



Opportunities and challenges for mangrove management in Vietnam

Lessons learned from Thanh Hoa, Thai Binh and Quang Ninh provinces

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Agroforestry

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Mangrove plantation in Hai Tien commune, Quang Ninh province

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Acronyms and abbreviations

5MHRP	Five Million Hectare Reforestation Program (Vietnam)
ACTMANG	Action for Mangrove Reforestation, Japan
AFoCO	Asian Forest Cooperation Organization
AGB	Above ground biomass
BAU	Business as usual
CARE	Cooperative for Assistance and Relief Everywhere
CPC	Commune People's Committee
DARD	Provincial Department of Agriculture and Rural Development
DONRE	Provincial Department of Natural Resources and Environment
DPC	District People's Committee
EU	European Union
F+, F-	FGD with women 31 years and older; FGD with women aged 18–30
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus group discussion
FLEGT	Forest Law Enforcement, Governance and Trade
FPD	Forest Protection Sub-department (under DARD)
FPG	Forest Protection Group
GCF	Green Climate Fund
GHG	Greenhouse gas
GIZ	German Agency for International Cooperation
GoV	Government of Vietnam
GSO	General Statistics Office of Vietnam
ha	Hectare
HH	Household
INDC	Intended Nationally Determined Contribution
JICA	Japan International Cooperation Agency
KVT	A Dutch funded mangrove planting project in Quang Ninh province
LULUCF	Land use, land-use change and forestry
M&E	Monitoring and Evaluation
M+, M-	FGD with men 31 years and older; FGD with men aged 18–30
MARD	Ministry of Agriculture and Rural Development
MONRE	Ministry of Natural Resources and Environment
NDC	Nationally Determined Contribution
NDS	National Development Strategy
NGO	Non-governmental organization
PAM	Forestry projects supported under The United Nations World Food Program
PES	Payment for Environment Services
PFES	Payment for Forest Environmental Services
PFMB	Protection Forest Management Board
PMU	Project Management Unit
PPC	Provincial People's Committee

REDD+	Reducing emissions from deforestation and forest degradation
SFM	Sustainable forest management
SP-RCC	Supporting Program on Responding to Climate Change
SWAMP	Sustainable Wetlands Adaptation and Mitigation Program
UNDP	United Nations Development Programme
UNICEF	United Nations International Children's Emergency Fund
USAID	United States Agency for International Development
USD	United States Dollar
VND	Vietnamese Dong
VNFOREST	Vietnam Administration of Forestry
VPA	Voluntary Partnership Agreement
VNA	Vietnam National Assembly

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Executive summary

Mangroves play an important role in providing goods (forest products and fishery resources) and services, both to the marine environment and people. However, in Vietnam, mangrove forests have been threatened by economic pressures and climate change. Mangrove protection and restoration have been key features in forestry policies over the last few decades, but studies on them rarely provide in-depth analysis, nor lessons learned from previous implementation to inform future policies. Using case studies from Thai Binh, Quang Ninh and Thanh Hoa provinces, this report aims to address these knowledge gaps and analyze both opportunities and constraints for mangrove protection and management in Vietnam. The report also aims to provide lessons learned on how existing and new policies can maximize opportunities and overcome problems.

This study has adopted a mixed research methodology. In total, 240 people participated in focus group discussions (68 in the older men's group, 52 in the younger men's group; 63 in the older women's group and 57 in the younger women's group). In addition, 604 households participated in the household surveys. We also conducted 24 key informant interviews with local authorities, non-governmental organizations (NGOs) and community representatives. Findings were presented and verified at a national consultation workshop with 42 participants as well as a provincial consultation workshop with 32 participants.

Opportunities for mangrove protection and management

The study found that local people appreciate the role that mangroves play in providing income, an attractive landscape and shelter from climate change related floods and storms. Many

communities would be willing to contribute between USD 2-20 per year to a trust fund so as to protect their forests. A large number of policies and projects promote mangrove conservation activities. This has helped strengthen law enforcement, raised local awareness of the role and importance of maintaining forests, and restricted the conversion of mangroves to other economic activities. Government policies and development projects also provide capacity building, training and seedlings for mangrove reforestation activities at the studied sites. Additionally, new incentives such as payment for forest environmental services (PFES) are emerging as a potential source of finance to support mangrove protection and development in the future.

Collective action for mangrove protection is widely recognized and promoted among study sites. People have self-organized strikes and protests to oppose converting mangrove to other economic purposes.

