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Valuation of Food Security and Cultural Landscape Services for Paddy Ecosystems in Developing Countries: A Case Study in Hongthai, Vietnam

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Abstract

In recent times, the assessment of ecosystem services has gained increased importance, as the disappearance of numerous ecosystems worldwide directly impact human well-being and the quality of the living environment, especially in developing countries where many environmental issues are increasingly concerned. The study was conducted to evaluate eco-services in terms of food security and cultural landscape services in Hongthai, Vietnam, by using a questionnaire survey to collect the market price, travel cost, and willingness to pay from the travelers and farmers. The results of the evaluation show that the total value of paddy eco-services in Hongthai is about 579,585.1 USD, with a use-value of 94,50.5 USD (29,146.9 USD of food security value, 65,353.6 of tourist landscape value); the non-use value is 485,084.6 USD (46,223.9 USD of option value; 61,549.0 USD of value left; 377,311.7 USD of value exists). To effectively exploit and use these ecosystem services, local government needs to propagate and raise awareness in maintaining, preserving, and promoting cultural and traditional values inherent in farming, providing tourist services to meet market needs, and providing paddy ecosystem services. Based on the findings, this study proposes some policy implications for Vietnam and similar low-living provinces in developing countries, helping them promote poverty reduction methods and develop sustainable tourism based on paddy ecosystem services.

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Agro-ecosystems are very complex-designed ecosystems; they are also large ecosystems that play an important role in humanity, providing essential ecosystem services depending on agricultural management and practices (Liu et al., 2022). The green revolution in agro-ecosystems has increased rice yields over the past five decades, and increasing dependence on human inputs such as synthetic fertilizers, pesticides, and energy will contribute to higher productivity (Macedo et al., 2021). While this has contributed to poverty alleviation, especially in Asian countries, it has reduced the beneficial ecosystems of humans and the diversity of other ecosystems, especially related to environmental pollution and greenhouse gas emissions (Pingali, 2023).

Ecosystem services (ES) refer to ecosystems' direct or indirect contributions to human well-being (TEBB, 2010). Promoting sustainable agriculture in ecologically sensitive regions is a critical global issue (Liu et al., 2020). According to Chivenge (2020), paddy ecosystems safeguard food security and drive socio-economic advancement for nations with well-established agricultural sectors. Across Southeast Asia, traditional rice production has contributed to forming distinct cultural landscapes and fostered specific agrobiodiversity (Tekken et al., 2017). Vietnam has become the third largest rice exporter in the world, but hunger still becomes a big challenge to managers in many provinces, especially in northern Vietnam (Dang et al., 2020). Agricultural ecosystems, particularly those associated with wet rice cultivation, are vital in achieving food security, environmental conservation, and socio-economic advancement in agriculturally developed nations. Rice cultivation is intertwined with socio-cultural values, contributing to the formation of a distinct agricultural biodiversity and cultural landscape in Southeast Asia. This study was conducted in Vietnam, a Southeast Asian developing country with typical wet rice, and approached ecosystem services according to the Millennium Ecosystem Assessment's classification, which focuses on food security and cultural landscape services (Millennium Ecosystem Assessment, 2005).

Studies on the evaluation of ecosystem services in Vietnam in recent years have only focused on the evaluation of forest ecosystem services and coastal ecosystems, and there have not been many studies on the evaluation of paddy ecosystems to serve tourism development. Tuyenquang is a mountainous province with a significant population of ethnic minorities, boasting a rich history and a varied, distinct cultural identity (Nguyen, 2022). The Dao Tien ethnic group (constituting over 90% of the population) residing in the highland commune of Hongthai, Tuyenquang province, has ingeniously crafted the cultivation of paddy on terraced fields which are renowned as some of the most picturesque paddy fields in Northeastern Vietnam. During both the season of submerged terraced fields and the period when the rice is ripe, these terraced landscapes have evolved into distinctive tourism attractions, drawing innumerable local and international visitors who come to explore and partake in the experience (People's Committee of Nahang district, 2019, People's Committee of Nahang district, 2021). Capitalizing on its inherent potential, the Hongthai commune possesses the capacity to harness the versatility of the paddy rice ecosystem for both sustaining food security and fostering eco-tourism in alignment with the preferences of the local community and a sustainable approach.

