

# Assessment Paddy Rice Ecosystem Services on Awareness and Satisfaction Level of Local People In Hongthai, Vietnam

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## Abstracts

The paddy fields in Hongthai is considered as one of the most beautiful terraced fields in the Northeast of Vietnam. However, the efficiency of use of paddy rice ecosystem services here is still limited. The study was conducted to assess farmers' awareness and satisfaction level of the paddy rice ecosystem services in Hongthai by using questionnaire survey. The results show that the paddy rice ecosystem provides many services to the farmers, specifically 12 non-market services, in which the majority of farmers clearly identify regulating services such as groundwater replenishment, flood prevention and soil erosion control. Also, although income from tourism is still low, most farmers in Hongthai are aware of the importance of cultural services such as tourist landscapes and culture. However, for other regulating and supporting services, farmers' awareness is still limited. The satisfaction level of farmers in Hongthai with the paddy rice ecosystem services is still low (2.7/10). The reason is explained by the limited awareness of the ethnic people and the local government have not yet exploited and used the non-market ecosystem service values to bring benefits. In the future, it is necessary to actively propagate and raise farmers' awareness about paddy rice ecosystem services and value non-market ecosystem services to provide a scientific basis for policy makers. The appropriate legal framework and supporting policies need to be developed for the conservation of paddy rice ecosystem through the services it provides.

**Keywords:** awareness assessment, satisfaction level, paddy ecosystem services, non-market services.

## Introduction

Ecosystem services (ES) are the direct or indirect contributions of ecosystems to human well-being (TEBB, 2010). P. Chivenge classifies rice-growing ecosystem services into three groups: (1) provisioning, (2) regulating and maintenance and (3) cultural (P. Chivenge, et al., 2020). The Millennium Ecosystem Assessment's classification system has an additional category of support services, whereby eco-services can be classified into four categories: provisioning, regulating, cultural and supporting (Millennium Ecosystem Assessment, 2005). This is a classification that is consistent with the approach of the study and the authors used the MEA classification approach to conduct this study.

Developing sustainable agriculture in ecologically fragile areas is important (Duan Liu., et al., 2020). The agricultural ecosystem in general and the wet rice ecosystem in particular are extremely important in ensuring food security and socio-economic development for agriculturally developed countries (P. Chivenge, et al., 2020). Traditional rice production has shaped distinctive cultural landscapes in Southeast Asia. Rice cultivation is closely linked to socio-culture and has created specific agrobiodiversity (Vera Tekken, et al., 2017). Although Vietnam has become the third largest rice exporter in the world, hunger is still challenging managers in many provinces, especially the mountainous provinces of northern Vietnam. Contrary to financial returns, the official rice supply chains have recently failed to provide enough food for all the people in these provinces (Kinh Bac Dang, et al., 2020). Ecosystem services need to be recognized and evaluated through farmers' awareness and farmers should be duly recognized and paid for the invisible fruits of their toil (Shenaz Rasheed, et al., 2021).

Tuyenquang is a mountainous province with a large number of ethnic minorities with a long history and diverse unique cultural identity (Chinh Nguyen Mai, 2022). The cultivation of wet rice on terraces is a wonderful creative work of the Dao Tien ethnic group (more than 90% of population) in the Hongthai highland

commune, Tuyenquang province, located at an altitude of 1,287m above sea level and is rated as a one of the most beautiful paddy in the Northeast of Vietnam. Terraced fields in the pouring water season and the ripe rice season have been one of the unique tourism products, attracting thousands of domestic and foreign tourists to visit and experience. In 2021, the whole Hongthai commune has 80,3 hectares of paddy, from then for productivity of 80.3 hectares of land for crop rice, 49.6 hectares of land for spring rice (People's Committee of Nahang district, 2019, People's Committee of Nahang district, 2021). Paddy fields distributed along the inter-commune road and around the central area the commune. With the available potential, Hongthai commune can multi-purpose use of the paddy rice ecosystem to maintain food security and develop eco-tourism according to the needs of the local community with sustainable direction. However, at present, the exploitation of the paddy rice eco-services in Hongthai has not been effective compared to the potential that nature offers. Production and service activities on the paddy rice ecosystem here are still carried out according to the traditional method and there is no innovation in the exploitation of non-use values.

