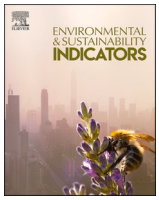
Environmental and Sustainability Indicators 28 (2025) 101038

Contents lists available at ScienceDirect

Environmental and Sustainability Indicators

journal homepage: www.sciencedirect.com/journal/environmental-and-sustainability-indicators



Motivational indicators for local participation in forest protection under Vietnam's payment for forest environmental services

Ha Thi Thu Le [a,b,*], Hitoshi Shinjo [a]

[a] Graduate School of Global Environmental Studies, Kyoto University, 606-8501, Kyoto, Japan
[b] Faculty of Forestry, University of Agriculture and Forestry, Hue University, 49000, Hue, Viet Nam

ARTICLE INFO

Keywords:
Motivational indicators
Intrinsic and extrinsic motivation
Forest protection
PFES
Community participation
Vietnam

ABSTRACT

This study developed and applied a set of motivational indicators to examine the drivers of local participation in forest protection under Vietnam's Payment for Forest Environmental Services (PFES) policy. A literature review identified key motivational factors, followed by a preliminary study and a semi-structured survey involving 243 households across three buffer-zone communes of the Phong Dien Nature Reserve. Participants were grouped into Forest Protection Groups (FPGs) and non-Forest Protection Groups (N-FPGs) based on their conservation involvement. Motivations were categorized as intrinsic (social and environmental) or extrinsic (economic and legal) and were measured using Likert-scale ratings. Data were analyzed using logistic and multiple regression models. Intrinsic motivations, particularly environmental values and cultural responsibility, were the strongest and most enduring drivers. Extrinsic motivations, especially financial incentives, were more evident among N-FPG households, reflecting their role in attracting initial involvement, while legal compliance was the weakest. Education enhanced recognition of environmental and social values as well as legal awareness, and lower-income households were more responsive to financial incentives. Participation in FPGs further strengthened environmental awareness through repeated engagement and peer learning. Willingness to join forest patrolling among N-FPG households was significantly associated with PFES satisfaction, education, and ethnicity. Overall, the study highlights that PFES should not be seen solely as a financial mechanism but as a culturally embedded and trust-based governance tool. Framing payments as collective recognition of community stewardship, combined with efforts to improve fairness, transparency, and youth engagement, can foster long-term participation and support resilient community forest governance.

1. Introduction

Losses and degradation of natural habitats have motivated biodiversity conservation efforts in agricultural landscapes (Pagiola et al., 2004). Payments for Ecosystem Services (PES) programs have been implemented globally to preserve and restore ecosystems while balancing conservation outcomes with equitable benefit distribution for local communities (Chu et al., 2019; Mayrand and Paquin, 2004; Wunder, 2005).

In Vietnam, the Payment for Forest Environmental Services (PFES) was initiated in 2008 and rolled out nationwide in 2011 (McElwee et al., 2014). Unlike some PES models emphasizing voluntary participation and conditional payments based on environmental outcomes (Wunder, 2005), PFES is legally mandated (Loft et al., 2019; McElwee et al., 2019; Suhardiman et al., 2013). Ecosystem service users, such as hydropower plants, water utilities, industrial facilities, and tourism companies, are required to pay financial contributions, functioning as a levy on water and hydropower consumption borne by end-users (Chu et al., 2019).

PFES payments are allocated to villagers or community groups responsible for forest protection and are treated as income (Pham et al., 2013). In essence, these payments compensate local people for their labor, while land and forest remain under state ownership (Chu et al., 2019). Villagers may collect non-timber forest products or grow shade-tolerant crops under the canopy (Decision 178/2001/QĐ-TTg), but are prohibited from timber harvesting or converting forestland (Decree 99/2010/NĐ-CP, Article 20). Violations such as illegal logging may incur fines up to 200 million VND per cubic meter (Decree 157/2013/NĐ-CP, Article 12) and be subject to criminal prosecution (Article 7). Failure to fulfill forest protection responsibilities is also punishable (Decree 15/2013/CP, Article 15) (Chu et al., 2019).

* Corresponding author. Graduate School of Global Environmental Studies, Kyoto University, 606-8501, Kyoto, Japan.
E-mail addresses: lethithuha@hueuni.edu.vn (H.T.T. Le), shinjo.hitoshi.4x@kyoto-u.ac.jp (H. Shinjo).

https://doi.org/10.1016/j.indic.2025.101038
Received 18 June 2025; Received in revised form 20 October 2025; Accepted 13 November 2025
Available online 14 November 2025

Vietnam's forest policies have evolved from centralized management by state forestry enterprises in the 1970s, to household land allocation in the 1990s, and adoption of community forestry in the 2000s (Bayrak, 2019; Suhardiman et al., 2013). The government integrated compensation schemes into natural resource management, leading to the development of PFES, which supports both household-level and collective forest protection (Nguyen et al., 2022).

In Vietnam, PFES was inherited from previous community forest management models (Nguyen et al., 2022), including communities with forest land titles using customary management; household groups (kin, clan, or neighborhood-based) with shared titles; individual households with land use rights; and sub-contracts for forest protection on behalf of state forest owners.

Previously, forest protection policies were constrained by the absence of financial mechanisms to support local actors (Suhardiman et al., 2013). Although local authorities managed forests, policies lacked funds or tools to establish income-generating forest institutions (Forest Sector Monitoring Information System, 2010). Prior to PFES, forest patrol groups operated with limited and unstable financial support (Duong and De Groot, 2020). PFES has strengthened these groups, attracting more participants and improving selection procedures, notably in Dien Bien province (Duong and De Groot, 2020).

Recently, community participation in forest management has gained recognition as more effective than top-down conservation (Coulibaly-Lingani et al., 2011). PFES not only improves governance but also enhances social cohesion and brings economic benefits to communities (Nguyen et al., 2022). However, factors such as assets, economic returns, culture, trust, and social capital influence involvement (Nguyen et al., 2022).

In addition to financial incentives (Fisher, 2012; Suhardiman et al., 2013; Wunder, 2008), non-monetary drivers also play key roles in participation decisions (Bottazzi et al., 2018; Bremer et al., 2014; Fisher, 2012; Hayes, 2012; Kosoy et al., 2008; Le et al., 2023; Van Hecken et al., 2012). These motivations often stem from individuals' desire to conserve natural resources and uphold cultural or spiritual values. In Mexico, participation in PES has been associated with the protection of forests, water sources, and sacred or culturally significant sites, with some communities even maintaining forest areas without any external financial support (Figueroa et al., 2016). In Nepal, intergenerational responsibility and respect for the efforts of ancestors have served as important foundations for sustaining long-term conservation commitments (Kimengsi et al., 2019). Similarly, a study by Maleknia (2025) on urban forests in Iran revealed that individuals who perceive forests as essential for air purification, mental well-being, and social cohesion are more likely to support forest conservation initiatives. These non-monetary motivations can interact with financial incentives, sometimes reinforcing (crowding-in) or undermining (crowding-out) them, depending on the social and institutional context (Kaczan et al., 2019). Understanding these drivers is essential for designing effective, context-appropriate management strategies (Coulibaly-Lingani et al., 2011; Dolisca et al., 2006; Soe and Yeo-Chang, 2019).

While several studies assessed PFES impacts on livelihoods in Vietnam (Do and NaRanong, 2019; Le et al., 2023; Nguyen et al., 2021; Pham et al., 2020; Tran et al., 2019), few have examined the underlying motivations behind local participation. Nguyen et al. (2024) highlighted social networks under PFES in enhancing forest value awareness and shaping conservation behavior in Northwest Vietnam; however, these findings are context-specific and not readily generalizable. Likewise, Le et al. (2023) highlighted social responsibility and appreciation for nature as key motivations for community participation in a mountainous commune of Thua Thien Hue. However, their conclusions were derived from a small, single-site sample, and the identified non-material drivers were not subject to quantitative testing or cross-domain analysis. Therefore, a comprehensive understanding of the motivations underlying participation across diverse community groups remains limited.

Building on this gap, this study hypothesizes that both intrinsic and extrinsic factors influence household decisions to engage in forest protection, and that perceptions of PFES impacts differ between members of Forest Protection Groups (FPGs) and non-Forest Protection Groups (N-FPGs) due to differences in roles, access to information, and benefit-sharing mechanisms.

To empirically examine these hypotheses, the study investigates motivational drivers of participation under the PFES scheme, with particular attention to variations between FPG and N-FPG households across communities. The specific objectives are to:

(i) develop and apply structured motivational indicators to classify participation drivers;
(ii) compare motivational patterns and PFES-related perceptions across FPG and non-FPG households; and
(iii) examine how sociodemographic attributes and PFES experiences influence both motivational domains and willingness to be engaged in forest protection.

By conceptualizing motivations as measurable indicators, the study introduces an indicator-based analytical framework for quantifying behavioral drivers. This approach contributes to the development of evidence-informed, context-sensitive PFES interventions that promote sustained community engagement and the long-term sustainability of forest ecosystem management.

2. Conceptual framework

Motivation plays a critical role in shaping human behavior (Thirupathy and Kannan, 2020), including participation in forest conservation. While definitions vary, it is generally viewed as a psychological process that initiates and sustains goal-directed actions (Kamaraij et al., 2019; Schunk et al., 2014; Weiner, 2013). Sudakov (2006) further emphasizes its influence on decision-making and cognition. This study adopts Self-Determination Theory (SDT) to classify motivation into two domains: intrinsic motivation, which arises from internal values and personal satisfaction, and extrinsic motivation, which is driven by external rewards or social and institutional pressures (Ryan and Deci, 2000).

Intrinsic motivation is fostered when basic psychological needs for autonomy, competence, and relatedness are fulfilled, leading to voluntary and sustained behavior. In the context of forest conservation, intrinsic motivation is nurtured by deep emotional connections with nature, cultural and spiritual attachments to forests (Kosoy et al., 2008; Sood and Dhyani, 2024), and the recognition of the long-term benefits and values of forests (Lovrić et al., 2025; Nunez Godoy et al., 2022). By contrast, extrinsic motivation stems from incentives such as financial payments (De Martino et al., 2017; Figueroa et al., 2016; Isyaku, 2021; Sommerville et al., 2010), legal regulations, or social expectations. PES schemes, including PFES in Vietnam, aim to strengthen this motivation through compensation for conservation efforts. Legal instruments such as logging bans and land-use restrictions further reinforce compliance (McElwee et al., 2014; To, 2015).

To capture broader institutional influences, the study integrates Ostrom's Institutional Analysis and Development (IAD) framework, which emphasizes the role of individual attributes, institutional rules, and external conditions in shaping collective behavior (Ostrom, 1990). Accordingly, the conceptual framework links motivational domains with socio-demographic and contextual variables such as gender, income, landholding, group participation, and satisfaction with PFES (Basu, 2021; Coulibaly-Lingani et al., 2011; Dolisca et al., 2006; Maskey et al., 2006; Soe and Yeo-Chang, 2019).