Nevertheless, the current utilization of paddy rice eco-services in Hongthai falls short of realizing its full potential as bestowed by nature. Both production and service endeavors within this paddy rice ecosystem adhere to conventional methods, lacking innovative approaches to tap into its non-utilized values. This study was carried out to solve the above problems, with the goal of evaluating the paddy eco-services in Hongthai, Tuyenquang, Vietnam, towards sustainable eco-tourism development for this region. This research direction is new and has practical applications, not overlapping with published research works in Vietnam and the world. Thus, evaluating agro-ecosystems is an important and necessary research direction, especially in developing countries where many environmental issues are increasingly concerned with.

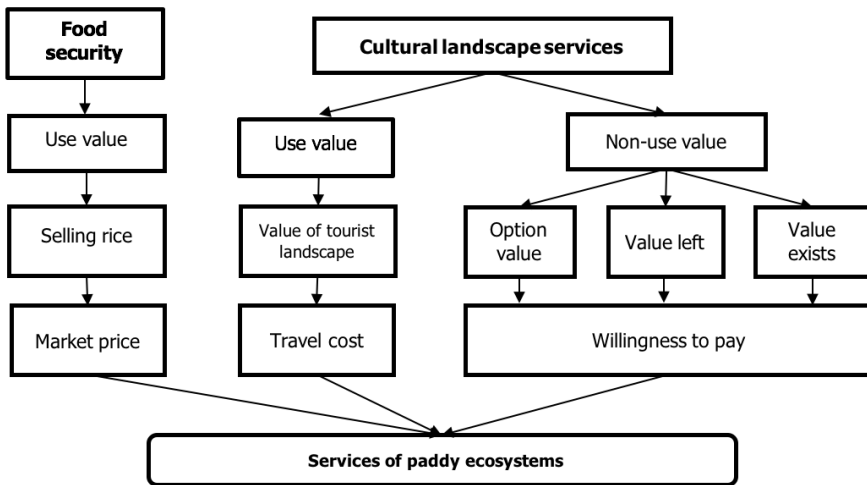
Materials and Methods

Methods of survey and interview are widely used in research on the evaluation of agro-ecosystem services (Rasheed et al., 2021; Tekken et al., 2017; Loc et al., 2017; Loc et al., 2018; Dang et al., 2020). This approach and methodology have important implications in the field of ecosystem services evaluation because these are the values people perceive based on culturally and socially shaped preferences.

The data collection method is used to collect the necessary inputs for the evaluation process. The evaluation criteria for paddy eco-services are presented in Figure 1. Due to limitations in local data, research time, and funding conditions, this paper only focused on evaluating eco-services in terms of food security and cultural landscape services. The relationship between food security and cultural landscape services underscores the importance of recognizing and integrating cultural values, traditions, and practices into food security policies and strategies. Protecting and managing cultural landscapes can contribute to sustainable food systems that address both the nutritional and cultural dimensions of food security.

Figure 1

Research Framework



Hongthai includes seven villages: Ban Muong, Hong Ba, Khau Trang, Khuoi Phay (or Khuy Phuyay), Na Kiem, Na Mu and Pac Khoang. In Hongthai, the government focuses on developing agricultural crops such as rice, corn, peanuts, sweet potatoes, soybeans, fruit trees, and beans of all kinds. Of these, 80.3 hectares (ha) of land for summer rice cultivation and 49.6 hectares for spring rice cultivation. Regarding industrial crops, currently, the commune has 90.4 hectares of tea, 16 hectares of harvested pear trees, and about 6 hectares of other medicinal plants. Ecotourism on terraced fields and experiencing pear flower gardens are unique tourist activities in Hongthai. Therefore, rice and pear-growing households were selected to conduct interviews about their level of awareness of ecosystem services and content related to the topic.

The survey data were collected through face-to-face interviews with 126 experienced rice and pear cultivation farmers in Hongthai. The interviews commenced with an overview of the ecosystem,

its services, and the study's objectives. A structured questionnaire was utilized, featuring a series of sequential inquiries. The questionnaire is designed to collect information with three main contents: (1) General information, (2) Income from growing rice and pears, and (3) Willingness to pay. The survey data underwent processing utilizing SPSS software. Each interview session spanned approximately 30 to 40 minutes.