Farmers' awareness of ecosystem services plays an important role in the effective use and optimization of policies (Smith H.F., et al., 2014). Increasing awareness of the importance of ecosystem services is needed to increase farmers' enthusiasm for environmental protection (X.C. Cao, et al., 2011, Fangfang Xun, et al., 2017). Many researchers have used questionnaire survey to study the awareness of farmers in different areas (J.; Shu He, X.B.; Yu, X.B. , 2010, Shenaz Rasheed, et al., 2021, Yuehan Dou, et al., 2022, Xin Yang, et al., 2022). The study was undertaken in Hongthai, Vietnam to assess the farmers' awareness of the paddy rice ecosystem as well as the non-market ecosystem services provided from paddy rice cultivation. Thereby, supporting the improvement of farmers' awareness, protect and develop non-market ecosystem services of paddy rice in Hongthai in the future.

## Materials and methods

The study used the questionnaire survey method. The survey data were conducted by directly interviewing 126 farmers with at least 5 years' experience in rice and pear cultivation in Hongthai, Vietnam. The interviews began with an introduction to the ecosystem, its services and the purpose of the study. The questionnaire is designed with many consecutive questions. At each household, interviews were conducted according to a prepared questionnaire with 3 main contents: (1) General information (age, gender, education level, time living in the locality, main occupation, income level dependent on paddy rice); (2) The level of farmers' awareness about non-market paddy rice ecosystem services; (3) Satisfaction with the non-market paddy rice ecosystem services of the farmers. These values are all evaluated in ascending order of importance, some questions on cognitive assessment are designed on a 3-point Likert scale and a 10-point satisfaction rating scale. Each interview lasted about 45–50 minutes.



Figure 1. Study area.

The mathematical statistical method is used to process quantitative information obtained by SPSS. Statistics on frequency of non-market ecosystem services being surveyed in local households according to each group of questions to assess the level of awareness. Then, the total score of non-market ecosystem services in the study area is calculated as assessed by people in a 10-point satisfaction scale.

## Results and Discussion

### Socioeconomic profile of paddy farmers of Hongthai

Among 126 farmers surveyed at Hongthai (50% cultivated rice, 50% pear), those growing pear had higher education level. Among social groups, majority belonged to the Dao Tien ethnic group who had been growing paddy since generations. Farmers of Hongthai cultivate paddy for self-consumption, as part of tradition and for conservation. Farmers said that because of assured food and income even during calamities such as floods.

Table 1. Socio-economic profile of paddy farmers of Hongthai.

Particulars		Quantity	Ratio (%)
I. Farmer cultivated rice			
1. Gender	Male	49	78
	Famale	14	22
	Sum	63	100
2. Age	< 20 yrs	0	0
	21-50 yrs	26	41
	51-65 yrs	37	59
	> 65 yrs	0	0
	Sum	63	100
3. Village	Khuay Phay	17	27
	Na Kiem	21	33
	Ban Muong	19	30
	Khau Trang	6	10
	Sum	63	100
II. Farmer cultivated pear			
1. Gender	Male	42	67
	Famale	21	33
	Sum	63	100
2. Age	< 20 yrs	0	0
	21-50 yrs	27	43
	51-65 yrs	35	56
	> 65 yrs	1	2
	Sum	63	100
3. Village	Khuay Phay	16	25
	Na Kiem	17	27
	Ban Muong	12	19
	Khau Trang	18	29
	Sum	63	100

### Paddy rice ecosystem services awareness and perception

There are 12 services listed by farmers as a function of the paddy rice ecosystem, most farmers choose groundwater replenishment service, followed by flood mitigation and soil erosion control (Figure 2). Groundwater replenishment as a function of paddy rice ecosystem services was listed by 35.1% of farmers and approved by 91% of farmers. Flood mitigation as a function of paddy rice ecosystem was listed by 21.5% and perceived by 89% of farmers in Hongthai. Preventing soil erosion as a function of paddy rice ecosystem services was listed by 17.2% of farmers and agreed by 81%. The intensity of landslides is said to have increased in Hongthai and 81% of the farmers surveyed are aware of this. They answered that the area of

paddy fields is shrinking, due to people selling their land to migrate or sell and conversion of land use purposes (Figure 4).

The majority of farmers in Hongthai are aware of the importance of landscape tourism and culture as a service of the paddy rice ecosystem. In particular, farmers believe that paddy rice can be processed into a variety of dishes and used in special occasions such as festivals, weddings, funerals, in which there are many dishes with the characteristics of Dao Tien ethnic group, one of Vietnam indigenous people. Culture is listed as a paddy rice ecosystem service by 15.9% and 88% agreed. Terraced fields in Hongthai are considered to have great potential in developing eco-tourism and raising income for farmers. Therefore, tourism landscape ecosystem services are listed by 16.8% and 89% of farmers agreed (Figure 2, 3).

