Direct and Indirect Payment for Ecosystem Services in Bac Kan Province, Vietnam: Are Households More Satisfied When There Is No State Involvement?

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Direct and Indirect Payment for Ecosystem Services in Bac Kan Province, Vietnam: Are Households More Satisfied When There Is No State Involvement?

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Payments for forest ecosystem services (PFES) have been widely implemented in Vietnam, and the environmental, social, and economic outcomes are becoming increasingly clear. However, the difference between the voluntary PFES schemes—which are a contract between an environmental service provider and service user—and indirect schemes, where the state acts as an intermediate, is not as well understood. In this study set in Bac Kan province, we discuss differences in payments, household satisfaction between the two schemes, and deforestation rates. Villagers from the Ba Be district can participate in either a state–induced PFES program (hydropower plant service user) or in a voluntary scheme (national park and tourist facilities are the service user). We interviewed 105 in the state–induced PFES program and 29 in the voluntary PFES scheme. Using a multiple–choice–based survey question of life satisfaction expressions from local people, we show a negative and significant correlation between participation in the voluntary scheme and life satisfaction among the households surveyed. In normal conditions, we would expect households participating voluntarily in the PFES program to show more satisfaction than households compelled to participate in an indirect program. We conclude that the unexpected finding could be linked to poor households, with little negotiating power against service buyers such as homestays and food providers.

Key words: Bac Kan province, bargaining power, life satisfaction perceptions, payment for forest ecosystem services (PFES)

INTRODUCTION

Many countries are increasingly using payments for ecosystem services (PES) as a tool for natural resource management. Examples include Costa Rica's PSA program (Pagiola, 2008); the PROFAFOR carbon sequestration program in Ecuador; the national program for hydrological services (PSAH) in Mexico (Muñoz–Piña *et al.*, 2008); and the sloping land conservation program of China (Bennett, 2008).

PES schemes offer financial compensation in exchange for the provision of ecosystem services such as forest protection. Wunder (2005) used a definition with three prominent criteria: First, PES is a voluntary, negotiated framework… Secondly, what is brought needs to be well–defined…Third, in any PES, there should be resources going from at least one ES (environmental services) to at least one provider. The definition is based on a Coasean approach by which an externality problem is solved without state involvement (Hausknost *et al.*, 2017, Ostrom *et al.*, 1992). In practice, the conditions are often violated because the environmental services (ES) are public goods and transaction costs are high. Usually, to address the challenge of high transaction costs, public agencies intervene to act as intermediates

(Engel, 2016). Later Wunder *et al.* (2018) added a few preconditions for PES to function of which one was crucial, namely ES users' willingness to pay is higher than ES providers' willingness to accept compensation.

Criticisms of using PES to solve environmental problems have been made by scholars with very different agendas, who propose that either PES is not a market–based instrument, or PES's introduction creates pre–conditions to the privatization or commodification of natural resources. If the ES is not tradeable, voluntarism is questionable in state intervention to force contact between buyers and sellers, and many PES programs lack monitoring and sanction instruments. They thus do not meet the criteria defined by Wunder (2005). At the other end of the spectrum, we find scholars concerned with the risk of nature becoming an arena for furthering the inflow of market ideologies. Although the original idea was to increase support for conservation, PES has transformed into an approach to seek payments or create an artificial conservation conceptualization linked to the circulation of new capital and leading to the commodification of nature (Fairhead *et al.*, 2012). In a study from Mexico, Corbera *et al.* (2019) observe that PES can enable develop an agreement on forest management but might fail in the long term to deliver an institutional arrangement regarded legitim by the entire community.

In between these two ideological opposites, several scholars focus on how PES plays out in practice. An important question is whether the overuse of natural resources is best handled by regulation or whether it is preferable to revert to another form of conservation PES

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also becomes a means to support social norms in favor of conservation (Cranford and Mourato, 2011). If PES can influence the ES providers' livelihoods, a more positive attitude to protection is expected. In a meta–study of PES programs in developing countries, Lieu and Kontoleon (2018) find that programs tend to achieve a positive correlation between access to PES and impact on livelihoods; however, this effect is only significant at a 10% level of livelihood improvement. Being limited to only 15 programs, the study does not provide conclusive evidence of PES's influence on livelihoods. Conversely, other studies find no signs of supporting the argument for a pro–poor approach in PES, or at least report mixed–message results from comparing similar geographical sites (Narloch *et al.*, 2013; Pagiola, 2008). Looking at how design principles are implemented in practice, Wunder *et al.* (2018) highlight that only a minority of PES programs are sanctioning non–compliance with objectives and very few programs use cost. Enforcement might be seen as difficult to implement since stakeholders could regard sanctions as politically sensitive.

Closely related is the question of fairness and transparency. Unfair outcomes often raise doubts about the legitimacy of PES programs on the ground and may increase transaction costs or, worse, trigger social conflicts (Narloch *et al.*, 2013). Transparency is particularly needed in PES schemes where the state intervenes (indirect payment schemes), and verification becomes complicated and relies primarily on trust in the performance of the environmental service provider (Muradian *et al.*, 2010). Summarizing various PES experiences, Pascual *et al.* (2010) differentiate between an egalitarian fairness approach (equal payment per hectare), an expected provision criterion (the difference between types of forests), and an essential provision criterion (payment based on an estimation of carbon sequestrated in each landholder's plot).