The valuation of food security services (marketed goods) was determined using the market price method. This approach provides the value of the product based on the returns achieved from its sale in the market (De Groot et al., 2012).

$$\text{Profit from selling rice/pear} = [\text{Yield (ton/ha)} \times \text{Market price (USD/ton)}] - \text{Cost (USD/ton)}$$

The use and non-use value of culture landscape services is calculated based on the travel cost method (TCM) and willingness to pay (WTP) through survey results from tourists and local people. This study used the travel cost and contingent valuation methods (CVM) to evaluate non-use value services, such as the value of the tourist landscape, the option value, the value left, and the existing value. The data was collected in 2022 through interviews by questionnaire and convenient sampling. The interviews lasted about 45 to 50 minutes and commenced by providing an introduction to the ecosystem, explaining its services, and outlining the study's objectives. After conducting surveys in 2022, 524 valid votes were obtained, including 126 households and 398 tourists. The questionnaire is designed to collect information with three main contents: (1) General information, (2) Travel costs, and (3) Willingness to pay. After being designed, the questionnaire was tested on a sample group of 80 people with good reliability (Cronbach's Alpha coefficient reached 0.83), ensuring reliability. Then, the survey was conducted on a large scale according to the contingent valuation method. The potential multicollinearity issue between travel cost and travel distance was addressed through statistical techniques such as variance inflation factor (VIF) analysis and correlation diagnostics. The survey data underwent processing utilizing SPSS software.

Traditional Choice Modeling (TCM) has been widely used in evaluating ecological services such as coastal wetland parks, freshwater fisheries, nature-based recreation, and recreational services (Xu, 2022; Cetin, 2021; Hwang, 2021; Sinclair, 2020). TCM encompasses three main techniques: zonal, individual, and random utility (Cetin, 2021). Also, TCM is considered the most established method for assessing recreational benefits (Sinclair, 2020). In this study, the travel cost includes two factors: the cost of time (the opportunity cost) and other costs (such as the cost of transportation, meals, buying souvenirs, and hiring guides). These costs are collected from questionnaires during the survey. The cost of time is the most difficult to determine, and there is no exact formula to evaluate this cost. How to determine and estimate this cost depends on each research characteristic. Usually, tourists will spend the whole day traveling to enjoy the fresh air and beautiful scenery and learn about nature. In return, they lose time doing other jobs and lose part of their income from travel. Within the scope of this paper, the opportunity cost of time in a day of tourists was chosen as the average salary per day. Also, the minimum wage was applied to each province region where tourists live.

The steps to carry out the zone travel cost method are as follows:

Step 1: Choose a location: terraced fields in Hongthai, Vietnam.

Step 2: Divide regions. Because tourists come from all over the country, spanning all three regions: North, Central, and South (the number of visitors from the North and Central regions is not small). The departure area is divided according to the origin of tourists, taking the research point as the center to calculate distance and dividing it into groups, ensuring continuity and suitability.

Step 3: Take a sample. Information about visitors to the terraced fields of Hongthai was collected through direct interviews and questionnaires by investigators.

Step 4: Calculate the tourist rate for each region: The Visitation Rate (VR) is calculated by dividing the total number of tourists visiting the tourist destination (yearly) of each region by the total adult population (1,000 population) of provinces located in the same region.

Step 5: Estimate travel costs. The cost of visiting a tourist destination includes transportation costs, opportunity costs, and other costs at the tourist destination.

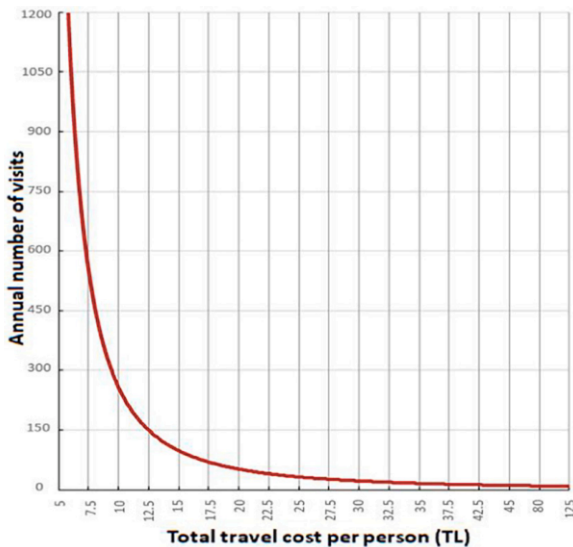
Step 6: Build the demand. Construct a tourism demand curve from the estimated regression function as shown, representing the relationship between tourism demand (number of visitation rate) and the cost of tourism activity.