Constraints for mangrove protection and management

Drivers of mangrove deforestation and degradation are complex, and often associated with provincial economic development strategies. Balancing environmental protection and economic development priorities is challenging. It requires strong political commitment from government to address the drivers of mangrove deforestation and degradation.

Many policies and projects offer social and economic incentives for mangrove protection. However, they are impeded by insecure tenure, land grabbing, elite capture and inequitable benefit-sharing. Several other factors constrain mangrove protection at the institutional level:

overlapping and unclear mandates and responsibilities among government agencies at central, provincial and multilateral levels. Access to information on both policies and projects is difficult for local people. Information on the effectiveness of non-state programs aimed at mangrove protection and development is also lacking.

The monitoring and evaluation (M&E) systems, incentives and disincentives designed by policies and projects, also have major drawbacks. These include low enforcement and compliance, unclear penalty mechanisms and a lack of requirement to replant mangrove forests after they are illegal cut. The study also reveals that local willingness to pay is driven and determined by effective law enforcement; transparent and accountable financial management; equitable benefit-sharing; equitable distribution of rights and responsibilities; co-funding from government or projects; the level of annual income; and direct dependence of local livelihoods on mangroves.

Policies and projects strongly emphasize and create incentives to replant mangrove forests, rather than to maintain and conserve existing mangrove forest areas. Incentives are also designed to compensate local labor costs for

replanting mangrove or patrolling activities, rather than addressing the direct drivers of deforestation and degradation. Local participation and engagement in mangrove conservation projects and programs are also limited, due to unclear tenure security and most mangrove forests being managed by state organizations.

Recommendations

Protecting mangroves requires a policy shift in land-use planning to address the drivers of mangrove deforestation and degradation. These drivers, in turn, respond to the national and provincial economic development agenda, such as aquaculture expansion and migration. Cross-sectoral coordination also needs to be further enhanced to improve effectiveness in law enforcement. Incentives designed by policies and projects should encourage local people to replant new mangrove forests, and also maintain and sustain newly planted mangroves and existing mangrove forests. Enhancing local participation in mangrove forest protection and development also requires a gender-sensitive approach and enabling conditions, such as well-enforced policies, accountable and transparent benefit-sharing, inclusive decision making and a combination of in-kind and in-cash payments.

1 Introduction

The area of Vietnam's mangroves declined considerably – from 450,000 ha to 155,290 ha – between 1943 and 2000 (Sam et al. 2005). Causes for mangrove loss in this period include conversion to agricultural production and aquaculture, destruction due to war and urbanization (Sam et al. 2005). The loss of mangroves leads to degradation of biodiversity, loss of habitat and breeding areas for fish and other seafood stocks, destruction of the nutrient cycle in mangroves and, above all, degradation of ecosystem services (Sam et al. 2005). Over the past 20 years, with support of international donors, the Government of Vietnam has invested significant resources into a number of initiatives and programs to restore and develop mangroves. This has led mangrove area to increase, on a national scale, from 155,290 ha to 164,701 ha between 2000 and 2017 (MARD 2018). Mangrove forest area thus saw an average net annual increase of 554 ha during this period.

Like other forest ecosystems, mangroves provide numerous direct tangible products for local livelihoods, such as medicine, timber, firewood and seafood. They also provide ecosystem services for social well-being, such as coastline erosion control, water regulation, soil stabilization and carbon sequestration. Several studies indicate the total economic value of mangroves in Vietnam varies from USD 1,000–4,200 ha/year (Sam et al. 2005; Phuong et al. 2012). Environmental services account for over 80% of total value (Phuong et al. 2012). Since 2011, Vietnam has had a national policy of payment for forest environmental services (PFES), which includes payment for mangroves. The policy is not yet fully operational due to the lack of detailed guidelines on service providers and users, as well as the lack of an operational payment mechanism (Pham et al. 2012). However, PFES is being piloted in a mangrove area in Ca Mau province (Ca Mau PPC 2014).

Vietnam is also considered one of the most vulnerable countries in the context of climate change. With a coastline of more than 3,000 km, its coastal area is highly exposed to climate change impacts (IMHEN and UNDP 2015). Although mangrove area accounts for only 1.5% of Vietnam's total forest area (14.4 million ha), it plays a significant role in mitigating the impacts of climate change. The government has recognized this important role through policies such as Decree No. 119/2016/ND-CP, which commits to conserving and developing mangroves in a sustainable manner, particularly in coastal areas. Managing and restoring mangroves is also considered an important measure in the Intended Nationally Determined Contribution (INDC) of Vietnam.