Fig. 1 presents the conceptual framework employed in this study. It illustrates the hypothesized relationships between socio-demographic and institutional factors, types of motivation (economic, social, environmental, and legal), and household willingness to participate in forest protection. These motivational domains were transformed into

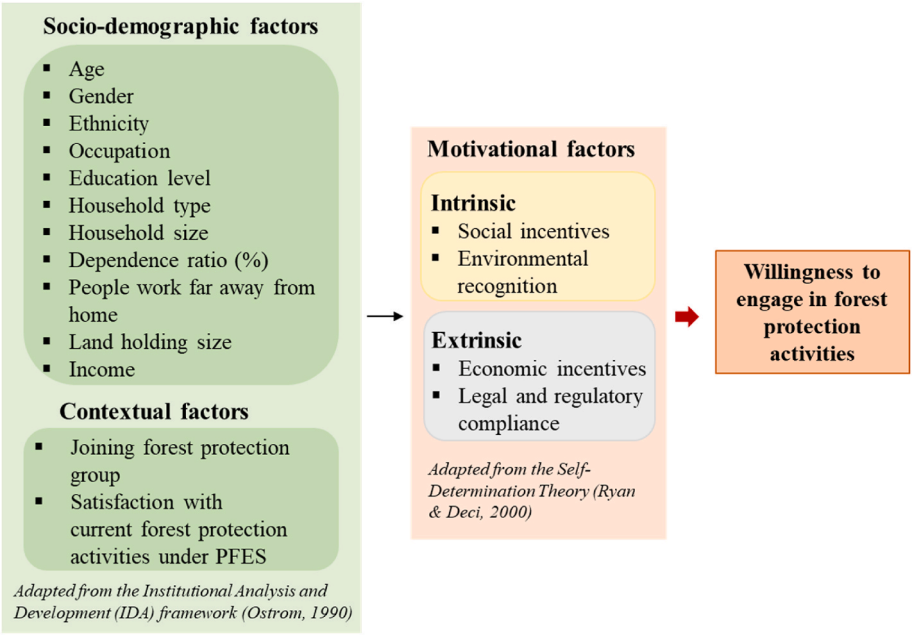


Fig. 1. Conceptual framework for examining households' willingness to engage in forest protection activities.
Source: Adapted from (Ostrom, 1990; Ryan and Deci, 2000)

measurable indicators, allowing for their empirical evaluation through household survey data. The conceptual model not only informed questionnaire design but also provided an analytical basis for identifying key motivational levers for strengthening community-based forest governance under PFES.

3. Materials and methods

3.1. Study sites

This study was conducted in Phong Dien Nature Reserve (Phong Dien NR) and its buffer zone communes: Phong My, Trung Son, and Hong Kim. The sites were selected to represent diverse ecological and socio-economic conditions and to reflect the active implementation of the PFES policy, thereby ensuring representativeness for analyzing factors influencing local participation in forest protection among both FPGs and N-FPGs.

Phong Dien NR is one of the largest nature reserves in Thua Thien Hue province, central Vietnam, covering approximately 40,814 ha (Phong Dien NR office, 2020). It lies between 107°03′–107°20′ E and 16°17′–16°35′ N, bordering Quang Tri province to the north and west (Fig. 2). While the reserve itself has no settlements, its buffer zone includes seven communes across Phong Dien and A Luoi districts, with nearly 33,000 residents in 8789 households, most living east of the reserve where farmland is more accessible (Phong Dien NR office, 2020). As part of the Central Truong Son Priority Landscape, the reserve harbors rich biodiversity and threatened lowland evergreen forests (Nguyen and Hardcastle, 2003). However, conservation efforts face pressures from agriculture, illegal hunting, logging, and mining (Tuan et al., 2017), highlighting the relevance of PFES support mechanisms.

Among the buffer-zone communes, Phong My (Phong Dien district), predominantly Kinh, manages nearly 2000 ha of community forest and, since 2021, also co-manages over 2600 ha of forest under subcontract agreements with Phong Dien NR (Table 1). Trung Son and Hong Kim (A Luoi district) are inhabited mainly by the Paco and other minorities, including the Kotu, Ta-Oi, and Van Kieu. Trung Son manages the largest PFES area (over 3700 ha) through community, household, and individual models (Table 1). In contrast, Hong Kim has only about 400 ha under community models (Table 1), where non-financial incentives significantly influence participation (Le et al., 2023).

This study focuses on individual members of community forest patrol groups in the three communes to ensure consistency in comparisons, as other PFES models are absent in Hong Kim.

3.2. Data collection

Both primary and secondary data were used to investigate drivers of community engagement in forest protection. A literature review was conducted using the keyword "motivation in forest management" to identify key incentives. Findings were categorized into economic, social, environmental, and legal motivations.

Based on the conceptual framework, an initial list of internal and external motivations was developed, followed by the design of a questionnaire. A preliminary study was conducted in August 2023 with ten individuals (five FPGs and five N-FPGs) from Ha Long village, Phong My commune, who also served as key informants for the main survey.

The preliminary survey focused on two main questions: Which factors from the predefined list do households agree influence community motivation for forest protection? Are there any additional motivations not listed in the questionnaire? This step aimed to confirm agreement with predefined motivations and identify others. A Likert scale was used to assess levels of agreement. Results informed revisions to improve the questionnaire's clarity and relevance.

The main survey employed a semi-structured questionnaire and was conducted in three buffer-zone communes of Phong Dien Nature Reserve: Phong My, Trung Son, and Hong Kim. Six villages were selected: Ha Long and Tan My (Phong My), Ta Ay Ta and Dut Le Trieng II (Trung Son), and A Tia 2 and Dut 1 (Hong Kim), with a total of 243 households surveyed (83 in Phong My, and 80 each in the other two). The sample size was calculated using Slovin's formula (Ellen, 2020):

$n = N/(1 + Ne^2)$, where N is the population, n is the required sample size, and e is the margin of error (generally set at 10 %).

A simple random sampling method was applied using household lists provided by local authorities, ensuring equal selection probability and minimizing selection bias (Thirupathy and Kannan, 2020).

Households were classified into two groups based on self-reported forest protection participation: FPGs (n = 144) and N-FPGs (n = 99). Participation included activities such as patrolling, attending meetings,

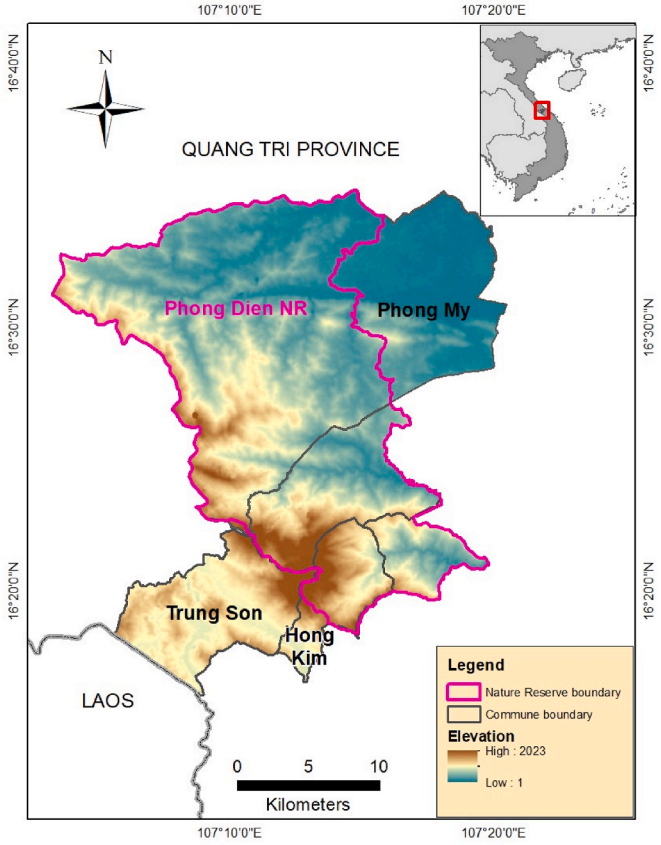


Fig. 2. The study sites (Phong Dien Nature Reserve and three selected buffer zone communes).
Note: At the time of the surveys, Phong My, Trung Son, and Hong Kim were independent communes under Phong Dien and A Luoi districts. Following Vietnam's nationwide administrative restructuring on July 1, 2025 (Resolution No. 1675/NQ-UBTVQH15), Phong My was merged with two other communes to form Phong Dien ward, while Trung Son and Hong Kim were merged with two other communes to create A Luoi 1 commune. For consistency with the administrative context at the time of data collection, this study retains the former commune names and original maps.
*Source:*AW3D30, 2025

Table 1
Characteristic of the study sites (buffer zone communes).

No.	Categories	Phong My commune	Trung Son commune	Hong Kim commune
1	Total area (ha)	39,361.06	7822.81	4089
2	Total population (people)	5472	3295	2127
3	Total household	1671	919	600
4	Ethnic minorities	Kinh (90 %), others: Pahy, Van Kieu, Paco, Kotu, …	Paco (95 %), Others: Kotu, Taoi, Kinh, Pahy, Van Kieu, Muong, …	Paco (85 %), Others: Kotu, Taoi, Kinh, Van Kieu, Muong, …
5	Natural forest area (ha)	27,811.47	5116.4	3442.5
6	PFES area (ha)	1920.64	3721.04	403.51
7	Sub-contract to protect the forest of Phong Dien NR (ha)	2612.26		

Source: Phong Dien NR office, 2020

Table 2
The basic information of interviewees in study sites.

Village	Commune	The number of household interviewees by groups
Ha Long (N = 120) Tan My (N = 378) TaAy Ta (N = 225) Dut Le Trieng II (N = 186)	Phong My (N = 498; n = 83) Trung Son (N = 411; n = 80)	FPGs (n = 60) N-FPGs (n = 23) FPGs (n = 42) N-FPGs (n = 38)
A Tia 2 (N = 185) Dut 1 (N = 212)	Hong Kim (N = 397; n = 80)	FPGs (n = 42) N-FPGs (n = 38)
Total of interviewee	**n = 243**	**FPGs (n = 144); N-FPGs (n=99)**

or other conservation-related tasks. These groups were proportionally drawn from the total sample (Table 2).

The field survey was conducted over 50 days, from August to September 2023.

3.3. Measuring motivational indicators for forest protection

Based on the literature review and preliminary surveys, a set of motivational indicators was developed to represent both intrinsic and extrinsic drivers of forest protection. Each indicator was operationalized as a single-item measure, capturing a distinct motivational perception across four domains: social incentives (SI), environmental recognition (ER), economic incentives (EI), and legal and regulatory compliance (LRC). All indicators were measured using a five-point Likert scale (1 = strongly disagree to 5 = strongly agree) (Table 3).