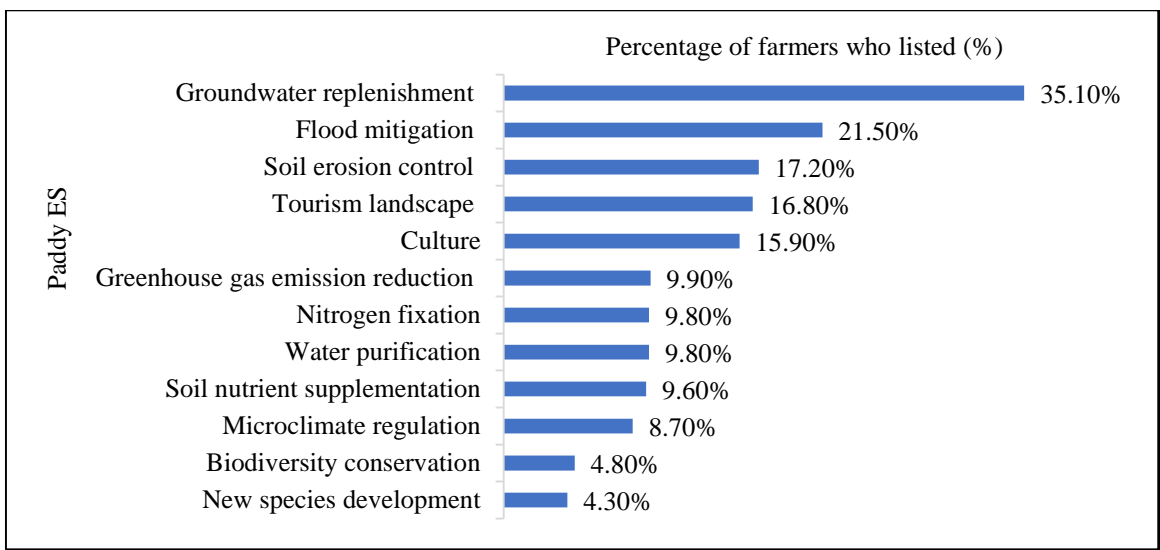


Figure 2. Farmers' awareness of paddy ES.

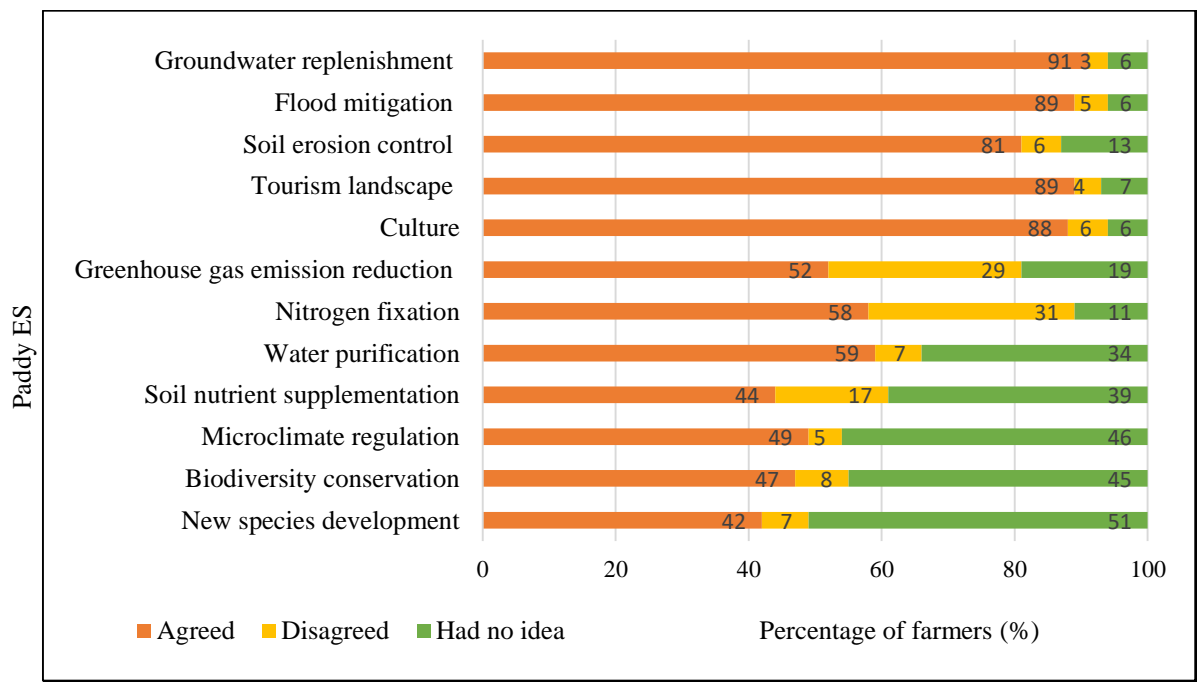


Figure 3. Farmers' perception of non-marketed paddy ES.