Generally, PES programs could be divided into direct payment and indirect payment programs (Engel *et al.*, 2008) or user–financed and government–financed schemes (Schomers and Matzdorf, 2013). In the direct payment program, the buyers are usually service users, and schemes are intended to be efficient given that actors with access to information are directly involved. The service buyers of indirect payment programs are significantly different because they are not direct users, but act on their behalf. Most of them are government institutions or NGOs. Buyers are not direct users, have less access to information, and might show less interest in overall efficiency. In the following, we focus only on PES arrangements with forests as the commodity under negotiation in the natural resource arrangements.

In Vietnam, the national PFES program began in 2010 with Decree No. 99/2010/NĐ–CP on "*Payment for forest ecosystem services*." (Government of Socialist Republic of Vietnam, 2010). In this Decree, the Vietnamese government confirmed the two types of PFES, namely direct and indirect payment systems (Article 6: Forms of payment). The content of the Decree also indicates the four types of forest services that could apply PFES: (i) Watershed forests; (ii) Conservation forests and ecotourism forests; (iii) Forests to become carbon sinks to reduce greenhouse gas emissions and sustainable forest development, conservation of biodiversity; (iv) Forests providing spawning grounds, natural water, natural feeds, and breeding sites for aquaculture activities. With Decree No. 99/2010, the PFES policy has been widely implemented in various Vietnamese provinces. After five years of implementation, the national evaluation conference of the PFES program stated that this policy received significant public support (Vietnam Administration Forestry, 2015). However, the panel additionally pointed out the lack of a genuine monitoring and evaluation mechanism in the Vietnamese PES model.

In the initial discussion leading up to defining the Vietnamese PFES model, the government identified the service users as primarily hydropower plants. The payment level was fixed at VND 20 per kilowatt–hour (in 2018, this increased to VND 36/kWh; Decree 156/2018). Service providers are state forest companies or local households or communities. A national fund and a provincial fund receive the payments. Upon collection of administrative fees on both the national and provincial levels, the provincial fund will distribute revenues to the service providers (To and Dressler, 2019). Direct payment is based on contracts between users and providers of forest environmental services (Government of Socialist Republic of Vietnam, 2010).

STUDY AREAS AND RESEARCH METHODS

Study area

The study was based on Ba Be District, Bac Kan province, a mountainous area located in northern Vietnam. Ba Be has 68,412 hectares in total, mean annual temperature range from 21.98°C–23.61°C, total sunshine hours in a year is around 1,283–1,577 hours, annual precipitation is from 1,151.3–1,699.2 mm and the annual humidity is 85–86%. In 2019, the total population of this district was 47,415 persons with an approximate population density of 70 persons per km². There are four main ethnic groups living in this district such as Tay, Dao, Kinh, and H'Mong groups. In comparison to other districts, Ba Be has slow economic growth, depends deeply on the agro–forestry sector (taking 50% of total GDP), has a low annual income per capita (10 million VND per person), and high rate of poverty in comparison to the average rate of Vietnam (18.04% poor households in total) (General Statistics Office in Vietnam, 2020).

Ba Be district is a prominent area for implementing the PFES policy of Bac Kan province in particular and of Vietnam in general. The indirect PFES program was established in Ba Be in 2013 in the Nang River basin. In addition, with the support of NGOs, Ba Be National Park established and began operating a program of direct PFES payments in the Leng River basin. The PFES policy in Ba Be is gradually stabilizing and contributing positively to forest protection. The PFES activities of Ba Be
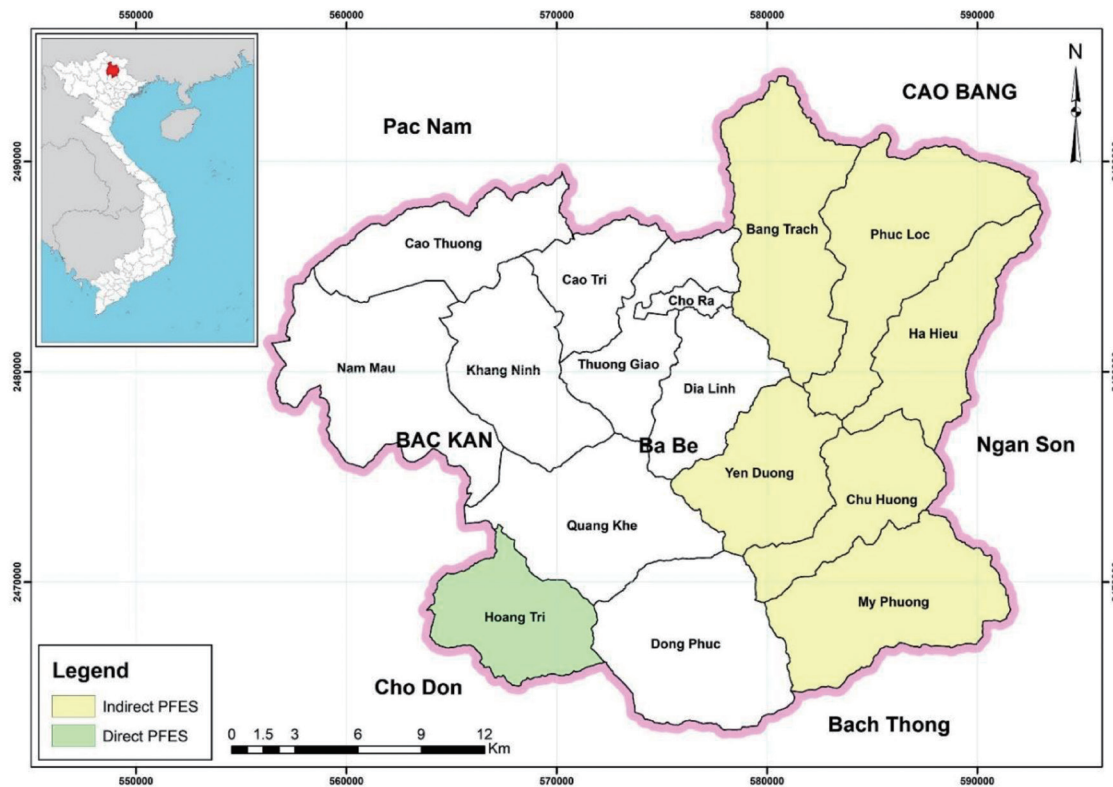
Fig. 1. Ba Be district— the area covered in this study shown on a map of Vietnam
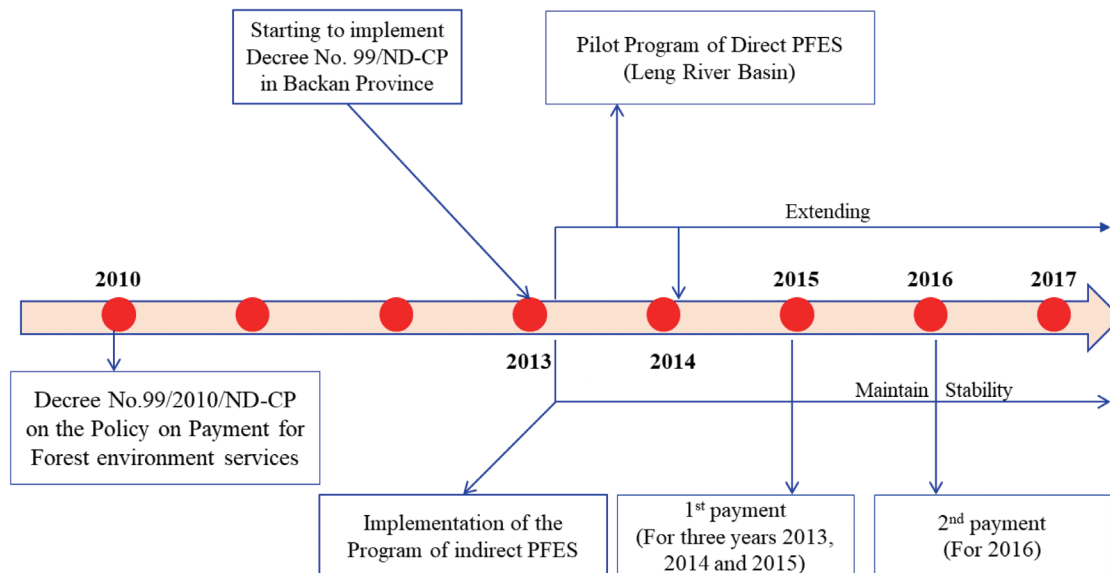