Step 7: Estimate landscape value and tourist surplus. The tourism demand curve is also the marginal price curve of tourists' willingness to pay for tourism services.

Thus, the landscape value of a tourist destination is evaluated as the total price willing to pay tourists, measured by the area below the demand curve. The area under the demand curve is triangular, so it can be calculated using the triangle area method. Based on the constructed demand curve, the tourist surplus can be estimated. Tourist surplus is the area of the triangle above the horizontal line corresponding to the cost and below the demand curve.

Figure 2

Relationship Between Total Travel Cost Per Person and Annual Visits (According to Cetin, 2021)



Determining the starting area and visiting rate: The starting zoning is based on the distance visitors travel to the Hong Thai commune (Figure 2). The whole territory surrounding Hongthai commune is divided into five zones, depending on the distance and road system from those places to the center of Hongthai. According to population statistics, Region 1 includes Caobang, Hagiang, and Thainguyen, with a population of 2,740,721. Region 2 includes Phutho, Hanoi, Vinhphuc, and Namdinh, with a total population of 12,869,073 people. Region 3 includes Haiduong, Haiphong, and Quangninh with a total population of 5,359,690 people. Region 4 includes provinces quite far from Thanhhoa and Nghean, with a total population of 7,107,831 people. Region 5 is Hochiminh City, which has a population of 9,411,805 people. Visitation Rate: $VR = \frac{\text{The average number of visitors in the region} * 1000}{\text{total population}}$.

The WTP method: The Willingness to Pay (WTP) method is a commonly used approach in environmental economics to measure the value of non-market environmental services (Ureta, 2024; Thuy, 2024). This method assesses individuals' willingness and ability to pay a certain amount for an environmental service or benefit. WTP is typically determined through survey methods, such as opinion surveys or focus group discussions, to collect data on people's valuations of the value of environmental services (Gould, 2024; Xu, 2024). This method provides essential information for valuing non-market environmental services and supports decision-making on environmental policy and management. In this study, the amount of money subjects are willing to pay (WTP) is divided according to three options corresponding to three values of the cultural landscape: selection value, legacy value, and transmission value. Moreover, with the collected data, it is possible to analyze the relationship between the level of contribution and the socio-economic characteristics of the interviewed target groups.

The CVM questionnaire is structured in four parts as follows:

Part 1: Socio-economic information of individuals and households. Socio-economic information of respondents (age, marital status, gender, education, occupation, income).

Part 2: Presenting issues of the cultural landscape of Hongthai terraced fields and its surroundings. Introducing and providing information about priority issues that need to be preserved, ecological services, and the role of the natural landscape and Hongthai terraced field culture

Part 3: Understanding knowledge and attitudes. Provide information about threats to the conservation of paddy ecosystem services and respondents' understanding and attitudes about the role of paddy ecosystem services.

Part 4: Scenario and questions about WTP level (Description, status, threats, proposing program/project, debriefing questions). Providing information about proposing an ecotourism development plan through establishing a conservation fund and contribution levels, answering questions (agree or disagree), and level of certainty.

Figure 3

Study Area



Results and Discussion

Socio-demographic characteristics

The survey sample's socio-demographic characteristics are shown in Table 1. Due to the agricultural characteristics of residents in the area, the study conducted interviews with 126 rice and pear farmers with a ratio of 1:1.

Table 1

The Survey Sample Socio-demographic Characteristics

	Particulars	Sample	Ratio (%)
Farmers			
Gender	Female	35	28
	Male	91	72
	Sum	126	100
Age			
Age	> 65 yrs	1	1
	51-65 yrs	72	57
	21-50 yrs	53	42
	< 20 yrs	0	0
	Sum	126	100
Village			
Village	Ban Muong	31	25
	Khau Trang	24	19
	Khuay Phay	33	26
	Na Kiem	38	30
	Sum	126	100
Visitors			
Gender	Female	236	59,3
	Male	162	40,7
	Sum	398	100
Age			
Age	> 65 yrs	4	1,0
	51-65 yrs	31	7,8
	21-50 yrs	331	82,7
	< 20 yrs	34	8,5
	Sum	398	100

	Particulars	Sample	Ratio (%)
Area	Northern Vietnam	345	86,7
	Central Vietnam	29	7,3
	Southern Vietnam	24	6,0
	Sum	398	100

When visiting Hongthai, tourists typically travel in groups comprising 5 to 20 individuals. The majority of visitors are drawn to renowned attractions within Hongthai, such as its picturesque terraced fields, pear gardens, and tea hills. Engaging in activities like sightseeing, photography, and savoring local cuisine are among the preferred pastimes for tourists in the region.

