There is a strong connection between me and hometown. | MF3 I only want to be happy at the moment. | SOP4 I feel proud about my hometown. |
| H7 Family members’ religious affiliation | SOP5 My hometown will always be a part of me. | MF4 I believe that if you do good, you feel good. | SOP6 I do not want to stay away from home. |
| MF1 I believe that saving one life is better than building a seven-story pagoda. | SOP7 I will do my best to contribute to my hometown’s development. | MF5 I used to donate clothes, books or some money. | SOP8 The development of hometown is none of my business. |
| MF2 I believe everything in the world has life and a soul. | WTP1 Willingness to pay for the local environment. | MF6 I am afraid of pain without gain. |  |
| MF3 I only want to be happy at the moment. |  | MF7 I believe that one good turn deserves another. |  |
| MF4 I believe that if you do good, you feel good. |  | MF8 I have rescued animals. |  |
| MF5 I used to donate clothes, books or some money. |  | SF1 I believe that helping others is helping myself. |  |
| MF6 I am afraid of pain without gain. |  | SF2 As long as everyone is dedicated, the world will be a warmer place for human existence. |  |
| MF7 I believe that one good turn deserves another. |  | SF3 The outside world does not concern me. |  |
| MF8 I have rescued animals. |  | SF4 Helping people always makes me happier. |  |
| SF1 I believe that helping others is helping myself. |  | SF5 Communal activity can help to achieve a common goal. |  |
| SF2 As long as everyone is dedicated, the world will be a warmer place for human existence. |  | SF6 What I put love into is what I will receive back. |  |
| SF3 The outside world does not concern me. |  | SF7 We need to preserve the environment for the benefit of our offspring. |  |
| SF4 Helping people always makes me happier. |  | SF8 I believe that people are selfish. |  |
3. Data Analysis

3.1. Sample Profile
Among the participants, a total of 90 respondents were female (71.4%), and 36 respondents were male (28.6%). An overview of the age groups is as follows: 15-19 (10.3%); 20-24 (49.2%); 25-29 (23.0%); and 30-34 (17.5%). The highest level of education for most respondents was a bachelor's degree (43.7%), while approximately 31.8% of respondents had a high school education or below. An overview of the occupational groups is as follows: government officials (6.3%), public enterprise staff (20.6%), farmers (10.3%), workers (3.2%), students (31%), employees in privately owned enterprises (0.8%), and others (15.9%). For family income, the monthly income of RMB 2,001 to 4,000 accounted for approximately 31.0% of the respondents; RMB 4,001 to 6,000, 26.1%; and RMB 6,001 to 8,000, 18.3%. The last items are family members’ RA, which was either yes (46.8%) or no (53.2%) (Table 2).

Table 2. The demographic and socioeconomic characteristics of the respondents

| Items               | Category | %  | Items               | Category | %  |
|---------------------|----------|----|---------------------|----------|----|
| Gender              | Male     | 28.6 | Female              | 71.4     |    |
|                     |          |     |                     |          |    |
| Age                 | 15-19 years old | 10.3 | 20-24 years old    | 49.2     |    |
|                     | 25-29 years old | 23  | 30-34 years old    | 17.5     |    |
| Minority            | Dai      | 43.7 | Han                 | 28.6     |    |
|                     | Other    |      | Other minority     | 27.8     |    |
|                     | Elementary | 2.4 | Under 2,000        | 13.5     |    |
|                     | Junior high | 15.1 | 2,001-4,000        | 31       |    |
|                     | Senior high | 14.3 | 4,001-6,000        | 26.1     |    |
|                     | Household monthly income (RMB) | 6,001-8,000 | 18.3 |
| Educational status | Junior college | 23.8 | 8,001-10,000       | 6.3      |    |
|                     | College | 43.7 | Above 10,001       | 4.8      |    |
|                     | Graduate school | 0.8 | Family             | Yes      | 46.8 |
|                     | members’ RA |      | No                | No       | 53.2 |

3.2. The contrast of Dai and Han
The results show the contrast of the young native Dai and the young native Han (Fig. 2).

Figure 2. Proposed model of the Dai-Han Group, ***p<0.001, **p<0.01, *p<0.05
RA’s three functions, especially the biological function (BF) and social function (SF), show a positive correlation with WTP (r=0.294, p<0.05, and r=0.226, p<0.05, respectively). That is, RA had a significant effect on WTP. Among the three functions of RA, psychological function (MF) had a significant positive correlation with BF (r=0.480, p<0.001), and SF and BF were positively correlated to each other (r=0.256, p<0.05). Overall, the MF and SF were positively correlated with BF.

The SOP had no correlation with WTP but had a significant positive correlation with RA’s three functions (r=0.686, p<0.001; r=0.273, p<0.001; and r=0.564, p<0.001). SOP also had a positive correlation with family members’ RA (r=0.306, p<0.05) but a negative correlation with education level (r=−0.332, p<0.05), which means that a stronger SOP indicates a higher proportion of family members’ RA and a lower education level.

On the other hand, education level was found to have a negative correlation with WTP (r=−0.338, p<0.01), indicating that the higher education an individual has, the lower their willingness to pay for local biodiversity and ecosystem services. Education level was also significantly negatively associated with family members’ RA (r=−0.485, p<0.001) but positively associated with RA’s mental function (r=0.028, p<0.05).