Fig. 2. The process of implementing the PFES policy in the Ba Be district

are summarized as shown in Fig 2.

With the simultaneous implementation of both direct and indirect PFES, Ba Be became an ideal place to conduct research and evaluate the implementation process of the PFES policy in Vietnam. This study was conducted by us to test 3 hypotheses about PFES programs in Vietnam, specifically as follows:

1) Providers of ecosystem services receive better pay through the voluntary PES scheme than through the state–induced scheme.

2) Providers of ecosystem services are more satisfied with the voluntary PES scheme than the state–induced scheme.

3) PES schemes regardless of the origin have been effective in the protection of forests.

Methodologies

Secondary data

Collect information on the geographical and socio–economic situation of PFES activities from local institutions, which are Bac Kan Forest Protection Fund, Ba Be People Committee, Ba Be National Forest and other relevant agencies.

Household interview

PFES has been implemented in Ba Be since 2013 with two payment systems: direct payment and indirect payment (Fig. 1). These two programs were chosen as case studies to investigate the performance of fairness and transparency while implementing the PFES process. The survey process was carried out according to the system (selected survey areas) in 2017 in both direct and indirect PFES programs.

A crucial concept is life satisfaction. We asked villagers in seven communes close to a hydropower plant and one commune close to a river questions about their experience with PES. In total 142 households, though the response rate varied among questions. Payments could be important and even if they are marginal (often the case in Vietnam), villagers could express satisfaction with PES due to other reasons (protection of forest, benefits to the community, water protection).

Indirect PFES program: The PFES program of Tuyen Quang Hydropower Company and Na Hang Hydropower Plant aim to protect forests to maintain water sources through payment to forest owners in Ba Be Province (located in the Nang River basin). The payment mechanism operates through the coordinator of state institutions. This program started in 2013 and completed two payment periods. The first period was 2015 (payment of three years 2013, 2014, and 2015), and the second one was conducted in 2016. The total payment paid was 8.9 billion VND.

In this program, we selected 6 communes outside Ba Be National Park (not in the core and buffer zone) for investigation, including Banh Trach, Phuc Loc, Ha Hieu, Yen Duong, Chu Huong, and My Phuong. In each commune, we selected 2 villages/hamlets to conduct the interview survey in 2017. The total number of households surveyed in the indirect PFES was 110 households belonging to 12 villages/hamlets of 6 communes (Fig. 1).

Direct PFES program: In 2013, through the support of the Pro–Poor Partnership for Agroforestry Development Project (3PAD), a mechanism of spontaneous PFES has been established. The trading system is carried out by tourism businessmen in Ba Be Lake (who mostly live in Pac Ngoi and Bo Lu Hamlet, Nam Mau Commune) and the forest owners in Duong Hamlet (Hoang Tri Commune) to protect the forest to maintain clean water for Ba Be Lake (Fig. 1). This is a pilot spontaneous PFES program run in 2013 and 2014. Two payment periods had been completed with a total payment of around 26 million VND. This payment mechanism could be considered a direct PFES program because the buyers are service consumers, and the payment rate was established with the negotiation of all stakeholders. Due

to the direct payment program being piloted on a small scale, all 57 households participating in this program were surveyed in 2017. Which, there were 28 tourism homestays in Pac Ngoi and Po Lu hamlets, Nam Mau commune (Buyers), and 29 households in Ban Duong village, Hoang Tri commune (providers).