In the Nahang district, Hongthai plays an important role as a prominent tourist destination. Consequently, tourism activities in Hongthai often form a part of the itineraries for delegations visiting Nahang. The duration of guests' stays varies, with those from the neighboring provinces generally opting for single-day trips, while guests traveling from over 300 kilometers away may extend their stay to 2 or 3 days.

Paddy ecosystem services evaluation results

The valuation of food security service by using the market price method

The rice cultivation area of households in Hongthai is relatively small and fragmented. The household with the largest rice growing area is 1.85 ha, and the smallest is 0.002 ha. Rice-growing households in Hong Thai mainly serve the family's food needs. A few have a surplus to sell for extra income. Thus, the value of food security is calculated by the income from selling rice to rice-growing households, or equivalent to the amount of money that households have to spend to buy rice in the market to meet the food needs of their families. From the results of the survey and survey of rice growing households in Hongthai commune, the value of food security from paddy rice cultivation in Hongthai commune is estimated at 19,416.2 to 38,878.5 USD, with an average of 29,146.85 USD per 80.3 ha (table 2).

Table 2

Farmers' Profit from Rice and Pear in 2022

Farmers' income from selling rice						
Selling rice	Average yield (ton/ha)	Paddy area (ha)	Production in 2022 (ton)	Market price (USD/ton)	Cost (USD/ton)	Profit (USD)
	5.73	80.3	460.1	506.6 - 633.3	464.4 - 548.8	19,416.2 - 38,878.5
						Average: 29,146.85

Farmers' income from pear cultivation						
Selling rice	Average yield (ton/ha)	Paddy area (ha)	Production in 2022 (ton)	Market price (USD/ton)	Cost (USD/ton)	Profit (USD)
	7.5	16	120	633.2 - 833.3	548.8 – 717.7	10,128 – 13,872
Visiting services		Average number of visitors (person/day)	Number of days visitors visit (days)	Entrance fees (USD/person)	National costume rental fee (USD/person)	Income from visiting services (USD)
		150	30	0.8	0.8	7,200
Total profit from pear growing activities (USD)						17,328 – 21,020

For control purposes, income from pear-growing activities was also collected through a survey form of pear-growing households in Hongthai. This income includes income from pear sales and income from pear garden services. In 2022, the commune harvested 16 hectares (ha) of pears, with an estimated output of over 120 tons. In addition, in recent years, pear-growing households have also gained additional income from photography services and visiting pear gardens in the blooming season. Total income from pear cultivation is estimated to range from 17,328 to 21,020 USD, with an average of 19,174 USD per 16 ha (table 2). Thus, it can be seen that the paddy growing area in Hong Thai commune is now five times larger than the pear growing area. However, 1 ha of paddy cultivation brings an average income of about 363 USD. Meanwhile, 1 ha of pear cultivation brings about an average income of about 1,198.4 USD, 3.3 times higher than income from paddy cultivation.

In mountainous regions, travel infrastructure presents challenges, severely constraining food transportation and trading activities. Consequently, the conveyance of rice from the lowlands to remote locales within Vietnam and several developing nations is notably absent. Thus, the preservation of rice cultivation in these regions assumes paramount significance. Beyond ensuring local food security, it concurrently fosters the cultivation of tourism and cultural landscapes, leveraging the intrinsic allure of the area's natural splendor and indigenous farming practices.

The valuation of cultural landscape services by using the travel cost method

The travel cost is shown in Table 3. This cost will be the sum of the above factors per person for a trip to Hong Thai. Collected data only focuses on asking tourists within the framework of tourist attractions in Hong Thai commune.