The management of mangroves faces a spectrum of diverse challenges: unclear responsibilities among management agencies, conflicts in land-use planning, high demand for land use from other sectors (aquaculture and urbanization), local community engagement and poverty to cite a few (Hawkins et al. 2010). Mangrove characteristics also differ across regions, which poses challenges for a uniform national management policy. Likewise, while various studies focus on a large area of mangrove in Mekong Delta, limited data and analysis are available to study the effectiveness of mangrove management in Red River Delta.

This report aims to address these knowledge gaps and provide in-depth analysis on both the opportunities and challenges for mangrove management in Vietnam. It draws on case studies in three Red River Delta provinces: Thanh Hoa, Thai Binh and Quang Ninh. The paper aims to address two research questions:

1. What are the opportunities and constraints for mangrove management in Vietnam?
2. How can policies be refined to overcome problems?

2 Study sites and methods

2.1 Study location

The study was conducted in three northern provinces in Vietnam: Thanh Hoa, Thai Binh and Quang Ninh (Figure 1; Table 1). These studied sites were selected due to their representation of different contexts for mangrove management in Vietnam. These include mangrove area, current mangrove management regime, land tenure, forest ownership, prior experience of mangrove management and accessibility of mangroves.

Thanh Hoa province, on the central coast, has a population of 3,712,600 made up of seven groups: Kinh, Muong, Thai, H'Mong, Dao, Tho and Khomu, with Kinh as the dominant group (Thanh Hoa DARD 2017). The main income sources in the area are agriculture and aquaculture. Mangroves in the province are mainly plantations established by domestic and international projects. The total area of mangroves is about 827 ha planted on alluvial and coastal mudflats. Species planted in the area are mainly *Sonneratia caseolaris* (Ban chua), *Kandenia obovata* (Trang), *Rhizophora stylosa* (Duoc Voi) and *Avicennia* (Mam) (Thanh Hoa DARD 2017).

Before 2000, mangrove forests were scattered across mudflats and estuaries. Between 1998 and 2010, the Five Million Hectare Reforestation Program (5MHRP) supported the plantation of new mangroves, as well as the protection of existing mangrove areas. At the same time, international donors such as CARE and the Japanese Red Cross also invested in the rehabilitation and protection of mangroves. Between 2008 and 2012, the mangrove area dropped from 2,319 ha to 1,174 ha. Mangrove forests in Thanh Hoa province have not been assigned to communes or villages, and are instead managed by the Project Management Unit (PMU) of the district's Forest Protection

and Development Department. The PMU signs an annual contract with communes or other organizations to protect the mangroves. The province has plans to plant more mangrove areas, as well as to protect existing mangroves efficiently.

Thai Binh province is on the coast of the Red River Delta in the north of Vietnam. The province has a coastline of 54 km, including five river mouths, where mangroves appear. The population of Thai Binh province is 1,781,842, of which almost all are Kinh people. In the study site of Tien Hai district, the 208,092 residents represent 11.7% of the total provincial population. Coastal people rely primarily on agriculture and aquaculture for their livelihoods. The mangrove area has not been assigned to any organization or commune; instead, the Provincial People's Committee (PPC) and its representative, the Department of Agriculture and Rural Development (DARD), oversee all mangrove forest areas in the provinces. Communes, however, are responsible for mangrove protection within their administrative boundaries. Annually, DARD signs a contract with communes to protect mangroves within their jurisdiction, using state budget. Communes also organize rehabilitation programs assigned by higher authorities or donors. The province has plans for protecting and managing mangroves until 2020, including the transfer of mangrove management and protection to communes.

Quang Ninh province is a coastal province in the Northeast with a population of 1,144,988. It is comprised of 22 ethnic groups, of which 86.6% are Kinh people, Dao (5.5%), Tay (2.98%), San Diu (1.58%), San Chay (1.2%) and Hoa (0.46%). In general, the rural population is poor. People rely primarily on agriculture and forestry for their livelihoods (GSO 2015).

A literature review, along with support from provincial, district and commune government agencies, helped the study teams identify representative villages, communes and districts for in-depth study of the socio-political context, as well as the different status of mangrove management.