Basic information on surveyed households belonging to two direct and indirect PFES payment programs is presented in Table 1.

Methods for testing hypotheses

The first hypothesis: we aimed to determine if payments were higher for the direct PFES scheme. The indirect PFES scheme is a state–induced arrangement with relatively fixed rules regarding payment and provider rights instead of, in principle, a volunteer scheme (direct PFES) where pay and conditions follow negotiation. The state decides the price under the indirect scheme and households share less than 85% of the original amount with state enterprises (Fig. 3). We would expect higher pay and a higher degree of satisfaction with the volunteer–based scheme.

The second hypothesis: we postulated that a free–market version, namely the voluntary PFES scheme, yields more satisfaction among villagers. The questionnaire included questions on villagers' satisfaction with life answered on a Likert five–point scale option, from very satisfied to very dissatisfied. For simplicity, we transformed the satisfaction option into a dummy variable (satisfied = 1 or unsatisfied = 0).

$$\ln\left(\frac{p_i}{1-p_i}\right) = B_1 + B_2 X_{1i} + B_3 X_2 + \dots \qquad (1)$$

Where: p_i is the probability of household satisfaction.

– Satisfaction, based on villagers' perception, is our dependent variable. In the logistic regression model, we use the following independent variables:

The efficiency of PFES (VillagePFES, village perception with 0=very effective, and 4 = very ineffective), the purpose of PES (higher payment, better forest protection, environmental protection, community benefits, others), type of PES program (indirect, direct), agriculture income, and total income.

We grouped the two environmental options in the 'purpose of PFES'; therefore, the three remaining categories are payment, protection, and other (a new variable called reason_PFES). The equation then becomes:

$$\ln\left(\frac{P\,(satisfaction\,dummy = 1\,for\,household\,number\,i)}{1 - P(satisfaction\,dummy = 1\,for\,household\,number\,i)}\right)$$
$$= B_1 + B_2\,VillagePFES_i + B_3\,Reason\,PFES_i +$$
$$B_4\,ProgramPFES_i + B_5\log(Revenueagr_i) +$$
$$B_6\log(Totalincome_i) \quad (2)$$

Because we work with probabilities, we will estimate the outputs by the method of maximum likelihood, not the standard least–square method.

– An alternative version uses the original values of satisfaction, from 1= very unsatisfied to 4= very satisfied. Because the variable is ordinal, we should perform

Table 1. Basic characteristics of eight communes of PFES in Ba Be District (2017)

No	Location	Population *(Person)*	Number of households	Forest area *(ha)*	Rate of forest cover *(%)*	Rate of poor household *(%)*	Income *(Million VNĐ/ person/ year)*	Ethnic composition
Direct PFES								
1	Hòang Trĩ commune	1,371	303	2392.9	67.8	26.4	8.0	Tày (72.7%) Dao (23.0%) Mèo (3.1%) Kinh (1.2%)
1.1	Duổng village	137	29	530	63.5	34.48	5.15	Tày (82.76%) Dao (17.24%)
2	Nam Mẫu commune	2,145	424	4,888	75.4	39.86	9.9	Tày (54.3%) Dao (29.2%) Nùng (9.0%) Mông (5.4%) Kinh (2.1%)
2.1	Pác Ngòi village	145	37	475		6.45	10.99	Tày (100%)
2.2	Bó Lù village	116	25	316		7.14	22.19	Tày (88.8%) Kinh (9.48%) Nùng (1.72%)
In–Direct PFES								
3	Bành Trạch commune	2,876	727	815.81	67.3	30.1	7.2	Tày (70%) Dao (20%) Kinh (8%) Nùng (2%)
3.1	Hon village	235	56	57.78	80.4	30.4	2.30	Tày (8%) Dao (70%) Nùng (2%) Kinh (20%)
3.2	Nà Nộc village	73	26	95.09	90.6	38.5	4.19	Tày (100%)
4	Phúc Lộc commune	3,157	748	5129.05	49.3	24.5	8.3	Tày (66.8%), Dao (22.0%), Nùng (10.2%), Kinh (1%)
4.1	Thiêng Điểm village	172	38	48.55	64.5	15.8	5.76	Tày (65%) Dao (24%) Nùng (10%) Kinh (1%)
4.2	Cốc Diễn village	214	52	38.90	68.2	19.2	4.78	Tày (5%) Dao (95%)
5	Hà Hiệu commune	2,596	695	2056.97	59.4	22.7	8.5	Dao (50%) Tày (30.5%) Nùng (15.5%)
5.1	Khuổi Man village	132	39	60.10	68.4	5.1	7.71	Tày (39%) Dao (35%) Nùng (26%)
5.2	Lủng Trảng village	163	42	78.13	70.2	42.5	4.82	Dao (100%)
6	Yến Dương commune	2,482	629	1310.26	74.9	27.8	7.8	Tày (78.8%) Dao (20.4%) Kinh (1.6%)
6.1	Nà Giáo village	135	36	51.14	86.39	25.0	5.19	Tày (93.3%); Dao (5.2%); Kinh (1.5%)
6.2	Phiêng Khăm village	87	22	191.27	94.29	68.4	3.65	Dao (100%)
7	Chu Hương commune	3,500	861	1816.8	68.8	31.1	8.2	Tày (68.2%) Dao (23.4%) Nùng (6.2%) Kinh (2.2)
7.1	Phiêng Kém village	121	32	30.71	80.35	31.25	4.66	Tày (85.95%); Dao (11.58%) Nùng (2.48%)
7.2	Khuổi Ha village	83	24	21.40	78.02	100	3.11	Dao (100%)
8	My Phương commune	3,505	943	3950.24	82.8	28.3	7.6	Tày (74.5%) Dao (22.5%) Kinh (3%)
8.1	Khuổi Lủng village	67	19	128.75	95.67	36.84	4.12	Dao (100%)
8.2	Thạch Ngõa 2 village	116	35	62.51	87.31	14.28	4.10	Tày (90.51%) Dao (6.9%) Kinh (2.59%)