In Table 3, SI1 and SI5 are intermediate motivations that can be seen as intrinsic or extrinsic depending on interpretation. This study treats both as intrinsic social motivations, as they are internally regulated and grounded in cultural and personal values. SI1 (the right to access forest and forest land) is viewed not as a legal right but as a belief rooted in tradition, subsistence needs, and emotional ties to place. It reflects behavior shaped by identity and cultural meaning, not external rules. SI5 (passing on land tenure to children or heirs) reflects intergenerational responsibility and a desire to preserve family legacy. Rather than stemming from legal obligation, this motivation arises from moral commitment, emotional bonds, and internalized values, aligning with intrinsic motivation as defined by self-determination theory. Both SI1 and SI5 are guided by internal drivers such as social identity and perceived responsibility, not external rewards or sanctions.

3.4. Statistical analysis

All statistical analyses were conducted using SPSS version 20. Descriptive statistics were used to summarize household characteristics and participation status in forest protection activities. As the motivational indicators and their aggregated domain scores did not meet the assumption of normality, non-parametric tests were applied. The Kruskal-Wallis H test was used to examine differences in socioeconomic characteristics among communes. The Mann-Whitney *U* test was used to examine differences in motivation scores between the two groups. Within each group, differences among the four motivational domains were examined using the Friedman test for related samples. When significant overall differences were detected, post-hoc pairwise comparisons were performed using the Wilcoxon signed-rank test with Bonferroni correction to identify which domains differed (Field, 2024).

To analyze factors influencing households' willingness to participate in forest protection, a binary logistic regression was applied (Hosmer Jr et al., 2013). The dependent variable was binary (1 = willing; 0 = not willing), with independent variables including demographic, socio-economic, and institutional characteristics described in Table 4.

Table 3
Name, abbreviations, and scales of motivational domains and indicators.

No	Dependent variable	Abbreviations	Likert scale	Findings from
I	**Intrinsic motivation: Social incentives**	**SI**		
I.1	Rights to access forest and forest land	SI1	[1–5]	Added by locals from preliminary surveys
I.2	Protect the cultural, traditional, and spiritual values of the community associated with forests	SI2	[1–5]	Hoang et al. (2021a); Ihemezie et al. (2021); Isyaku (2021); Mook et al. (2022)
I.3	Concern for future of next generation	SI3	[1–5]	Fisher (2012); Ihemezie et al. (2021); Kimengsi et al. (2019); Le et al. (2023)
I.4	Good relationship among forest patrolling members	SI4	[1–5]	Bremer et al. (2014); Hoang et al. (2021a); Isyaku (2021)
I.5	Pass land tenure to their children or other heirs	SI5	[1–5]	Mook et al. (2022); Tian and Pelkki (2021)
II	**Intrinsic motivation: Environmental recognition**	**ER**		
II.1	Protect forest to supply food and habitat for wildlife	ER1	[1–5]	Ihemezie et al. (2021); Isyaku (2021); Mook et al. (2022); Tian and Pelkki (2021)
II.2	Protect forest to preserve nature and biodiversity conservation	ER2	[1–5]	Tian and Pelkki (2021); Truong (2022)
II.3	Protect forest to maintain a good living environment for human lives	ER3	[1–5]	Isyaku (2021); Kimengsi et al. (2019)
II.4	Forest's role in water supply and water regulation	ER4	[1–5]	Bremer et al. (2014); Hoang et al. (2021a); Nguyen et al. (2024); Thoker et al. (2024); Truong (2022)
II.5	Forest's role in climate regulation	ER5	[1–5]	Fisher (2012); Ihemezie et al. (2021); Thoker et al. (2024)
II.6	Forest's role in limiting soil erosion and landslides	ER6	[1–5]	Fisher (2012); Hoang et al. (2021a); Nguyen et al. (2024); Thoker et al. (2024); Truong (2022)
III	**Extrinsic motivation: Economic incentives**	**EI**		
III.1	Receive remuneration for joining forest patrols to create additional household income	EI1	[1–5]	Coulibaly-Lingani et al. (2011); Hoang et al. (2021a), (2021b)
III.2	Get a higher income from the PFES payment compared to other livelihood sources	EI2	[1–5]	Added by locals from preliminary surveys
III.3	The PFES payment satisfies our household expense	EI3	[1–5]	Added by locals from preliminary surveys
III.4	To harvest NTFPs within permitted levels	EI4	[1–5]	Coulibaly-Lingani et al. (2011); Dolisca et al. (2006); Hoang et al. (2021b)
III.5	Logging is allowed with the approval of local authorities and forest ranger	EI5	[1–5]	Added by locals from preliminary surveys
III.6	Access to loans for other livelihood activities	EI6	[1–5]	Added by locals from preliminary surveys
III.7	Opportunity to earn extra income from other Livelihood activities such as community-based eco-tourism	EI7	[1–5]	Added by locals from preliminary surveys
III.8	Participate in projects and training courses on local community forestry development	EI8	[1–5]	Le et al. (2023)
IV	**Extrinsic motivation: Legal and regulatory compliance**	**LRC**		
IV.1	We have to fulfill mandatory work as agreed by local authorities and forest rangers	LRC1	[1–5]	Added by locals from preliminary surveys
IV.2	Because forest land cannot be converted to other land use under government law	LRC2	[1–5]	McElwee (2004)
IV.3	Involvement in the decision on forest monitoring and evaluation	LRC3	[1–5]	Coulibaly-Lingani et al. (2011)

Table 4
Explanatory variables used in logistic and multiple regression analyses.

Sociodemographic	Abbreviation	Description
Gender	GE	Binary: 1 (male); 0 (female)
Ethnicity	ETH	Binary: 1 (Ethnic minority); 0 (Kinh)
Occupation	OC	Binary: 1 (Farmer); 0 (Others)
Education level	EDU	Ordinal: 1 (Illiterate); 2 (Literate); 3 (Primary school); 4 (High school); 5 (Vocational school/ technical institute); 6 (University)
Household type	HT	Binary: 1 (Poor/near poor); 0 (Non-poor)
Household size	HS	Continuous
Dependence ratio (%)	DR	Continuous
People work far away from home	PWFAFH	Binary: 1 (Yes); 0 (No)
Total land area (m^2) (log)	TLA	Continuous
Average income per person per month (million VND)	AI	Continuous
Joining forest protection groups	JFPG	Binary: 1 (Yes); 0 (No)
Satisfaction with forest protection activities under PFES support	SWF	Ordinal: 1 (Extremely dissatisfied); 2 (Dissatisfied); 3 (Neutral); 4 (Satisfied); 5 (Extremely satisfied)

Among these, satisfaction with forest protection activities under PFES was measured using a five-point Likert scale (1 = strongly dissatisfied, 5 = strongly satisfied). The model is specified as follows:

$$\text{Logit}(P) = \ln\left(\frac{P}{1-P}\right) = \beta_0 + \beta_1 AG + \beta_2 GE + \beta_3 ETH + \beta_4 OC + \beta_5 EDU + \beta_6 HT + \beta_7 HS + \beta_8 DR + \beta_9 PWFAFH + \beta_{10} TLA + \beta_{11} AI + \beta_{12} SWF$$

Where P is the probability of willingness to participate, and βi are regression coefficients. Model fit was assessed using the Hosmer-Lemeshow test, and multicollinearity was evaluated via Variance Inflation Factors (VIF).

Multiple linear regression was also used to examine how socio-demographic and contextual variables influence motivational domains (SI, ER, EI, and LRC). Each domain served as a dependent variable in separate models:

$$\text{Factor}_i = \text{Constant} + \beta_1 AG + \beta_2 GE + \beta_3 ETH + \beta_4 OC + \beta_5 EDU + \beta_6 HT + \beta_7 HS + \beta_8 DR + \beta_9 PWFAFH + \beta_{10} TLA + \beta_{11} AI + \beta_{12} JFPG + \beta_{13} SWF + \varepsilon$$

Where Factor_i is represents the dependent variable corresponding to a specific motivational domain, and ε is the error term. Diagnostic tests confirmed that the assumptions of ordinary least squares (OLS),

including normality, linearity, homoscedasticity, and the absence of multicollinearity, were not violated (Porter and Gujarati, 2008).

4. Results

4.1. Historical development of community forest protection groups in the buffer zone of Phong Dien Nature Reserve

Following the Doi Moi policy (1986), forests in Phong Dien were managed by state-owned enterprises. The rediscovery of the endangered Edwards's pheasant (*Lophura edwardsi*) in 1996 highlighted the area's ecological value, leading to the establishment of Phong Dien NR in 2003 (Phong Dien NR office, 2020).

Logging was banned in the core zone, but restricted forest access in the buffer zone created tensions with local residents who depended on forest resources (Tuan et al., 2017). Excluding locals also increased risks of outside encroachment and weakened community monitoring (Boissière et al., 2009). To ease conflicts, Thua Thien Hue province pioneered forest land allocation to community groups and households from the early 2000s (Huy Tuan, 2006). In 2010, the provincial government issued (Decision No. 430, 2010), titled "Forest Allocation and Lease in TTH Province for the Period 2010–2014", to expand forest land allocation to eligible communities.

In practice, community forest allocation began earlier in some areas. In 2005, Phong My commune piloted a voluntary forest protection group of 30 households, though it lacked precise benefit-sharing mechanisms and external supervision. That same year, approximately 45 Paco households in Trung Son commune received forest land under the Biodiversity Conservation Corridor Project, with technical support to plant native tree species and non-timber forest products (NTFPs). In Hong Kim commune, forest allocation took place during 2006–2007 through donor-funded programs; however, formal FPGs were not officially established until 2013.

Initially, these FPGs were mobilized by village leaders and commune authorities. Participation was voluntary and unpaid, with limited technical support from local forestry officers. Due to constrained resources, group effectiveness remained low, with no formal patrol plans or operational procedures.

A significant turning point occurred in 2014 with PFES implementation across the three communes. PFES funding enabled communities to develop local regulations, internal spending mechanisms, and regular patrol routines. Members received training, payments, and forestry extension support. Participation motivation increased, attracting interest from non-members. However, limited community forest areas restricted group expansion, and new members had to meet health, commitment, and availability criteria for patrols.

These institutional changes provided an appropriate context for examining how individual motivations, both intrinsic and extrinsic, shape participation in forest protection under PFES.