In total, the study selected six villages in four communes belonging to three districts in three provinces. (Table 1). These six villages have different socio-political contexts, the summary of which is below.

Dong Tan village lies in Da Loc commune, Hau Loc district, Thanh Hoa province. The village, with total land area of 211.7 ha, has 230 households and a population of 1,020 people. Almost all villagers are Kinh people (Dong Tan village 2017). Local people mainly work in agriculture and aquaculture, although a small number of villagers commute to cities for their livelihoods. Da Loc commune, including Dong

Tan village, has a mangrove area of 317 ha. The mangroves are mainly plantation forests resulting from domestic and international programs to rehabilitate the mangroves and improve the livelihoods of local people. To date, the mangrove area has not been formally assigned to the commune and village. However, the commune oversees activities related to mangrove development and management.

Ninh Phu village is in Da Loc commune, Hau Loc district, Thanh Hoa province. Located near Dong Tan village, the total land of Ninh Phu is 102.6 ha. The village has 332 households with a total population of 1,426 people (Ninh Phu village 2017). Almost all villagers are Kinh people. As in other coastal villages in the commune, local livelihoods are mainly derived from agriculture and aquaculture. Mangroves cover the mudflats in the village, the result of a plantation created by domestic and international projects and programs. The Commune People's Committee oversees protection of mangroves

Table 1. General information on the three study sites

ID	Study site	Total land area (ha)	Total population (person)	Total households (HH)	Total mangroves area (ha)
1	Thanh Hoa province	1,112,948	3,400,595	893,549	968
1.1	Hau Loc district	14,150	165,742	NA	412
1.2	Da Loc commune	1,207	8,240	1,984	317
	a. Dong Tan village	218	1,020	230	220
	b. Ninh Phu village	103	1,426	332	70
2	Thai Binh province	154,650	1,781,842	547,727	3,209
2.1	Tien Hai district	22,590	208,092	NA	3,621
2.2	Dong Long commune	783	5,669	1,588	673
	a. Hung Long Nam village	250	2,023	634	170
2.3	Nam Phu commune	985	5,293	1,580	226
	a. Thuy Lac village	82	1,326	361	150
3	Quang Ninh province	610,235	1,144,988	316,732	19,426
3.1	Tien Yen district	64,789	44,352	NA	3,767
3.2	Dong Rui commune	4,929	2,974	812	1,608
	a. Thuong village	1,036	741	190	600
	b. Bon village	2,016	690	160	677

Sources: Central Population and Housing Census Steering Committee 2010; Dong Rui CPC 2017; Nam Phu CPC 2017; Da Loc CPC 2018; Dong Long CPC 2018; VNFOREST 2018 (<http://maps.vnforest.gov.vn>).

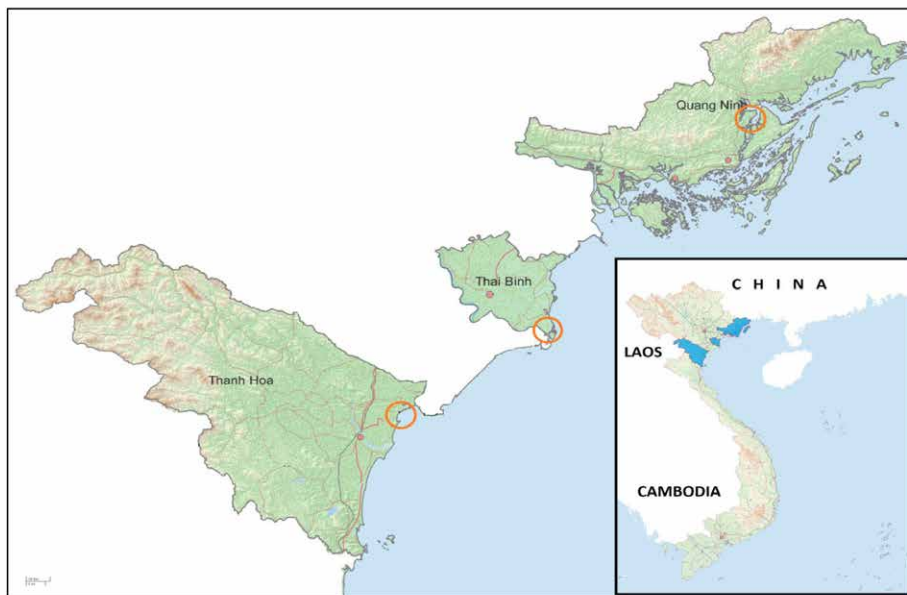


Figure 1. Study location map

within its jurisdiction, which includes Ninh Phu village.