a multiple logistic regression with ordinal variables. In the ordinal logistic regression, we estimate models for probabilities:

$$P\,(X \leq 1),\, P\,(X \leq 2),\, P\,(X \leq 3),\, \text{and}\, P\,(X \leq 4)$$

Where $P\,(X \leq 4) = 1$. Note that if these probabilities increase, the overall satisfaction decreases.

Estimates of coefficients and statistical significance relate to the reference category. If we choose category 4 (very satisfied), we ask which variables are significant compared with any other satisfaction situation, meaning less than being very satisfied.

The third hypothesis: We assessed the forest cover of Ba Be district, Bac Kan province from 2000 to 2017 to verify the actual impact of payment programs on forest protection. We used QGIS software (version 3.16.6) to generate satellite image analysis based on photos (resolution of 30 x 30 m) downloadable from Global Land Analysis and Discovery (https://glad.geog.umd.edu/dataset). Data from the University of Maryland in the US served as a base to calibrate the annual forest loss rates in Bac Kan.

RESULTS AND DISCUSSIONS

Current status of payment programs for environmental services in Ba Be district, Bac Kan province

Direct PFES program

A voluntary PFES scheme was launched in 2013 with Ba Be national park's support and a pro–poor partnership for agroforestry development (3PAD). The ecosystem services payment linked households around Ba Be Lake (living in Pac Ngoi and Bo Lu Hamlet, Nam Mau Commune) and the forest owners in Duong Hamlet (Hoang Tri Commune) to protect the forest and main-

tain clean water for Ba Be Lake (Fig. 1). The service providers are villagers in Hoang Tri commune, in total 29 households. Service users of the forest and water resources are households offering homestays to tourists, small businesses running canoe tours, and Ba Be national park. This program is called a direct payment program by immediate purchase and sale of environmental services (Pagiola and Platais, 2007). In 2014, homestay owners stopped the payments because of the alleged lack of transparency. The national park took a more active role, and the program was re–launched in 2016, which is when we conducted the interviews.

Lack of transparency in the direct PFES program included the following problems:

1) The fund management board failed to publish the amount originating from homestay business households and boat drivers.
2) Lack of information on assessment criteria of forest protection activities supplied by service providers.

In 2016, the national park stepped in to monitor the forest protection activities and publish openly the contribution from homestay business households and boat drivers. Furthermore, the national park added 50 million VND/per year and mobilized food service businesses and motels around the Ba Be Lake area to expand the program.

Environmental service users transfer 2% of the estimated value of the business to a fund management board. In 2017, Ba Be's total estimated value of the business was VND 21.9 billion (or USD 980,000). Therefore, 2% of it was VND 438 million (USD 19,437).

Four members sit on the board: one representative of Ba Be National Park, one from the homestay businesses, one from the canoe cooperatives, and one from the Nam Mau People's Committee. The rules of the payment mechanism are as follows:
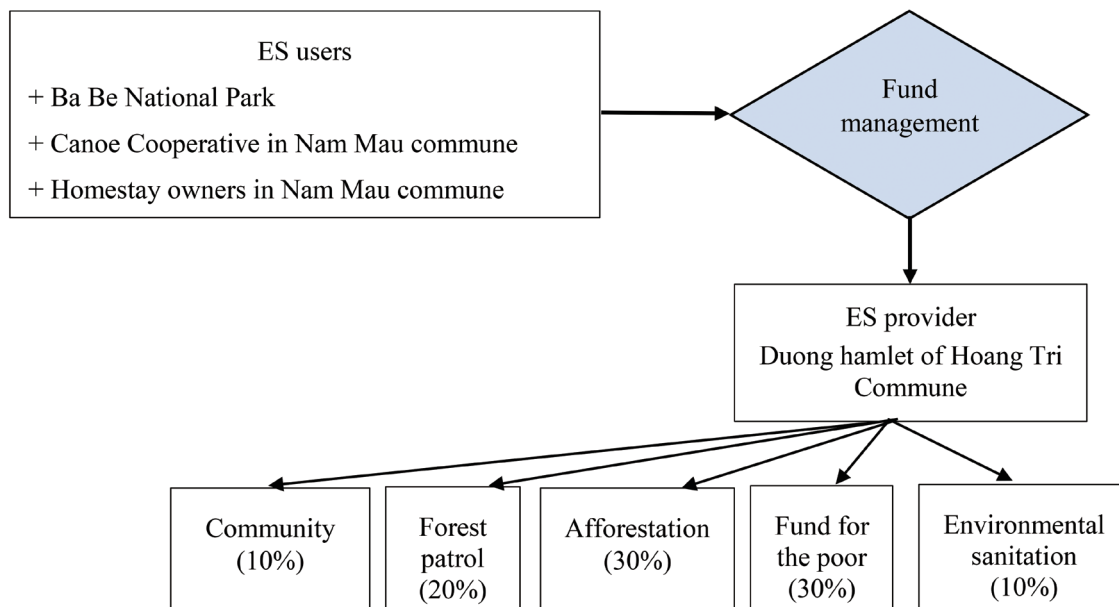

Fig. 3. Cash flow, direct PFES program in Ba Be province

– Canoe cooperatives will deduct 1% of their monthly revenue and 1% of the cooperative members' income to contribute to the PFES fund. The number of business households in Nam Mau accounts for one–third (30%) of the total number of business households around Ba Be Lake. According to statistics of Ba Be National Park in 2020, the total revenue of these facilities will reach VND 7.3 billion. Therefore, if all business households are mobilized to participate in the PES program directly, the collected amount will reach 146 million VND/year (2% of total revenue).