The remaining 7 ecosystem services such as new species development, biodiversity conservation, microclimate regulation, soil nutrient supplementation, water purification, nitrogen fixation, and greenhouse gas emission reduction are also listed with the rate of less than 10% and less than 60% of the farmers agreed. This shows that farmers' awareness about paddy rice ecosystem services is low. This is understandable when the cultural level of the respondents is mostly at high school level (over 60%). The majority of farmers in Hongthai are elderly (over 50%), have experience in farming, but their awareness and understanding of the ecosystem services is still limited. When asked about maintaining and developing rice farming, most of the respondents answered that they wanted their children go to the city to study and earn a living, the benefit from



selling rice is low, and ecosystem services such as culture and tourism landscape are currently provided free of charge, they do not get benefit from this activity.

When asked about the need to change land use purpose, more than 21% of farmers answered that they have a need. These farmers responded that they wanted to sell land and migrated to other places for economic development and to avoid extreme weather events. However, most farmers in Hongthai are aware that the shrinking of rice fields has contributed to the severity of natural disasters in the area (Figure 4).

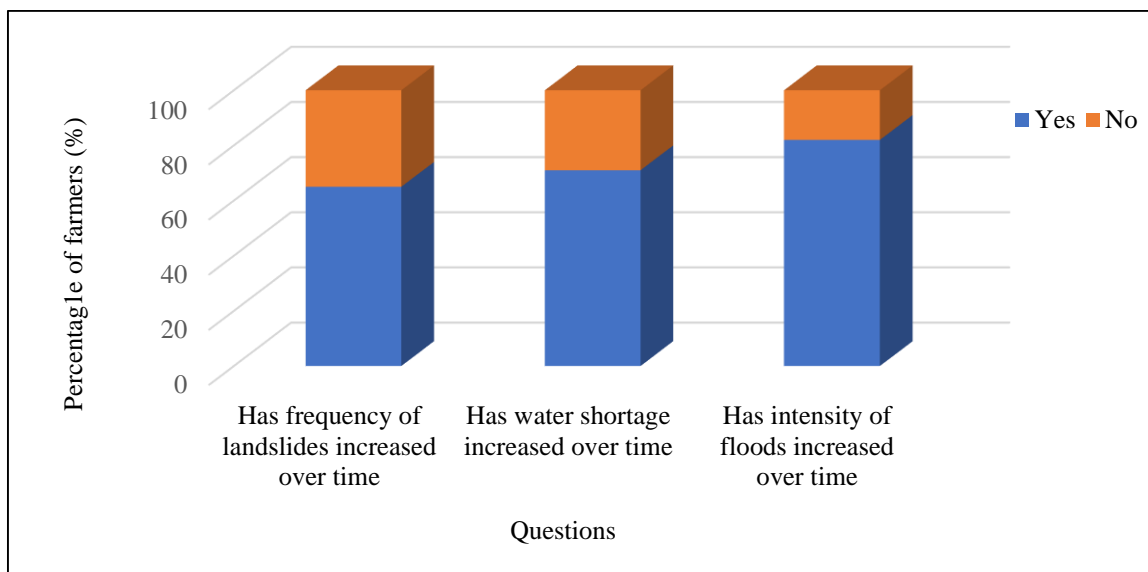


Figure 4. Farmers' perception of paddy land conversion effects.

### **Paddy rice ecosystem services on awareness and satisfaction level of farmers in Hongthai, Vietnam**

Satisfaction level of paddy rice ecosystem services is rated by the farmers on a 10-point scale (Figure 5). The results show that the group of cultural services is evaluated fairly evenly between 3.2 and 3.5 points, showing that tourism development and preservation of cultural values is being concerned and promoted. In the group of regulating and maintenance services, groundwater replenishment is rated at the highest level (4.8 points), followed by flood mitigation (4.1 points), soil erosion control (3.9 points), microclimate regulation (2.7 points), water purification (2.6 points), nitrogen fixation (1.7 points), greenhouse gas emission reduction (1.2 points). This shows that farmers are more interested and satisfied with regulation services that are beneficial to their living and farming activities such as supplementing groundwater sources and preventing natural disasters than other regulatory services. Due to the limitations of traditional farming methods of the ethnic farmers, the group of support services is rated relatively low, such as soil nutrient supplementation (2.7 points), biodiversity conservation (1, 3 points), new species development (1.1 points). Thus, the average result of farmers' satisfaction in Hongthai with the paddy rice ecosystem services is 2.7/10, which is still low.