4.2. Socio-demographic characteristics of household interviewees

Household survey results (Table 5) show that the average respondent age was 47.7 years, with Phong My significantly older than Trung Son and Hong Kim. Gender distribution varied, with males predominating in Phong My (74.7 %) and Hong Kim (61.3 %), while females were majority in Trung Son (55 %) (Table 6). Ethnic composition differed: Trung Son and Hong Kim were mainly Paco (93.8 % and 98.8 %), while Phong My included Kinh (55.4 %), Pahi (27.7 %), and Van Kieu (14.5 %). The Kinh are the majority ethnic group in Vietnam (approximately 85 % of the national population) (CIA factbook, 2025), while the others are recognized as ethnic minorities. Most Kinh households in Phong My migrated from lowland areas of Thua Thien Hue province to the upland region after 1975 under the government's New Economic Zones program (Chandola, 1977), which promoted resettlement to support agricultural and economic development. Agriculture was the main occupation (65.8 %), especially in Hong Kim (71.3 %), while non-agricultural work was more common in Phong My. Education levels were generally low, with illiteracy rates of 20 % and 25 % in Trung Son and Hong Kim respectively, in contrast to 62.7 % of respondents in Phong My who had completed at least lower secondary school. Households were categorized based on Vietnam's multidimensional poverty criteria (Decision No. 59/2015, 2015). In rural areas, a household is poor if monthly per capita income $\leq$700,000 VND or between 700,000 and 1,000,000 VND with deprivation in at least three of ten social indicators (e.g., education, health, housing). Near-poor households fall within the same income range but have fewer than three indicators. Poor and near-poor households were grouped and coded as 1, non-poor as 0 (Table 4). This binary coding enabled the calculation of a poverty index as the mean within each commune. Poverty rates varied significantly (Table 5), with Phong My lowest (0.1), lower than Trung Son (0.6) and Hong Kim (0.7). Average household sizes were 4.2 $\pm$ 1.2 in Phong My, 4.0 $\pm$ 1.3 in Trung Son, and 4.6 $\pm$ 1.4 in Hong Kim. Monthly per capita income differed significantly: Phong My was the highest (2.0 $\pm$ 1.4 million VND), then Hong Kim (1.5 $\pm$ 1.1 million), and Trung Son (1.1 $\pm$ 1.0 million) (Table 5). The highest proportion of households with members working away was in Hong Kim (32.5 %). Land ownership was most significant in Phong My (1.8 $\pm$ 2.8 ha) and smallest in Hong Kim (0.4 $\pm$ 0.5 ha). Participation in forest protection groups was highest in Phong My (72.3 %), versus 52.5 % in the other communes (Table 6).

4.3. Differences in motivational domains within and between FPG and willing N-FPG households

Among the 243 surveyed households, 40 respondents who explicitly stated that they did not wish to participate in forest protection activities (due to age, health conditions, or livelihood constraints) were excluded from the motivation analysis. Consequently, motivational domains were analyzed for 203 respondents, comprising 144 members of FPGs and 59 N-FPGs who expressed willingness to participate (Table 7).

Table 7 presents the mean Likert scores of motivational domains among FPGs and willing N-FPGs. For both FPGs and N-FPGs, intrinsic motivations (SI, ER) scored significantly higher than extrinsic motivations (EI, LRC) ($p < 0.05$). The Mann–Whitney *U* test results showed that FPG members were more motivated by environmental recognition (ER), while N-FPGs were more influenced by external economic incentives (EI). No significant differences were found in SI and LRC between the two groups.

4.4. Factors related to motivational dimensions

Regression results (Table 8) indicated that ten out of thirteen socio-demographic and institutional factors influenced the four motivational domains for forest protection. Multicollinearity diagnostics, examined through variance inflation factors, confirmed that no multicollinearity was present (all VIF <10) (O'brien, 2007). The models explained 16.8 %, 29.4 %, 18.2 %, and 12.1 % of the variance in SI, ER, EI, and LRC, respectively. The standardized Beta coefficients (β) indicate the relative strength and direction of each factor's influence. Among the significant predictors, education emerged as the strongest and most consistent factor, being positively associated with SI ($\beta = 0.211$), ER ($\beta = 0.441$), and LRC ($\beta = 0.164$), indicating that higher levels of education foster stronger conservation motivation among local respondents. Age was also positively related to social incentives ($\beta = 0.185$), suggesting that older respondents tended to be more socially engaged in forest protection activities. By contrast, household type ($\beta = -0.167$) and dependence ratio ($\beta = -0.182$) were negatively associated with LRC, implying that poorer households with more dependents were less responsive to legal compliance motivations. Income showed a negative relationship with economic incentives ($\beta = -0.225$), indicating that financial rewards less drove higher-income households. Membership in forest protection groups was positively associated with environmental recognition

Table 5
Comparison of socio-demographic and economic characteristics across communes.

Sociodemographic	Phong My (n = 83)	Trung Son (n = 80)	Hong Kim (n = 80)	Total (n = 243)
	Mean (Std.Dev.)	Mean (Std.Dev.)	Mean (Std.Dev.)	Mean (Std.Dev.)
Age	47.7 ± 14.2 [b]	40.5 ± 12.0 [a]	44.1 ± 12.9 [ab]	44.2 ± 13.3
Household type	0.1 ± 0.3 [a]	0.6 ± 0.5 [b]	0.7 ± 0.5 [b]	0.5 ± 0.5
Household size	4.2 ± 1.2 [a]	4.0 ± 1.3 [a]	4.6 ± 1.4 [a]	4.3 ± 1.3
Average income per person per month (million VND)	2.0 ± 1.4 [c]	1.1 ± 1.0 [a]	1.5 ± 1.1 [b]	1.6 ± 1.2
Total land area (ha)	1.8 ± 2.8 [b]	1.2 ± 1.6 [b]	0.4 ± 0.5 [a]	1.1 ± 2.0

Refer to Table 4 for the description of variables.

Table 6
Characteristic of household interviewees.

Categories	Socio-demographic characteristic							
	Phong My (n = 83)		Trung Son (n = 80)		Hong Kim (n = 80)		Total (n = 243)	
	n	%	n	%	n	%	n	%
Gender								
Men	62	74.7	36	45.0	49	61.3	147	60.5
Women	21	25.3	44	55.0	31	38.8	96	39.5
Ethnicity								
Paco	2	2.4	75	93.8	79	98.8	156	64.2
Kotu	0	0.0	2	2.5	0	0.0	2	0.8
Van Kieu	12	14.5	0	0.0	0	0.0	12	4.9
Pahi	23	27.7	1	1.3	0	0.0	24	9.9
Kinh	46	55.4	2	2.5	1	1.3	49	20.2
Occupation								
Farmer	49	59.0	54	67.5	57	71.3	160	65.8
Builder/mason	1	1.2	0	0.0	2	2.5	3	1.2
Hired worker	12	14.5	12	15.0	11	13.8	35	14.4
Business	5	6.0	5	6.3	0	0.0	10	4.1
Government officials	2	2.4	3	3.8	7	8.8	12	4.9
Others	14	16.9	6	7.5	3	3.8	23	9.5
Education level								
Illiterate	1	1.2	16	20.0	20	25.0	37	15.2
Literate	14	16.9	13	16.3	7	8.8	34	14.0
Primary school	16	19.3	7	8.8	16	20.0	39	16.0
Secondary school	34	41.0	17	21.3	24	30.0	75	30.9
High school	12	14.5	18	22.5	8	10.0	38	15.6
Vocational school/ technical institute	3	3.6	0	0.0	0	0.0	3	1.2
University	3	3.6	9	11.3	5	6.3	17	7.0
Households have members working away from home	16	19.3	21	26.3	26	32.5	63	25.9
Joining forest patrolling activities								
N-FPGs	23	27.7	38	47.5	38	47.5	99	40.7
FPGs	60	72.3	42	52.5	42	52.5	144	59.3

Table 7
Mean Likert scores of the motivation domains within and between FPGs and willing N-FPGs.

No	Abbreviation	Motivation	FPGs (n = 144)	N-FPGs (n = 59)
I	SI	Intrinsic	4.1 ± 0.4^{bA}	4.1 ± 0.4^{aA}
II	ER	Intrinsic	4.4 ± 0.5^{aA}	4.2 ± 0.5^{aB}
III	EI	Extrinsic	3.5 ± 0.3^{cB}	3.7 ± 0.5^{bA}
IV	LRC	Extrinsic	3.5 ± 0.6^{cA}	3.6 ± 0.7^{cA}

Different lowercase letters (a, b, c) indicate significant differences among motivational domains within each group ($p < 0.05$). Different uppercase letters (A, B) indicate significant differences between FPGs and N-FPGs ($p < 0.05$). Each motivational domain represents the average score of multiple single-item indicators (see Table 3 and Appendices A).

($\beta = 0.233$) but negatively with economic incentives ($\beta = -0.285$). This finding corroborates the Mann–Whitney *U* test results (Table 7), indicating that FPG members were more environmentally motivated but less driven by economic incentives.

4.5. Determinants of willingness to participate in forest protection activities of non-forest protection groups

Among the 99 individuals who had never participated in FPGs, the logistic regression model was statistically significant ($\chi^2 = 36.64$, $p < 0.001$), with a Nagelkerke R^2 of 0.418 and a correct classification accuracy of 75.8 % (Table 9). As variables were not standardized, the interpretation focused on statistical significance and the direction of effects rather than the effect size.

Three variables significantly predicted willingness to participate: ethnicity ($p < 0.05$), education level ($p < 0.05$), and satisfaction with forest protection activities under the PFES program ($p < 0.01$). A positive coefficient for ethnicity indicates that minority ethnic individuals were more likely to express willingness to participate than Kinh counterparts. Education level also showed a positive association, suggesting that those with higher educational attainment were more likely to engage in forest protection activities. Satisfaction with PFES was another strong predictor of participation. Participants who reported higher satisfaction, reflecting perceived improvements in forest conditions, reductions in illegal logging and land encroachment, stronger community responsibility, and fairer compensation, were more likely to express willingness to participate in forest protection activities. This suggests that perceptions of fairness and effectiveness in PFES implementation are essential for fostering long-term community engagement.

5. Discussion

5.1. Intrinsic and extrinsic motivations in forest protection

The results show that intrinsic motivations, particularly environmental concern and social responsibility, were central in driving participation among both FPG and N-FPG households (Table 7). Respondents emphasized key ecological functions of forests such as water protection, climate regulation, and soil fertility, values directly linked to livelihoods and long-term community security (Table 3, Appendix A). This reflects the perception that forests in Vietnam's uplands are life-supporting systems rather than mere economic resources (Martín-López et al., 2019; Price, 1998). The findings reinforce international evidence that environmental motivations often represent the most sustainable foundation for conservation behavior. For instance, in Bunyaruguru, Uganda, people participated primarily for ecological rather than financial benefits (Fisher, 2012). Likewise, in Ecuador, some communities had already been engaged in conservation before the introduction of PES, motivated by previous degradation and viewing the program merely as support for existing efforts: "I conserve to conserve, not only for water, but for biodiversity, for everything" (Bremer et al.,

Table 8
Sociodemographic variables associated with social incentives (SI), environmental recognition (ER), economic incentives (EI), and compliance with legal regulations (LRC) that motivate local people to protect forests in three communes.