Table 3

The Valuation of Culture Landscape Services in Hongthai

Region	Distance (km)	Provinces	Popu. (people)	Ratio (%)	Visitors per year	VR (%)	Oppurt. cost (USD)	TC (USD)	Tourism benefits (USD)
1	0-200	Caobang, Hagiang, Thainguyn	2,740,721	14.8	12,110	4.419	4.6	67.1	9,688.0
2	200-300	Phutho, Hanoi, Vinhphuc, Namdinh	12,869,073	49.7	40,641	3.158	5.9	100.2	32,512.8
3	300-400	Haiduong, Haiphong, Quangninh	5,359,690	14.1	11,494	2.145	5.9	120.2	9,195.2
4	400-600	Thanhhoa, Nghean	7,107,831	16.1	13,136	1.848	5.1	138.0	10,508.8
5	>600	Hochiminh City	9,411,805	5.3	4,310	0.458	5.9	288.9	3,448.0
Total									65,353.6

From the relationship between the visitation rate (VR) and the travel costs of each region (TC), the regression by least squares results in the demand function for entertainment in the Hong Thai commune of the form $VR = 307.8 - 58.39 \cdot TC$. R2 value reached 76.63%. Also, the input variables' Variance Inflation Factor (VIF) coefficients indicate values of less than 2, indicating the absence of multicollinearity. In the TCM method, the area below the demand curve is the total recreational value of tourists to Hong Thai. The area between the demand curve and the average cost value will show the consumer surplus value of tourists. The benefit a tourist receives when traveling in Hong Thai, calculated in money, is 811.3 USD/1,000 person, which means 0.8 USD/person. Total benefits per region in the year = the average number of regular visitors to Hong Thai commune/1 year x Benefits of an individual (Table 3). Thus, the value of culture landscape services in Hongthai is 65,353.6 USD per year.

The opportunity cost of time in the TCM calculation directly influences travel costs, indirectly affects demand for cultural landscape services, impacts consumer surplus, and has important policy implications. Therefore, it needs to be considered in the process of providing sustainable tourism development solutions in the future.

The valuation of farmers' and visitors' willingness to pay (WTP) for paddy ecosystem services

In the 524 questionnaires collected, 409 respondents were willing to contribute to the conservation of the local paddy rice ecosystem (Figure 4). The willingness to pay of the respondents is summarized in Table 4.

Figure 4

Survey Results on Willingness to Contribute to the Conservation

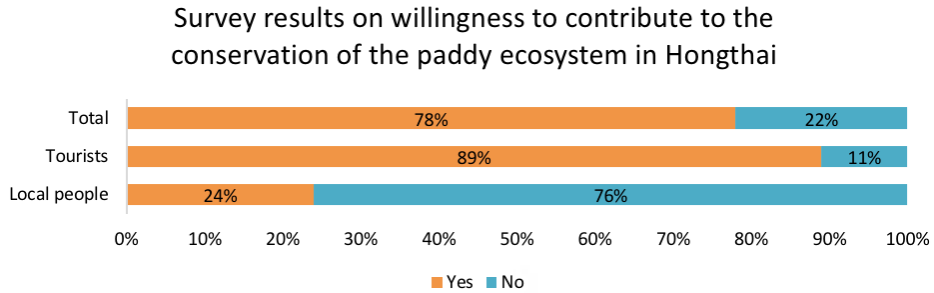


Table 4

Respondents' willingness to contribute for non-use value from paddy eco-services in Hongthai (USD)

Non-use value	Residents				Visitors				Total (USD)
	Min	Max	Average	Total	Min	Max	Average	Total	
Option value	0	0.4	0.04	203.8	0	3.8	0.6	46,020.1	46,223.9
Value left	0	0.8	0.07	346.5	0	4.4	0.8	61,202.6	61,549.0
Value exists	0	0.4	0.04	224.2	0	12.7	4.6	377,087.5	377,311.7

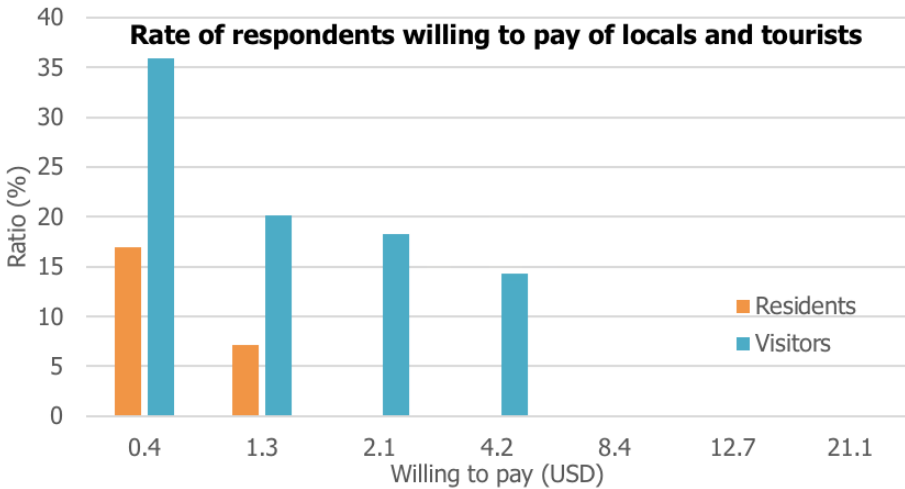
The results show that, for tourists willing to pay, the common amount is in the range of 0.4 to 4.2 USD. The value of existence is chosen the most, accounting for the largest amount of tourists' willingness to pay. Local people are the beneficiaries of the values that the cultural landscape brings, such as entertainment, tourism, aesthetics, culture, and spirit. However, only 24% of the respondents agreed to contribute money to the conservation fund, the most chosen reason being to preserve values for children and grandchildren. These people were aware of the importance of preserving the landscape and local ecosystem service values. They wished it would survive, develop, and pass it on to future generations.