3.3. The contrast of the three groups
Xishuangbanna is a transboundary place where many ethnic groups coexist and different cultures intermingle. Hinayana Buddhism impacts the people living here despite what minority group they belong to. However, the Dai ethnicity has regular religious customs, especially among the local Dai residents. Therefore, there are differences between the three groups (Table 3).

| Item            | Groups                  | Groups                  | Groups                  |
|-----------------|-------------------------|-------------------------|-------------------------|
|                 | Dai-Han                 | Dai-Other               | Dai-Other minority     |
| SF-WTP          | 0.226*                  |                         |                         |
| BF-WTP          | 0.294*                  | 0.025*                  | 0.379*                  |
| E-WTP           | -0.338***               | -0.373***               | -0.408***               |
| BF-SF           | 0.256*                  | 0.238*                  | 0.191*                  |
| BF-MF           | 0.309***                | 0.309***                | 0.296**                 |
| SOP-SF          | 0.273**                 | 0.305***                | 0.292**                 |
| SOP-MF          | 0.564***                | 0.537***                | 0.511***                |
| SOP-BF          | 0.686***                | 0.738***                | 0.727***                |
| SOP-E           | -0.332*                 | -0.235**                |                         |
| SOP-FMRA        | 0.306*                  | 0.220*                  |                         |
| E-MF            | 0.028*                  |                         |                         |
| E-FMRA          | -0.485***               | -0.481***               | -0.441***               |

Significant at the 0.05 level;** significant at the 0.01 level;*** significant at the 0.001 level. Red means an increased correlation; blue means a diminished correlation; and yellow means a faded correlation.

Note. SF=Social Function; BF=Biological Function; MF=Mental Function; WTP=Willingness To Pay; E=Education; SOP=Sense of Place; FMRA=Family Members’ Religious Affiliation; SF-WTP=SF impact on WTP; BF-WTP=BF impact on WTP; E-WTP=E impact on WTP; BF-SF=the interaction effects between BF and SF; BF-MF=the interaction effects between BF and MF; SOP-SF=SOP impact on SF; SOP-MF=SOP impact on MF; SOP-BF=SOP impact on BF; SOP-E=the interaction effects between SOP and E; SOP-FMRA=the interaction effects between SOP and FMRA; E-MF=E impact on MF; E-FMRA=the interaction effects between E and FMRA.

4. Conclusion
Our research studied how RA and SOP influence local youth’s WTP for biodiversity and ecosystem services in Xishuangbanna. The study aimed to gain a deeper understanding of how WTP is affected by RA and SOP.
Our main findings indicated that RA has an important impact on WTP, especially for residents living in minority frontier areas. RA’s three functions, especially BF, have significant effects on WTP. The BF and SF show a positive correlation with WTP. Among RA’s three functions, MF has a significant positive correlation with BF, and SF has a positive correlation with BF. Overall, MF and SF are positively correlated with BF. However, the SF of the Dai-Other group and Dai-Other minority group had no correlation with WTP, which is different from the SF of the Dai-Han group. The ecological culture of Dai people in Xishuangbanna, which is based on the belief in Hinayana Buddhism, shows the important roles ethnic ecological culture plays in biodiversity conservation.

The results of the empirical studies support the contention that SOP has no correlation with WTP but has a significant positive correlation with RA’s three functions. SOP also has a positive correlation with family members’ RA but a negative correlation with education level, which means that the stronger the SOP is, the higher the proportion of family members’ RA and the lower the education level. However, these correlations were most obvious in the Dai-Han group; in the other two groups, the correlation increased or faded. Generally, SOP has been linked to the length of residence. The longer they stay, the more attached individuals become to the place. These affective bonds to a place may encourage action to safeguard and develop the places important to them [18].

We also assessed the effect of demographic and socioeconomic characteristics of the respondents as control variables on WTP. Education level was found to have a significant negative correlation with WTP, indicating that the more educated individuals are, the lower their willingness to pay for local biodiversity and ecosystem services. The Dai-Other group and Dai-Other minority group showed a higher negative correlation than the Dai-Han group. Our results differ from other studies, perhaps because more educated local youth can perform other work to protect biodiversity and the ecosystem rather than pay money for it.

According to the literature, income is positively correlated with WTP. Some scholars have found that people with higher incomes have a higher WTP than those with low incomes. Our results differed from other studies; other demographic and socioeconomic characteristics of the respondents, such as age, gender, occupation, and income, had no correlation with SOP or RA. Education level was also significantly negatively associated with family members’ RA to each other.

The interaction effects between education level and family members’ RA were significantly negative. The local youth who were well educated have more work opportunities in large cities, so they have lower SOP and are less influenced by RA. In addition, education level was positively associated with RA’s mental function, but the correlation diminished in the Dai-Other group and Dai-Other minority group.

Finally, this research has certain limitations that need to be recognized. One limitation is that we have not explored into the question that whether the WTP method evaluate true, objective and accurate willingness to pay for biodiversity and ecosystem services among Chinese people?

Another limitation may be that the sample size is insufficient and may cause type II errors; it does not take into account the influence of cultural homogeneity within the region.

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