Motivation	SI		ER		EI		LRC		VIF
Explanatory variables	*Coef.*	*t*	*Coef.*	*t*	*Coef.*	*t*	*Coef.*	t	
	Beta		Beta		Beta		Beta		
Age	0.186**	2.403	0.087	1.215	0.127	1.655	0.033	0.418	1.360
Gender	−0.086	−1.139	0.101	1.452	0.044	0.592	0.105	1.361	1.288
Ethnicity	0.124	1.545	0.082	1.109	0.093	1.167	0.104	1.270	1.455
Occupation	−0.031	−0.422	0.005	0.074	0.178**	2.412	0.051	0.666	1.252
Education	0.215***	2.769	0.444***	6.205	0.108	1.406	0.156*	1.957	1.373
Household type	−0.034	−0.423	0.017	0.227	−0.063	−0.783	−0.166**	−1.991	1.491
Family size	−0.064	−0.793	0.061	0.816	−0.057	−0.714	0.156*	1.870	1.492
Dependence ratio	0.084	0.996	0.053	0.680	0.029	0.353	−0.183**	−2.127	1.597
People working far from home	0.039	0.511	0.028	0.406	0.060	0.791	−0.115	−1.467	1.315
Total land area (log)	0.293***	3.915	0.034	0.498	0.031	0.421	−0.187**	−2.426	1.274
Average income per person per month	−0.154*	−1.740	−0.036	−0.442	−0.225**	−2.562	0.023	0.256	1.788
Joining forest protection group	−0.001	−0.015	0.232***	3.408	−0.280***	−3.814	−0.079	−1.038	1.245
Satisfaction with forest protection activities under PFES	0.055	0.740	0.122*	1.777	−0.050	−0.678	−0.080	−1.041	1.257
R-square	**0.168**		**0.294**		**0.182**		**0.121**		
Observations	**203**		**203**		**203**		**203**		

*, p < 0.10; **, p < 0.05; ***, p < 0.01.
Refer to Table 4 for the description of the explanatory variables.

Table 9
Binary logistic regression results identifying significant predictors of households' willingness to participate in forest protection activities.

Variables	B	S.E.	Wald	Exp (B)
Age	−0.030	0.020	2.304	0.971
Gender	−1.109	0.676	2.689	0.330
Ethnicity	2.305**	0.977	5.571	10.024
Occupation	−0.508	0.683	0.552	0.602
Education level	0.415**	0.196	4.485	1.514
Household type	0.560	0.595	0.888	1.751
Household size	−0.071	0.238	0.089	0.932
Dependence ratio	0.002	0.017	0.018	1.002
People work far away from home	0.247	0.690	0.128	1.280
Total land area (log)	0.092	0.431	0.045	1.096
Average income per person per month	−0.157	0.270	0.336	0.855
Satisfaction with forest protection activities under PFES	1.981**	0.622	10.137	7.249
Constant	−8.279	2.841	8.491	0.000
Chi-square	36.64***			
Nagelkerke	41.80 %			
No. of correct predictions	75.80 %			
No. of observations	99			

*, p < 0.10; **, p < 0.05; ***, p < 0.01.
(Refer to Table 3 for coding variables).
Note: B: Unstandardized regression coefficient; S.E: Standard Error of the coefficient estimate; Wald: Wald chi-square test statistic; Exp(B): Odds ratio.

2014). Similarly, Isyaku (2021) found that the Ekuri people of Nigeria valued forests as essential for survival and global climate regulation. Social motivations rooted in cultural, traditional, and spiritual values were also prominent. Among ethnic minority groups such as the Pa Co in Trung Son and Hong Kim in this study, rituals of forest worship before patrols embody both local ecological knowledge and intergenerational responsibility. This exemplifies the concept of place attachment, the emotional, behavioral, and cognitive bond between people and landscapes (Brown et al., 2012), which has been linked to pro-environmental behavior (Agarwal et al., 2017; Isyaku, 2021; Lin and Lockwood, 2014). In this context, forests are not only economic assets but also cultural–spiritual spaces that strengthen long-term conservation commitments.

Although intrinsic motivations dominated, extrinsic drivers, particularly financial incentives, still played a complementary role, especially among N-FPG households. This difference likely stems from the historical context of forest protection efforts. Initially, FPG members participated voluntarily without any financial compensation, motivated primarily by a sense of communal responsibility. Similarly, a study in Sri Lanka found that many individuals engaged in conservation out of social obligation rather than direct material gain (Nuggehalli and Prokopy, 2009). Once PFES was introduced, external rewards became a major incentive attracting the participation of N-FPGs. This aligns with Nguyen et al. (2022), who observed that PES in Vietnam increasingly functions as a financial incentive mechanism, and with international studies highlighting the role of monetary or in-kind payments in promoting participation in PES (Authelet et al., 2021; Waruingi et al., 2021). By contrast, legal and regulatory compliance motivations exerted the weakest influence across both groups. This reflects the weak institutionalization of local rules and limited enforcement capacity. As Nguyen et al. (2022) noted, PES participants in Vietnam face few legal consequences beyond payment reductions when forest cover declines. Similar results have been reported in other developing contexts, where weak law enforcement reduces deterrence effects (McElwee, 2004; Tacconi, 2012). In this context, PFES has become a critical institutional mechanism to compensate for enforcement gaps.

A distinctive feature of Vietnam is that PFES is implemented as a nationwide mandatory policy, unlike voluntary PES schemes in many other countries. The persistence of intrinsic motivation within this compulsory framework suggests that legal obligations do not necessarily erode intrinsic values when programs are perceived as transparent and culturally appropriate. While several studies warn that financial rewards may weaken intrinsic motivation if they fail to offset opportunity costs or align with local values (De Martino et al., 2017; Rode et al., 2015), sometimes even producing backlash effects when land-use restrictions cause income loss (Luck et al., 2012), our results indicated the opposite. PFES payments acted as complementary incentives, stimulating initial participation while environmental, cultural, and social values sustained long-term commitment. This dynamics reflects a "crowding-in" rather than "crowding-out" effect, where intrinsic and extrinsic motivations can reinforce one another when embedded in legitimate and culturally resonant institutions, an outcome also observed in southern Mexico, where community-based conservation persisted through intrinsic commitments even after the introduction of financial incentives (Méndez-López et al., 2015).

Overall, these findings reinforce the conceptual expectation that both intrinsic and extrinsic motivations jointly shape household engagement in forest protection. The complementary interaction between internal values and external incentives supports the theoretical

premise that sustainable conservation behavior emerges when financial, social, and cultural drivers are aligned within legitimate and locally meaningful institutions.

5.2. Determinants of motivational domains and willingness to participate

Regression analysis revealed that sociodemographic and institutional factors significantly shaped motivational domains (Table 8). Among the factors examined, education emerged as the most consistent and influential predictor, positively associated with social incentives, environmental recognition, and legal compliance. This finding aligns with previous studies showing that individuals with higher educational attainment tend to demonstrate greater environmental awareness, civic engagement, and understanding of institutional mechanisms (Jumbe and Angelsen, 2007; Lise, 2000; Obua and Turyahabwe, 1998; Ratsimbazafy et al., 2012). Education fosters both agency and knowledge about the ecological and regulatory dimensions of PFES, thereby strengthening intrinsic and rule-based motivations. Although some studies have shown no statistically significant relationship between education and participation (Apipoonyanon et al., 2019; Soe and Yeo-Chang, 2019), the effect of education in this context was evident. This underscores the importance of integrating environmental education and capacity-building initiatives into PFES implementation to strengthen local people's long-term commitment to forest conservation. Age also had a positive effect on social motivation, reflecting the stronger sense of responsibility among older individuals possibly due to experience and long-standing engagement in community forest management (Ratsimbazafy et al., 2012; Soe and Yeo-Chang, 2019). These intergenerational differences indicate that conservation values are often rooted in lived experiences and community identity (Boafo et al., 2016; Sinthumule and Mashau, 2020), while modernization (Kandari et al., 2014) and migration (Le et al., 2023) may gradually weaken place attachment among younger generations. Economic characteristics further shaped motivation. Household type had a significant adverse effect on legal-regulatory compliance motivation, indicating that poor and near-poor households were less responsive to legal obligations. As To (2015) observed in Ban Yen village, Vietnam, some households continued illegal logging despite official bans, suggesting that vulnerable groups may prioritize livelihood security over legal compliance. This underscores the need for governance approaches that address livelihood constraints rather than relying solely on enforcement. Similarly, the dependence ratio was negatively associated with legal–regulatory compliance. This may be because a higher proportion of non-working members (e.g., children or the elderly) increases economic pressure on the working population, thereby limiting their ability or willingness to comply with forest protection rules. Such households tend to prioritize immediate livelihood needs, particularly in contexts of weak enforcement and minimal sanctions. Income levels also influenced economic motivation. Lower-income households regarded PFES payments as essential, whereas wealthier ones were less dependent on financial incentives. As illustrated by a N-FPG respondent in Trung Son, "*For a low-income family like mine, earning money is very difficult, so the income from forest protection means a lot*". This finding is consistent with international evidence that low-income households are more likely to participate in PES schemes (Kosoy et al., 2008). Ensuring equity and maintaining sufficiently attractive payments for vulnerable groups is therefore vital to sustain participation.

Institutional factors also played a decisive role. Membership in forest protection groups was positively associated with environmental recognition but negatively with economic incentives, corroborating the group-level differences identified by the Mann–Whitney *U* test (Table 7). This pattern suggests that repeated institutional participation fosters ecological awareness while reducing dependence on financial rewards. One explanation is that PFES payments are relatively small, accounting for less than 2 % of household income, and are often perceived as insufficient compared with the effort required for forest protection (Le et al., 2023; Nguyen et al., 2024). Over time, however, long-term FPG members tend to internalize conservation values through regular patrols and collective activities that promote peer learning, information sharing, and ecological understanding. Taken together, these findings highlight the importance of institutional design in strengthening intrinsic motivations and promoting lasting behavioral change beyond economic incentives. The observed interlinkages between individual and institutional factors also validate the theoretical consistency of the study framework combining STD (Ryan and Deci, 2000) and IAD (Ostrom, 1990), thereby confirming that both personal values and rule-based structures jointly sustain participation in PFES.

For N-FPG households, willingness to participate was strongly influenced by ethnicity, education, and satisfaction with PFES (Table 9). Ethnic minority households expressed higher willingness than Kinh households, reflecting greater dependence on forests for livelihoods and deep cultural–spiritual attachments to sacred landscapes (Hoang, 2006; Sunderlin and Huynh Thu Ba, 2005). These cultural values underpin intergenerational responsibility, consistent with recent studies on cultural identity and local knowledge (Nghi and Thu, 2023). Education again emerged as a robust predictor, confirming its cross-cutting role not only in shaping motivational domains but also in translating motivation into behavioral intentions. This suggests that education enhances the capacity to act on pro-environmental values, reinforcing findings from other PES contexts (Kimengsi et al., 2019; Masha et al., 2024; Tadesse et al., 2017). Satisfaction with PFES was another decisive factor shaping willingness to participate. Respondents who perceived PFES as fair, transparent, and effective were significantly more likely to engage in forest protection. This finding highlights the central role of institutional trust, which develops through perceptions of fairness, transparency, and legitimacy, in sustaining voluntary participation (Corbera et al., 2007; Sommerville et al., 2010).