Besides, some villagers replied that they did not want to contribute because they needed land sales and migration. This is understandable because, in some areas with difficult living conditions in developing countries, young people strongly desire to escape poverty and migrate to areas with better living conditions. This opens up opportunities to improve the quality of life for young people but also creates challenges when land is abandoned and long-standing farming traditions are lost. This shows that the local government needs to have appropriate solutions to improve the quality of life for people, encourage people to stay and grow rice through payments based on the value of ecosystem services, keep land, and maintain cultural values in these areas.

The correlation between the money level and the yes rate of the two groups of subjects above is shown in Figure 5. As the figures show, the payout rates, as a rule, are that the higher the amount, the lower the WTP percentage.

Figure 5

Rate of Respondents Willing to Pay of Locals and Tourists



Thus, the result of the evaluation of paddy ecosystem services in Hongthai is about 579,585.1 USD, including 29,146.9 USD in food security value, 65,353.6 USD in tourist landscape value, 46,223.9 USD in option value, 61,549.0 USD of value left; 377,311.7 USD of value exists. This result is at a lower level than other evaluation studies worldwide. The reason is that the value of rice grown in this area is low, and the awareness of people living in poor provinces in developing countries affects their answers about willingness to pay during the survey. At the same time, the economic value of paddy in other study areas is much higher than in Hongthai because rice in Hongthai mainly serves the purpose of food security and supply for the local people.

Results of ecosystem service valuation underscore the imperative for local government to formulate policies aimed at harnessing and leveraging ecosystem services to benefit the community, particularly in terms of food security and the inherent value of tourism landscapes. By judiciously tapping into this resource, local governments can effectively enhance the quality of life for residents inhabiting challenging mountainous regions within developing nations.

Conclusion

The paddy ecosystem in developing countries not only plays an important role in ensuring regional food security and protecting the environment but also in creating a landscape for ecotourism development and preserving the native cultural identity. In addition to the use value that the paddy ecosystem brings to people, like rice, it also provides many other non-use services, including regulatory, cultural, and support services. The results of the evaluation show that the total value of paddy eco-services in Hongthai is about 579,585.1 USD. To effectively use these ecosystem services, Dao Tien ethnic people need to propagate and raise awareness in maintaining, preserving, and promoting cultural and traditional values inherent in farming and the practice of providing tourist services to meet market needs.

Also, local governments should have policies to encourage businesses to develop agriculture or ecotourism services to explore available ecosystem services. Besides, policies encourage people to

maintain paddy farming activities through ecological compensation payments equivalent to the value of the services provided by the paddy ecosystem. Valuing ecosystem services can guide policymakers in developing appropriate legal frameworks and supporting policies to conserve wet rice ecosystems through their services. Supporting ecological compensation is important in promoting agricultural biodiversity conservation, maintaining regional landscapes, and preventing rice land conversion.

The results provide a theoretical and practical basis for the process of evaluating the effectiveness of investment programs and projects for economic and social development and ecotourism activities in poor provinces in developing countries. At the same time, it recommends and orients the agricultural development activities of local people in the direction of improving the efficiency of exploiting the available eco-services, maintaining food security, and developing tourism associated with preserving indigenous culture.

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Conflict of Interest Statement

I have no conflict of interest to disclose.

AI Disclosure

I declare that this manuscript was prepared without the assistance of artificial intelligence. Hence, the content of this paper is original.

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