– The homestays will provide funding based on the number of tourists staying overnight at their houses (4,000 VND / person/night).

– Members of the fund management board will conduct an inventory of the fund's money twice a year. The Fund Management Board consists of 3 members elected by the payers: a representative of the homestay, a representative of canoe cooperatives, and a representative of the national park.

After receiving the money, the environmental service providers will use it to distribute to community members for specific purposes: Communities, forest patrol, environmental protection, afforestation, and special support for poor households (Fig. 3).

Indirect PFES program

Under the indirect PFES scheme, service providers are households from six communes: Phuc Loc, Banh Trach, My Phuong, Ha Hieu, Chu Huong, and Phieng Kham. In total, 109 households were interviewed. In this case, the service users are two hydropower plants: Tuyen Quang Hydropower Company and Chiem Hoa Hydropower Plant. The central and provincial forest protection funds act as mediators and collect payments from the hydropower plants and distribute earnings to three partners: Ba Be national park, Ba Be Forest Company, and villagers/communities. As in the case of the direct PFES program, the indirect program goes back to 2013. Households receive compensation for the time that they contribute to forest protection, which is called "Financial support to forest patrol activities"; furthermore, local people take care of the forest and are allowed to collect non–timber forest products (mushrooms and bamboo shoots) during forest patrol tasks. The payment scheme is illustrated in Fig. 4.

The results of testing the hypotheses

The first hypothesis

Table 2 displays the average payment per household for the two schemes. A simple t–test of the difference in mean and standard deviation yields a difference in standard deviation but no significance in terms of the mean. However, we notice a higher standard deviation with the indirect scheme. A few households from the voluntary PFES program refused to inform about their PFES payments (originally 29 households).

Most households, regardless of the scheme, expressed discontent with the payment amount (94 out of 104 households that answered this question). If we turn to the payment delay assessment, the difference between the two schemes shows significance. We disregarded two communes because of a low number of observations (Phuc Loc and Yen Duong) and excluded households not reporting any opinion on payment timing. Service providers working with the direct PFES scheme are more dissatisfied with their scheme than those under the indirect scheme (Table 3, p =0.013). The total number of respondents varies slightly from Tables 2 and 3, as not all households are informed about their PES payment.

If we examine the efficiency, service providers under the voluntary scheme consider the PFES program more effective than those under the indirect program (Table 4). In this case, we requested villagers' judgment on how efficient they thought the PES was to protect forests or slower the deforestation rate. The response rate was lower in this case as some households found the question difficult to answer.

The second hypothesis

The result of binary logistics with life satisfaction as the dependent variable was shown in Table 5. The binary logistic regression shows a significant correlation between satisfaction as the dependent variable and the reason for PFES and agricultural income. The estimated coefficient for the payment version of reason_PFES is negative and significant, indicating that households indicating protection as the objective of PFES are more satisfied compared to households for which payment is essential. The difference between direct and indirect payment schemes is not significant (ProgramPFES).

Table 6 showed the results of Multiple logistic regression with life satisfaction as the dependent variable. The variable VillagePFES is significant. Its positive coefficient indicates that higher values corresponding to the household perception of lower effectiveness increase the probabilities of $P(X \leq 2)$, meaning that satisfaction decreases. The order of the variable VillagePFES is such that high values correspond to ineffectiveness: the conclusion is that effectiveness and life satisfaction move in the same direction, as expected.

If the purpose of PFES is "Payment", the probabilities are larger than if the purpose is the baseline "Protection" and the level of satisfaction decreases. The same is true for the category "Other" for the variable Reason_PFES. The conclusion is that people who state that the purpose of PFES is "Protection" are most satisfied.

A larger total income decreases the probabilities, meaning that a larger income then increases satisfaction as expected. Service providers under the direct scheme are less likely to express satisfaction due to increased probabilities like $P(X \leq 2)$ compared with the indirect scheme, which is the basis category/reference group as seen from the positive coefficient.