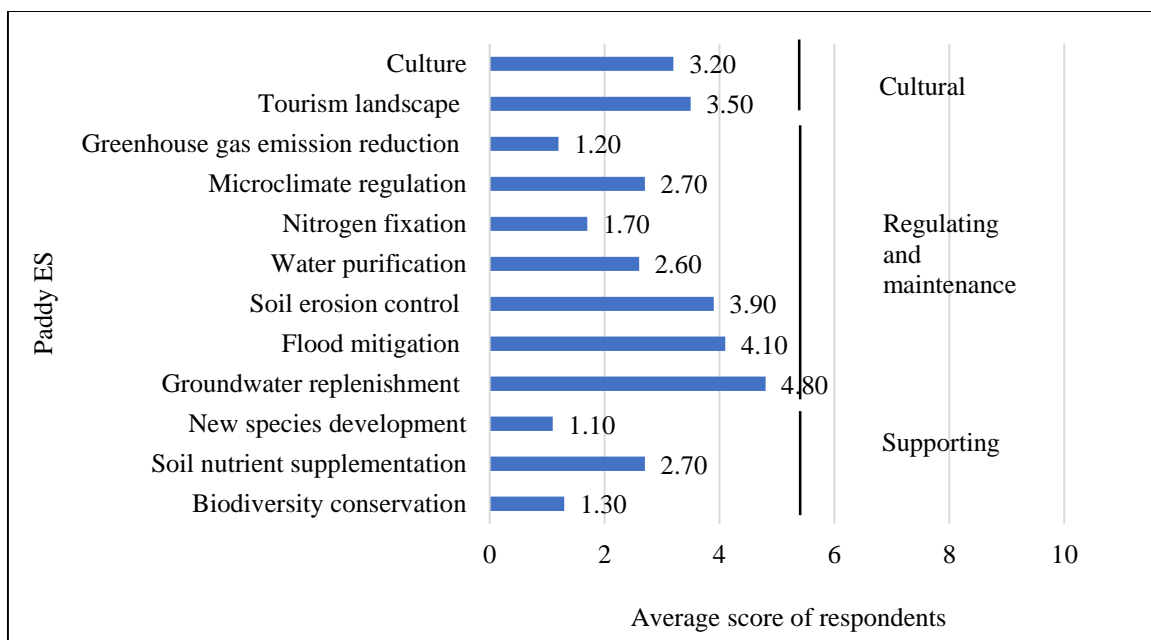


Figure 5. Average score of non-marketed paddy ES (10-point scale).

## Conclusions

From the statistical results, it can be seen that the frequency of ecosystem services identified by farmers has shown that terraces are an ecosystem that provides many services to people (12 non-market services). Most farmers clearly identify regulatory services such as groundwater replenishment, flood mitigation and soil erosion control. Also, although income from tourism is still not high, most farmers in Hongthai are aware of the importance of cultural services such as tourist landscapes and culture. However, for other support and regulatory services, farmers' awareness is still limited. This can be explained by the fact that the cultural level of the Dao Tien ethnic people is still at the high school level, the number of vocational trained level is still very low.

The results of the assessment of satisfaction level of the paddy rice ecosystem services show that the group of cultural services and the three regulatory services (including soil erosion control, flood mitigation, groundwater replenishment) are evaluated higher and more uniform than other services. The results of the overall assessment of farmers' satisfaction in Hongthai with the non-market ES of the terraced fields are still at a low level (2.7/10). The reason is explained that farmers' awareness of ecosystem services is still limited and the local government has not yet exploited and used the value of ecosystem services to get benefit. This is reflected in more than 21% of people wishing to migrate or sell land.

The paddy rice ecosystem in Hongthai not only plays an important role in ensuring regional food security, but also creating a landscape for ecotourism development and preserving native cultural identity. The paddy rice ecosystem provides many non-market services including regulatory, culture and support. In order to effectively exploit and use these ecosystem services, the Dao Tien ethnic people need to be propagated and raised awareness in maintaining, preserving and promoting cultural and traditional values inherent cultivation as well as practice of providing tourist services to meet the needs of the market.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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