These results indicate that motivations for forest protection are shaped by the interaction between intrinsic and extrinsic drivers, which are in turn influenced by underlying sociodemographic characteristics, livelihood dependence, and institutional experiences. Accordingly, the design and implementation of PFES should be tailored to account for socio-cultural diversity and varying levels of institutional trust to enhance equity and sustain long-term participation. Moreover, the observed differences between FPG and N-FPG households substantiate the study's conceptual premise that motivational structures and perceptions of PFES vary according to institutional roles, access to information, and benefit-sharing mechanisms. This finding highlights the heterogeneous nature of community participation and demonstrates the internal consistency between the empirical results and the theoretical framework.

5.3. Theoretical implications

This study contributes to the theoretical literature on PES and environmental governance by expanding the understanding of motivation in community-based conservation programs. First, conceptually, it distinguishes four motivational domains: financial incentives, social motivation, recognition of environmental values, and legal compliance, thereby applying and extending Self-Determination Theory (SDT) (Ryan and Deci, 2000) to a mandatory institutional context such as PFES. Findings show that motivation is not only shaped by individual autonomy but also by cultural identity, community responsibility, and institutional trust, which are often overlooked in conventional applications of SDT.

Second, the study refines debates on the "crowding-out" hypothesis. Rather than assuming that extrinsic motivations undermine intrinsic ones, the results reveal a form of sequential complementarity, in which financial incentives and legal rules attract initial participation, while cultural and environmental values sustain long-term commitment. This "motivation sequencing" perspective extends PES theory beyond the substitution logic commonly assumed.

Third, methodologically, the study introduces a structured set of motivational indicators, translating abstract concepts such as cultural identity, intergenerational responsibility, and institutional legitimacy into measurable domains. This approach not only facilitates comparison across communities within a country but also opens possibilities for cross-national studies, contributing to the development of a comparative framework of motivation in PES.

By operationalizing SDT in a mandatory PES context, this study advances theoretical understanding of how intrinsic and extrinsic motivations interact under institutional constraints, particularly in state-led conservation programs.

Overall, these contributions bridge the gap between individual-level psychological theories and institutional analyses of environmental governance, offering an integrated framework for understanding participation in PES.

5.4. Limitations and future research

Despite its contributions, several limitations should be acknowledged. First, the geographic scope was limited to three buffer-zone communes of the Phong Dien Nature Reserve, which may constrain generalizability to areas with different socioeconomic conditions or PFES implementation contexts. Future research should expand to diverse ecological regions to assess the consistency of these findings. Second, the cross-sectional design allowed identification of associations but not causal relationships, leaving unanswered how motivations change over time or under policy shocks. Longitudinal designs or natural experiments would provide stronger insights into the dynamics and long-term impacts of PFES. Third, reliance on self-reported Likert-scale measures may involve social desirability bias, though anonymity and standardized protocols were applied. Future research should complement surveys with qualitative methods (e.g., interviews, focus groups, participant observation) to capture cultural and institutional dynamics more fully. Fourth, legal motivation may have been underestimated due to weak enforcement and limited exposure to forest regulations in remote areas. Incorporating perspectives from local authorities and enforcement agencies in future studies would provide a fuller understanding of institutional compliance. Finally, the analysis did not explicitly examine the ongoing erosion of intrinsic motivation due to social change, modernization, or youth migration. These trends may gradually weaken cultural and spiritual attachments that historically sustained conservation. Future research should therefore explore how generational transitions, value shifts, and changes in rural livelihoods influence the long-term transmission of intrinsic motivations in PFES communities.

6. Conclusion and policy implications

This study investigated the motivations driving household participation in forest protection under Vietnam's Payment for Forest Environmental Services (PFES), focusing on both intrinsic and extrinsic factors across three buffer-zone communes of the Phong Dien Nature Reserve. The findings have important implications for the design and implementation of PFES in Vietnam, while also offering insights for other countries adopting or considering similar payment schemes.

Results showed that intrinsic motivations remained the most enduring drivers of participation, while financial and legal–regulatory incentives played supporting roles, attracting initial engagement but not sustaining long-term commitment. Education, age, ethnicity, dependence ratio, household type, income, and institutional trust (e.g., participation in Forest Protection Groups and satisfaction with PFES) significantly shaped both motivational domains and willingness to participate, underscoring the interlinkages between livelihood conditions, institutional experiences, and cultural identity.

These results confirm the multidimensional nature of motivations and contribute to ongoing debates on motivational crowding, institutional trust, and cultural identity in environmental governance. They also highlight the importance of adopting a motivation-based approach to explain conservation behavior and to inform community forest governance strategies.

Several policy implications arise from these findings. First, sustaining community participation requires moving beyond short-term financial incentives toward embedding forest conservation within local cultural identity, ecological understanding, and intergenerational responsibility. Second, fairness and transparency in benefit distribution are critical to strengthening institutional trust and social cohesion. Third, PFES design should acknowledge motivational heterogeneity and pay special attention to vulnerable groups. Poorer households tend to respond more strongly to financial incentives, whereas ethnic minority communities are often guided by cultural and spiritual values; these differences call for tailored, context-specific engagement strategies. Practical implementation of this principle requires integrating indigenous knowledge and traditional practices into environmental education, community activities, and PFES design. Communicating PFES not as a "wage for patrols" but as recognition of community stewardship could further reinforce existing social and cultural motivations for forest protection.

CRediT authorship contribution statement

Ha Thi Thu Le: Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Hitoshi Shinjo:** Writing – review & editing, Supervision, Methodology, Data curation, Conceptualization.

Data availability statement

The data presented in this study are available upon request from the corresponding author.

Funding

This research was funded by the Ministry of Education, Culture, Sports, Science and Technology of Japan (MEXT) under the Japanese Government (MEXT) Scholarship Program.

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.

Acknowledgments

The authors extend their sincere thanks to the staff of the People's Committees of Phong My, Trung Son, and Hong Kim communes, as well as the Forest Protection Department of A Luoi District and the Thua Thien Hue Provincial Forest Protection and Development Fund, for their generous institutional support and for providing valuable documents relevant to this study. We are especially grateful to Mr. Ho Van Sao, Mr. Ho Thanh Phuong, Mr. Tran Duc Loc, Mr. Le Xuan Thanh, Mr. Tran Huu Tam, Mr. Trinh Dinh Do, Mrs. Vu Thi Thuy Trang and Mrs. Le Thi Phuong Thao for their invaluable assistance and commitment during the data collection phase.

Appendix A. Mean Likert scores of individual motivational indicators between FPGs and willing N-FPGs

No	Abbreviation	FPGs (n = 144)	NFPGs (n = 59)	Mann-Whitney *U* test
I.1	SI1	4.4 ± 0.6	4.5 ± 0.6	ns
I.2	SI2	4.4 ± 0.6	4.4 ± 0.6	ns
I.3	SI3	4.6 ± 0.5	4.7 ± 0.5	ns
I.4	SI4	4.3 ± 0.6	4.2 ± 0.6	ns
I.5	SI5	2.9 ± 1.1	2.8 ± 1.2	*
II.1	ER1	4.2 ± 0.7	4.0 ± 0.9	*
II.2	ER2	4.2 ± 0.7	4.0 ± 0.7	ns
II.3	ER3	4.5 ± 0.5	4.0 ± 0.7	*
II.4	ER4	4.6 ± 0.5	4.3 ± 0.5	*
II.5	ER5	4.6 ± 0.5	4.3 ± 0.5	*
II.6	ER6	4.6 ± 0.6	4.2 ± 0.6	*
III.1	EI1	4.4 ± 0.6	4.2 ± 0.6	ns
III.2	EI2	2.8 ± 0.6	4.5 ± 0.5	*
III.3	EI3	3.0 ± 0.7	3.3 ± 0.6	*
III.4	EI4	4.3 ± 0.7	3.6 ± 0.7	ns
III.5	EI5	2.6 ± 1.0	4.3 ± 0.7	*
III.6	EI6	3.4 ± 0.8	3.3 ± 1.2	ns
III.7	EI7	3.5 ± 0.8	3.5 ± 0.9	ns
III.8	EI8	4.3 ± 0.5	3.6 ± 0.9	ns
IV.1	LRC1	2.9 ± 1.1	2.9 ± 1.0	ns
IV.2	LRC2	3.9 ± 0.6	4.0 ± 0.5	*
IV.3	LRC3	3.6 ± 0.8	3.7 ± 1.0	ns

Significance levels are indicated as follows: ns = not significant ($p \geq 0.05$); *$p < 0.05$.

Data availability

Data will be made available on request.

References

Agarwal, S., Marathe, A., Ghate, R., Krishnaswamy, J., Nagendra, H., 2017. Forest protection in Central India: do differences in monitoring by state and local institutions result in diverse social and ecological impacts? Biodivers. Conserv. 26, 2047–2066. https://doi.org/10.1007/s10531-017-1344-6.

Apipoonyanon, C., Kuwornu, J., Szabo, S., Shrestha, R., 2019. Factors influencing household participation in community forest management: evidence from Udon Thani Province, Thailand. J. Sustain. For. 39. https://doi.org/10.1080/10549811.2019.1632211.

Authelet, M., Subervie, J., Meyfroidt, P., Asquith, N., Ezzine-de-Blas, D., 2021. Economic, pro-social and pro-environmental factors influencing participation in an incentive-based conservation program in Bolivia. World Dev. 145, 105487. https://doi.org/10.1016/j.worlddev.2021.105487.

AW3D30, 2025. ALOS Global Digital Surface Model "ALOS World 3D - 30m (AW3D30).

Basu, J.P., 2021. Forest participation of local communities: a study of a tribal dominated region in India. J. Soc. Econ. Dev. 23, 180–201. https://doi.org/10.1007/s40847-020-00142-w.

Bayrak, M.M., 2019. State of Forest governance in Vietnam: where are the local communities?. In: Population, Development, and the Environment. Palgrave Macmillan, Singapore, pp. 273–295. https://doi.org/10.1007/978-981-13-2101-6_16.

Boafo, Y.A., Saito, O., Kato, S., Kamiyama, C., Takeuchi, K., Nakahara, M., 2016. The role of traditional ecological knowledge in ecosystem services management: the case of four rural communities in Northern Ghana. J. Adv. Res. Dynami. Control. Sys. 12, 24–38. https://doi.org/10.1080/21513732.2015.1124454. Ecosystem Services & Management.

Boissière, M., Sheil, D., Basuki, I., Wan, M., Hien, Le, 2009. Can engaging local people's interests reduce forest degradation in Central Vietnam? Biodivers. Conserv. 18, 2743–2757. https://doi.org/10.1007/s10531-009-9627-1.

Bottazzi, P., Wiik, E., Crespo, D., Jones, J.P.G., 2018. Payment for environmental "Self-Service": exploring the Links Between Farmers' motivation and additionality in a conservation incentive Programme in the Bolivian andes. Ecol. Econ. 150, 11–23. https://doi.org/10.1016/j.ecolecon.2018.03.032.