The Third hypothesis

The forest dataset available from 2000 to 2017 showed a total loss of 6% (equivalent to 8,466 ha) of
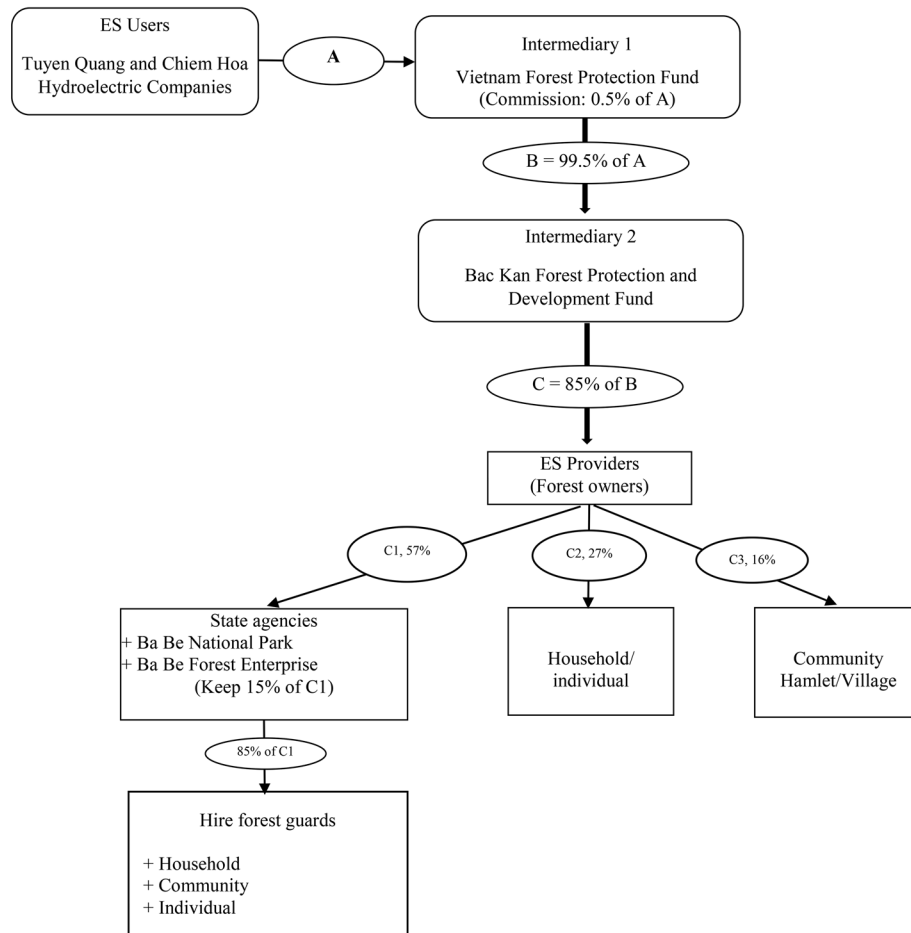
Fig. 4. Cash flows, indirect PFES program in Ba Be province

Table 2. Payments of direct and indirect PFES programs; a survey from Bac Kan province, Ba Be district, in million dongs per year per household

Type	N	Mean	Std Dev	StdErr	Minimum	Maximum
Indirect	105	1.1308	1.4842	0.1448	0	10.0000
Direct	25	0.9510	0.5880	0.1176	0.5590	1.8590

Table 3. Payment timing, direct and indirect PFES schemes in Bac Kan province

		*Commune dummy * Assessment of payment timing*				
		Too long	*Long time*	*Average*	*Fast*	*Total*
Commune dummy	*Direct*	5	19	5	0	29
	Indirect	20	37	33	15	105
Total		25	56	38	15	134

Table 4. Perceived efficiency, direct and indirect PFES schemes

		*Commune dummy * Village PFES dummy*		
		Village PFES dummy		*Total*
		Effective	*Non–effective*	
Commune dummy	*Direct*	23	4	27
	Indirect	9	87	96
Total		32	91	123

Table 5. Binary logistic regression with life satisfaction as the dependent variable; Bac Kan province

Analysis of Maximum Likelihood Estimates						
Parameter		*DF*	*Estimate*	*Standard Error*	*Wald chi–square*	*Pr > ChiSq*
Intercept		1	–10.3812	3.7871	7.5143	0.0061
VillagePFES		1	–0.6377	0.4322	2.1767	0.1401
reason_PFES	*Other*	1	–0.5853	0.4414	1.7586	0.1848
reason_PFES	*Payment*	1	–0.7097	0.3566	3.9620	0.0465
ProgramPFES	*Direct*	1	–0.3648	0.4138	0.7771	0.3780
log_revenueagr		1	0.7659	0.3508	4.7674	0.0290
log_Totalincome		1	0.4324	0.3247	1.7730	0.1830

Table 6. Multiple logistic regression with life satisfaction as the dependent variable in Bac Kan province

Analysis of Maximum Likelihood Estimates						
Parameter		DF	Estimate	Standard Error	Wald chi–square	Pr > ChiSq
Intercept	*1*	1	–0.4371	2.6357	0.0275	0.8683
Intercept	*2*	1	2.6555	2.4625	1.1629	0.2809
Intercept	*3*	1	5.4115	2.5124	4.6394	0.0312
VillagePFES		1	0.9645	0.3797	6.4533	0.0111
reason_PFES	*Other*	1	0.7989	0.3859	4.2868	0.0384
reason_PFES	*Payment*	1	0.5412	0.2990	3.2765	0.0703
ProgramPFES	*Direct*	1	1.1352	0.3763	9.1015	0.0026
log_Totalincome		1	–0.6674	0.2331	8.1962	0.0042
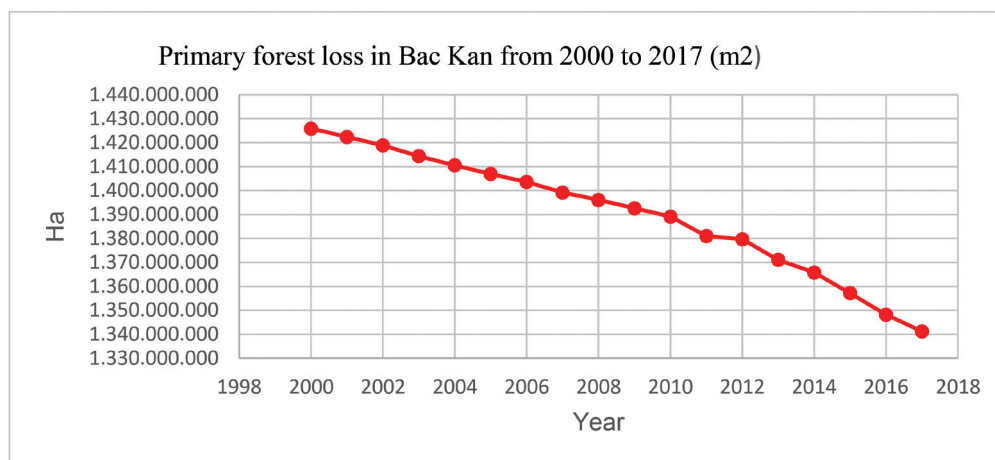
Fig. 5. Primary forest loss in the period 2000–2017

pristine forest during a period of 18 years.