Bremer, L., Farley, K., Lopez-Carr, D., Romero, J., 2014. Conservation and livelihood outcomes of payment for ecosystem services in the Ecuadorian Andes: what is the potential for 'win–win'? Ecosyst. Serv. 8. https://doi.org/10.1016/j.ecoser.2014.03.007.

Brown, B.B., Altman, I., Werner, C.M., 2012. Place attachment. In: Smith, S.J. (Ed.), International Encyclopedia of Housing and Home. Elsevier, San Diego, pp. 183–188. https://doi.org/10.1016/B978-0-08-047163-1.00543-9.

Chandola, H., 1977. New economic zones. Econ. Polit. Wkly. 12, 83–85.

Chu, L., Quentin Grafton, R., Keenan, R., 2019. Increasing conservation efficiency while maintaining distributive goals with the payment for environmental services. Ecol. Econ. 156, 202–210. https://doi.org/10.1016/j.ecolecon.2018.10.003.

CIA factbook, 2025. The world factbook. Explore all Countries - Vietnam [WWW Document]. URL. https://www.cia.gov/the-world-factbook/countries/vietnam/.

Corbera, E., Kosoy, N., Martínez Tuna, M., 2007. Marketing Ecosystem Services Through Protected Areas and Rural Communities in Meso-America: Implications for Economic Efficiency, Equity and Political Legitimacy.

Coulibaly-Lingani, P., Savadogo, P., Tigabu, M., Oden, P.-C., 2011. Factors influencing people's participation in the forest management program in Burkina Faso, West Africa. For. Pol. Econ. 13, 292–302. https://doi.org/10.1016/j.forpol.2011.02.005.

De Martino, S., Kondylis, F., Zwager, A., 2017. Protecting the environment: for love or money? The role of motivation and incentives in shaping demand for payments for environmental services programs. Public Finance Rev. 45, 68–96. https://doi.org/10.1177/1091142115604352.

Decision No. 430/QD-UBND, Dated March 2, 2010, of the People's Committee of Thua Thien Hue Province, on Approving the Project of Forest Allocation and Forest Leasing in Thua Thien Hue Province for the Period 2010-2014, 2010.

Decision No. 59/2015/QD-TTg, Issued on November 19, 2015, Promulgating the multi-dimensional Approach Poverty Lines Applicable to the Period 2016-2020, 2015.

Do, D.T., NaRanong, A., 2019. Livelihood and environmental impacts of payments for Forest environmental services: a case Study in Vietnam. Sustainability 11, 4165. https://doi.org/10.3390/su11154165.

Dolisca, F., Carter, D.R., McDaniel, J.M., Shannon, D.A., Jolly, C.M., 2006. Factors influencing farmers' participation in forestry management programs: a case study from Haiti. For. Ecol. Manag. 236, 324–331. https://doi.org/10.1016/j.foreco.2006.09.017.

Duong, N.T.B., De Groot, W.T., 2020. The impact of payment for forest environmental services (PFES) on community-level forest management in Vietnam. For. Pol. Econ. 113, 102135. https://doi.org/10.1016/j.forpol.2020.102135.

Ellen, S., 2020. Slovin's Formula Sampling Techniques [WWW Document]. Sciencing. URL. https://www.sciencing.com/slovins-formula-sampling-techniques-5475547/.

Field, A., 2024. Discovering Statistics Using IBM SPSS Statistics, sixth ed. Sage publications limited.

Figueroa, F., Caro-Borrero, Á., Revollo-Fernández, D., Merino, L., Almeida-Leñero, L., Paré, L., Espinosa, D., Mazari-Hiriart, M., 2016. "I like to conserve the forest, but I also like the cash". Socioeconomic factors influencing the motivation to be engaged in the Mexican Payment for Environmental Services Programme. J. For. Econ. 22, 36–51. https://doi.org/10.1016/j.jfe.2015.11.002.

Fisher, J., 2012. No pay, no care? A case study exploring motivations for participation in payments for ecosystem services in Uganda. Oryx 46, 45–54. https://doi.org/10.1017/S0030605311001384.

Forest Sector Monitoring Information System (FOMIS), 2010. Vietnam Forest Sector Progress Report 2006–2010.

Hayes, T.M., 2012. Payment for ecosystem services, sustained behavioural change, and adaptive management: peasant perspectives in the Colombian Andes. Environ. Conserv. 39, 144–153. https://doi.org/10.1017/S0376892912000045.

Hoang, H.T., 2006. Decentralization and local politics of forest management in Vietnam: a case study of Cơ Tu ethnic community. J. Leg. Pluralism Unoff. Law 38, 169–206.

Hoang, P.B.N., Fujiwara, T., Iwanaga, S., Sato, N., 2021a. Challenges of the Payment for Forest Environmental Services (PFES) program in forest conservation: a case study in Central Vietnam. J. For. Res. 26, 400–409.