Among the seven communes participating in FPES (six under the state induced scheme and one participating in a voluntary scheme), Hoang Tri commune (voluntary schemes) covers the greatest area of primary forest (1,855 ha) in 2017, Yen Duong commune ranks second (1,108 ha) while Ha Hieu commune has the smallest area of natural forests (39 ha) in the same year. All communes shared a loss of forest cover between 2000 and 2017 with the greatest loss observed in Hoang Tri commune under the voluntary program (54 ha, accounting for 2.9%), and Chu Huong commune (state induced program) as second with a reduction of 2.1% (8.1 ha). Hoang Tri commune under the voluntary scheme did not fare better than the state–induced PES scheme.

Compared to the average in Ba Kan province, Ba Be district showed a lower deforestation rate with a loss of 1.2%, but we cannot confirm that this observation is due to the presence of PES programs.

DISCUSSION

Haas *et al*. (2019) observed a marked difference – by a factor of nearly 18 – in Thua Thien Hue province between community forest participants and those who obtained a subcontract with a national park. The national park subcontracts yield a supplement to income the PFES participants regard as substantial. Their results showed that authorities allocated lucrative national park participation on an uneven basis, with pri-

ority given to households affiliated with government authorities. The authors concluded that this is a clear example of elite capture of benefits.

We are unable to confirm the findings of Hass *et al.* (2019) in our case study. Under the voluntary PFES scheme in Ba Kan province, households receive a similar payment for their involvement in forest protection as households in the indirect scheme. For all households, the payment households achieve from participation in the forest protection programs only constitute a very small percentage of their total income (less than 1%). Most households, regardless of the PFES program, also complain about the amount of payment. Out of 144 households declaring an interest in continuing to participate in the PFES in the future, 94 indicated that they expected a higher payment. The number of households under the direct program is limited (29). They together do not carter for much bargaining power; therefore, the reasonably low payment and announced expectation of a higher rate in the future

Doubts exist regarding sustainability as the long–term objective of either of the two PFES schemes. Many small businesses benefit from the direct PFES program as shop owners (such as owners of bike rentals) and suppliers of food to tourist catering (e.g., vegetables, chicken, pork, etc.) without any financial contribution to the scheme. Thus, the direct schemes come with the obvious problem of free–riding. Households participating in the indirect scheme are as dissatisfied as those involved in the direct scheme, indicating that measures and changes are required to increase the general level of satisfaction.

Efficiency is difficult to estimate and in this study, we asked participating households what they thought of the efficiency of the PFES programs. We found a positive correlation between the perception of efficiency and life satisfaction, and, conversely, that lower efficiency relates to less life satisfaction. The observations of Engel *et al.* (2008) who claim that indirect PFES schemes should be less efficient, given that buyers of environmental services are often intermediaries, confirm the hypothesis.

Initially, we asked whether households that voluntarily participate in PFES programs experience more satisfaction than those under a state–run PFES program with fewer options to stay clear of the forest protection scheme. In our last version of a life satisfaction survey, with a four–category answer range, we demonstrate a negative and significant correlation between households contributing to the direct PFES program and life satisfaction. Households under the direct PFES scheme do not appear to be in a position to negotiate an arrangement they believe reflects fair compensation for their participation in the protection of river systems. Future studies of direct PES schemes might show a stronger position of households in the negotiation of the payment with environmental service users. Finally, we show a substantial deforestation rate in Bac Kan province with a lower record in Ba Be district.

CONCLUSIONS

In conclusion, In Ba Be, Bac Kan, the indirect PES program has been widely deployed and stabilized, while the direct PES program has just stopped at a pilot scale. We note that payment did not differ between the two schemes (first hypothesis). In terms of payment delay, we observed a higher level of dissatisfaction among households under the voluntary scheme. Compared with the second hypothesis, the conclusion confirms the dissatisfaction among the direct scheme service providers. PFES for protection purposes is significant in both models. Satisfaction decreases with the PFES programs' perceived lesser efficiency among service providers if we use the extended interpretation of life satisfaction (multiple logistic regression) and total income is significant and positive in the extended version. The deforestation rate was less in Ba Be district than in the rest of Bac Kan province, though we can't be certain this is due to the presence of two PES programs (third hypothesis).

AUTHOR CONTRIBUTIONS

Cao Truong Son formed the research idea, designed the questionnaire for the survey, collected, analyzed the data, and drafted the manuscript. Thorkil Casse analyzed the data, drafted the manuscript, supervised the research, commented and edited on the manuscript. Anders Milhøj analyzed the data, commented and edited the manuscript. Nguyen Thanh Lam supervised the research and made critical revisions to the manuscript. Do Thi Nhinh collected the secondary and primary data, commented and edited on the manuscript. Mitsuyasu Yabe supervised the research, commented and edited on the manuscript. All authors read and approved the final manuscript.

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