Hoang, P.B.N., Fujiwara, T., Iwanaga, S., Sato, N., 2021b. Participation of local people in the payment for forest environmental services program: a case study in central Vietnam. Sustainability 13, 12731.
Hosmer Jr, D.W., Lemeshow, S., Sturdivant, R.X., 2013. Applied Logistic Regression. John Wiley & Sons., third ed. John Wiley & Sons.
Huy Tuan, H., 2006. Decentralization and local politics of Forest management in Vietnam: a case Study of Cơ Tu ethnic community. J. Leg. Pluralism Unoff. Law 38, 169–206. https://doi.org/10.1080/07329113.2006.10756595.
Ihemezie, E.J., Nawrath, M., Strauß, L., Stringer, L.C., Dallimer, M., 2021. The influence of human values on attitudes and behaviours towards forest conservation. J. Environ. Manag. 292, 112857. https://doi.org/10.1016/j.jenvman.2021.112857.
Isyaku, U., 2021. What motivates communities to participate in forest conservation? A study of REDD+ pilot sites in Cross River, Nigeria. For. Pol. Econ. 133, 102598. https://doi.org/10.1016/j.forpol.2021.102598.
Jumbe, C.B.L., Angelsen, A., 2007. Forest dependence and participation in CPR management: empirical evidence from forest co-management in Malawi. Ecol. Econ. 62, 661–672. https://doi.org/10.1016/j.ecolecon.2006.08.008.
Kaczan, D.J., Swallow, B.M., Adamowicz, W.L.Vic, 2019. Forest conservation policy and motivational crowding: experimental evidence from Tanzania. Ecol. Econ. 156, 444–453. https://doi.org/10.1016/j.ecolecon.2016.07.002.
Kamaraij, S., Raju, D.V., Kannan, J., 2019. A study on employees motivation in B & B developers and builders private ltd., Vellore. Journal of Advanced Research in Dynamical and Control Systems 11, 211–216. https://doi.org/10.5373/JARDCS/V11/20192557.
Kandari, L.S., Bisht, V.K., Bhardwaj, M., Thakur, A.K., 2014. Conservation and management of sacred groves, myths and beliefs of tribal communities: a case study from north-India. Environ. Syst. Res. 3, 16. https://doi.org/10.1186/s40068-014-0016-8.
Kimengsi, J.N., Bhusal, P., Aryal, A., Fernandez, M.V.B.C., Owusu, R., Chaudhary, A., Nielsen, W., 2019. What (De)Motivates Forest users' participation in Co-Management? Evidence from Nepal. Forests 10, 512. https://doi.org/10.3390/f10060512.
Kosoy, N., Corbera, E., Brown, K., 2008. Participation in payments for ecosystem services: case studies from the Lacandon rainforest, Mexico. Geoforum, Placing Splintering Urbanism 39, 2073–2083. https://doi.org/10.1016/j.geoforum.2008.08.007.
Le, H.T.T., Nguyen, M.T.H., Le, H.T., Shinjo, H., 2023. Implementation of payment for forest environmental services and its influence on the livelihood of ethnic minorities in Thua Thien Hue Province, Vietnam. Trees, Forests and People 13, 100404. https://doi.org/10.1016/j.tfp.2023.100404.
Lin, C.-C., Lockwood, M., 2014. Forms and sources of place attachment: evidence from two protected areas. Geoforum 53, 74–81. https://doi.org/10.1016/j.geoforum.2014.02.008.
Lise, W., 2000. Factors influencing people's participation in forest management in India. Ecol. Econ. 34, 379–392. https://doi.org/10.1016/S0921-8009(00)00182-8.
Loft, L., Gehrig, S., Le, D.N., Rommel, J., 2019. Effectiveness and equity of Payments for Ecosystem Services: Real-effort experiments with Vietnamese land users. Land Use Policy 86, 218–228. https://doi.org/10.1016/j.landusepol.2019.05.010.
Lovrić, M., Torralba, M., Orsi, F., Pettenella, D., Mann, C., Geneletti, D., Plieninger, T., Primmer, E., Hernandez-Morcillo, M., Thorsen, B.J., Lundhede, T., Loft, L., Wunder, S., Winkel, G., 2025. Mind the income gap: income from wood production exceed income from providing diverse ecosystem services from Europe's forests. Ecosyst. Serv. 71, 101689. https://doi.org/10.1016/j.ecoser.2024.101689.
Luck, G.W., Chan, K.M.A., Eser, U., Gómez-Baggethun, E., Matzdorf, B., Norton, B., Potschin, M.B., 2012. Ethical considerations in On-Ground applications of the ecosystem services concept. Bio. sci 62, 1020–1029. https://doi.org/10.1525/bio.2012.62.12.4.
Maleknia, R., 2025. Roots of urban forest conservation behaviors: discovering determinants of citizens' attitudes. Environ. Sustain. Indic. 26, 100671. https://doi.org/10.1016/j.indic.2025.100671.
Martín-López, B., Leister, I., Lorenzo Cruz, P., Palomo, I., Grêt-Regamey, A., Harrison, P. A., Lavorel, S., Locatelli, B., Luque, S., Walz, A., 2019. Nature's contributions to people in mountains: a review. PLoS. One 14, e0217847. https://doi.org/10.1371/journal.pone.0217847.
Masha, M., Bojago, E., Tadila, G., Belayneh, M., 2024. Effects of participatory forest management programs on Land use/land cover change and its Determinants in Alle District, southwest Ethiopia. Heliyon 10, e35179. https://doi.org/10.1016/j.heliyon.2024.e35179.
Maskey, V., Gebremedhin, T.G., Dalton, T.J., 2006. Social and cultural determinants of collective management of community forest in Nepal. J. For. Econ. 11, 261–274. https://doi.org/10.1016/j.jfe.2005.10.004.
Mayrand, K., Paquin, M., 2004. Payments for Environmental Services: a Survey and Assessment of Current Schemes 60.
McElwee, P., 2004. You say illegal, I say legal: the relationship between 'Illegal' logging and land tenure, poverty, and Forest use rights in Vietnam. J. Sustain. For. 19, 97–135. https://doi.org/10.1300/J091v19n01_06.
McElwee, P., Nghiem, T., Le, H., Vu, H., Tran, N., 2014. Payments for environmental services and contested neoliberalisation in developing countries: a case study from Vietnam. J. Rural Stud. 36, 423–440.
McElwee, P., Bernhard, H., Nguyen, T.H.V., 2019. Hybrid outcomes of payments for ecosystem services policies in Vietnam: between theory and practice. Dev. Change 51, 253–280.
Méndez-López, M.E., García-Frapolli, E., Ruiz-Mallén, I., Porter-Bolland, L., Reyes-Garcia, V., 2015. From paper to Forest: local motives for participation in different conservation initiatives. Case studies in Southeastern Mexico. Environ. Manag. 56, 695–708. https://doi.org/10.1007/s00267-015-0522-0.
Mook, A., Goyke, N., Dwivedi, P., 2022. Conservation intentions and place attachment among Male and female Forest landowners. Rural Sociol. 87, 817–846. https://doi.org/10.1111/ruso.12434.
Nghi, T.H., Thu, N.Q., 2023. Spiritual Forests—A Nature conservation model of ethnic minority communities in central Viet Nam. Open J. For. 14, 74–86. https://doi.org/10.4236/ojf.2024.141005.
Nguyen, C., Hardcastle, J., 2003. Phong Dien Nature Reserve. an Operational Management Plan 2004 to 2008. Thua-Thien Hue Provincial Forest Protection Department.
Nguyen, T.Q., Huynh, N.T., Hsu, W.-K.K., 2021. Estimate the impact of payments for environmental services on local livelihoods and environment: an application of propensity scores. Sage Open 11, 21582440211040774. https://doi.org/10.1177/21582440211040774.
Nguyen, T.H.V., McElwee, P., Le, T.V.H., Nghiem, T., Vu, T.D.H., 2022. The challenges of collective PES: insights from three community-based models in Vietnam. Ecosyst. Serv. 56. https://doi.org/10.1016/j.ecoser.2022.101438.
Nguyen, D., Do, T., Huyen, D., Tran, N.T., Thi, D., To-The, N., 2024. Effect of payment for forest ecosystem services on forest conservation practices in Vietnam. Journal of Infrastructure Policy and Development 8. https://doi.org/10.24294/jipd.v8i5.5254.
Nuggehalli, R.K., Prokopy, L.S., 2009. Motivating factors and facilitating conditions explaining women's participation in co-management of Sri Lankan forests. For. Pol. Econ. 11, 288–293. https://doi.org/10.1016/j.forpol.2009.05.002.
Nunez Godoy, C.C., Pienaar, E.F., Branch, L.C., 2022. Willingness of private landowners to participate in forest conservation in the Chaco region of Argentina. For. Pol. Econ. 138, 102708. https://doi.org/10.1016/j.forpol.2022.102708.
Obua, J., Turyahabwe, N., 1998. Attitudes of local communities towards forest management practices in Uganda: the case of Budongo forest reserve. Commonwealth Forest/)' Review 77 (2), 1998.
Ostrom, E., 1990. Governing the Commons: the Evolution of Institutions for Collective Action. Cambridge University Press.
O'brien, R.M., 2007. A caution regarding rules of thumb for variance inflation factors. Qual. Quantity 41, 673–690. https://doi.org/10.1007/s11135-006-9018-6.
Pagiola, S., Paola, A., José, G., Cees de, H., Muhammad, I., Enrique, M., Elías, R., Mauricio, R., Juan, P.R., 2004. Paying for Biodiversity Conservation Services in Agricultural Landscapes. The World Bank Environment Department.
Pham, T.T., Bennett, K., Vu, T.P., Brunner, J., Le Ngoc, D., Nguyen, V.D., 2013. Payments for forest environmental services in Vietnam from policy to practice. CIFOR Occasional paper, Bogor.
Pham, T.T., Ngo, H.C., Dao, T.L.C., Hoang, T. long, Fisher, M.R., 2020. The politics of numbers and additionality governing the national Payment for Forest Environmental Services scheme in Vietnam: a case study from Son La province. For. Soc. 379–404. https://doi.org/10.24259/fs.v4i2.10891.
Phong Dien NR office, 2020. Sustainable forest management plan for Phong Dien Nature Reserve in the period of 2021-2030. Phong Dien Nature Reserve Management Board.
Porter, D.C., Gujarati, D.N., 2008. Basic Econometrics. McGraw-Hill Education.
Price, M.F., 1998. Forests in sustainable Mountain development. In: Sassa, K. (Ed.), Environmental Forest Science: Proceedings of the IUFRO Division 8 Conference Environmental Forest Science, Held 19–23 October 1998. Kyoto University, Japan. Springer Netherlands, Dordrecht, pp. 39–49. https://doi.org/10.1007/978-94-011-5324-9_5.
Ratsimbazafy, C.L., Harada, K., Yamamura, M., 2012. Forest resources use, attitude, and perception of local residents towards community based forest management: case of the Makira Reducing Emissions from Deforestation and Forest Degradation (REDD) Project, Madagascar. JENE 4, 321–332. https://doi.org/10.5897/JENE11.123.
Resolution No. 1675/NQ-UBTVQH15 dated June 16, 2025, of the Standing Committee of the National Assembly, on the arrangement of commune-level administrative units of Hue City in 2025," 2025.
Rode, J., Gómez-Baggethun, E., Krause, T., 2015. Motivation crowding by economic incentives in conservation policy: a review of the empirical evidence. Ecol. Econ. 117, 270–282. https://doi.org/10.1016/j.ecolecon.2014.11.019.
Ryan, R.M., Deci, E.L., 2000. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. Am. Psychol. 55, 68–78. https://doi.org/10.1037/0003-066X.55.1.68.
Schunk, D.H., Pintrich, P.R., Meece, J.L., 2014. Motivation in Education : Theory, Research, and Applications, third ed., international ed. Pearson Education.
Sinthumule, N.I., Mashau, M.L., 2020. Traditional ecological knowledge and practices for forest conservation in Thathe Vondo in Limpopo Province, South Africa. Glob. Ecol. Conserv. 22, e00910. https://doi.org/10.1016/j.gecco.2020.e00910.
Soe, K.T., Yeo-Chang, Y., 2019. Perceptions of forest-dependent communities toward participation in forest conservation: a case study in Bago Yoma, South-Central Myanmar. For. Pol. Econ. 100, 129–141. https://doi.org/10.1016/j.forpol.2018.11.009.
Sommerville, M., Milner-Gulland, E.J., Rahajaharison, M., Jones, J.P.G., 2010. Impact of a community-based payment for environmental services intervention on forest use in Menabe, Madagascar. Conserv. Biol. 24, 1488–1498. https://doi.org/10.1111/j.1523-1739.2010.01526.x.
Sood, R., Dhyani, S., 2024. Spiritual commons: an Indigenous narration for sacred high-conservation value landscapes of Himachal Pradesh, India. In: Sacred Landscapes, Indigenous Knowledge, and Ethno-Culture in Natural Resource Management. Springer, Singapore, pp. 471–484. https://doi.org/10.1007/978-981-97-4206-6_24.
Sudakov, K.V., 2006. Motivation as a basis of mental activity. Zh. Nevrol. Psikhiatr. Im. S S Korsakova 106, 4–11.
Suhardiman, D., Wichelns, D., Lestrelin, G., Hoanh, C.T., 2013. Payments for ecosystem services in Vietnam: Market-based incentives or state control of resources? Ecosyst. Serv. 5, 94–101.

Sunderlin, W.D., Huynh Thu, Ba, 2005. Poverty Alleviation and Forests in Vietnam. CIFOR, Jakarta.
Tacconi, L., 2012. Redefining payments for environmental services. Ecol. Econ. 73, 29–36. https://doi.org/10.1016/j.ecolecon.2011.09.028.
Tadesse, S., Woldetsadik, Muluneh, Senbeta, F., 2017. Forest users' level of participation in a participatory forest management program in southwestern Ethiopia. For. Sci. Technol. 13, 164–173. https://doi.org/10.1080/21580103.2017.1387613.
Thirupathy, B., Kannan, J., 2020. A Study on Rural Employees Motivation in B & B Developers and Builders Private Ltd. Malaya Journal of Matematik, Vellore.
Thoker, I.A., Bhat, M.S., Shah, S.A., Lone, F.A., Mir, S., Parrey, H.A., Akbar, M., 2024. Towards sustainable forest management: an examination of environmental knowledge among forest dwellers in the Kashmir Himalayas. Environ. Dev. Sustain. https://doi.org/10.1007/s10668-024-04823-y.
Tian, N., Pelkki, M., 2021. Nonindustrial private forest landowner perspectives on forest certification: a look at awareness and barriers. For. Pol. Econ. 131, 102552. https://doi.org/10.1016/j.forpol.2021.102552.
To, P.X., 2015. State territorialization and illegal logging: the dynamic relationships between practices and images of the State in Vietnam. Crit. Asian Stud. 47, 229–252. https://doi.org/10.1080/14672715.2015.1041278.
Tran, V.C., Trinh, Q.T., Cao, Q.A., Pham, M.T., Camacho, L.D., Hoang, V.S., 2019. Contribution of forest to rural households' livelihood: evidences from Da river basin in the northwest mountainous region of Vietnam. For. Soc. 235–247. https://doi.org/10.24259/fs.v3i2.7050.
Truong, D.D., 2022. Impacts of payment for forest environmental service policy in Vietnam: a case study of Muong Nhe protected area. Trees, Forests and People 7, 100198. https://doi.org/10.1016/j.tfp.2022.100198.
Tuan, N.D.A., Dung, N.T., Sharma, S., 2017. Chapter 12 - comanagement approach for conflict management: a case Study of the Phong Dien Nature reserve. In: Thang, T. N., Dung, Ngo Tri, Hulse, D., Sharma, Shubhechchha, Shivakoti, G.P. (Eds.), Redefining Diversity & Dynamics of Natural Resources Management in Asia, 3. Elsevier, pp. 179–188. https://doi.org/10.1016/B978-0-12-805452-9.00012-6.
Van Hecken, G., Bastiaensen, J., Vásquez, W.F., 2012. The viability of local payments for watershed services: empirical evidence from Matiguás, Nicaragua. Ecol. Econ. 74, 169–176. https://doi.org/10.1016/j.ecolecon.2011.12.016.
Waruingi, E., Mbeche, R., Ateka, J., 2021. Determinants of forest dependent household's participation in payment for ecosystem services: evidence from Plantation Establishment Livelihood Improvement Scheme (PELIS) in Kenya. Glob. Ecol. Conserv. 26, e01514. https://doi.org/10.1016/j.gecco.2021.e01514.
Weiner, B., 2013. Human Motivation: Metaphors, Theories, and Research. Psychology Press.
Wunder, S., 2005. Payments for Environmental Services: Some Nuts and Bolts. CIFOR, Bogor, Indonesia.
Wunder, S., 2008. Payments for environmental services and the poor: concepts and preliminary evidence. Envir. Dev. Econ. 13, 279–297. https://doi.org/10.1017/S1355770X08004282.