Hung Long Nam village is in Dong Long commune, Tien Hai district, Thai Binh province. With total land area of 250 ha, the village has 634 households and 2,023 people (Hung Long Nam village 2017). The mangrove area of the commune is 673 ha, which includes Hung Long Nam village. All is plantation forest. These mangroves have not been assigned to the commune and village, but the village oversees relevant activities, including protection. Local people rely primarily on agriculture and aquaculture for their livelihoods.

Thuy Lac village is in Nam Phu commune, Tien Hai district, Thai Binh province. Total land area of Thuy Lac is 81.4 ha. The village has 361 households with a total population of 1,326 people. The mangroves have not been assigned to commune and villages, but the commune protects and maintains the mangroves. Since 1980, a large area of mangroves and mudflats has been converted into fish and shrimp ponds, for the purpose of economic development. As a result, mangroves have been severely damaged and degraded.

Thuong village is in Dong Rui commune, Tien Yen district, Quang Ninh province. Thuong village has a total land area of 1,036 ha. The village has a population of 741, across 190 families. People

in the village has mostly come from Hai Phong province since the 1980s. Livelihoods primarily rely on agriculture and aquaculture (Dong Rui CPC 2017). Like other coastal villages in the commune, mangroves along the village coastline are not assigned to the village, and are instead protected by the commune. The mangrove area of the commune is nearly 3,000 ha. Mangrove species include *Sonneratia caseolaris* (Ban chua), *Kandelia obovata* (Trang), *Bruguiera gymnorrhiza* (Vet du), *Avicennia marina* (Mam bien) and *Aegiceras corniculatum* (Su). Previously, a large area of mangroves was converted into shrimp and fish ponds. Some fish and shrimp ponds are now being reconverted to mangroves.

Bon village is also in Dong Rui commune. The total land area of the village is 2,016 ha, while the population is 690, spread across 190 households. Dao and Kinh people account for 56% and 41% of the total population, respectively; the remaining 3% are Muong. According to the field survey, villagers are migrants from other districts in the province). People rely on agriculture and aquaculture for their livelihoods. Their living standards and educational background are generally low. Like in Thuong village, a large area of mangrove and mudflats in Bon village was converted into shrimp and fish ponds, and swamps. However, after a period of aquacultural farming, more ponds are being reconverted to mangrove.

2.2 Methods

The study employed a wide range of methods. The team was comprised of six people (three each from CIFOR and VAFS) with interdisciplinary skills. It was also balanced in terms of gender to ensure both men and women interviewees feel comfortable.

A literature review was conducted to understand mangrove area and distribution, historical change in mangrove, biodiversity and mangrove management regimes; the legislative and policy environment for mangrove management and development at national, provincial, district and commune levels; and previous and ongoing programs to restore mangrove. Documents reviewed included:

- Journal articles and reports on mangrove forests, mangrove restoration and management;
- Statistics on mangroves, as well as reports from the Ministry of Agriculture and Rural Development (MARD), and the provincial Departments of Agriculture and Rural Development;
- National and provincial policies (e.g. strategies, decrees, circulars, decisions);
- Other relevant papers and reports from donors and civil society organizations (CSOs).

Key informant interviews. The study conducted 24 key informant interviews in three study provinces at provincial, district, commune and village levels (Table 2). Selected key informants are representative of management agencies (provincial, district, commune level) and sociopolitical

organizations (unions, groups) directly involved with mangrove management.

These interviews aimed to explore stakeholders' perceptions on different aspects of mangrove management and cover the following topics:

- Change in structure and institution (mangrove forest owners, mangrove forest users, purpose of use, spatial distribution in mangrove forest use and changes in mangrove use over time);
- Change in use and access rights and relevant institutions (user rights, including gender issues and regulations for mangrove use);
- Conflicts over mangrove forests;
- External support for mangrove forests in the village;
- Customary rules or local regulations;
- Financial incentives and mangrove management incentives, willingness to pay and to protect mangroves, and possibilities of payment for environmental services (PES) for mangroves;
- Issues with/gaps in mangrove forest management and policy.

Focus group discussions (FGDs). In total, 24 FGDs with 240 people were conducted across the three studied provinces (Table 3). In each village, four FGDs took place to include:

- One FGD with women 18–30 years of age (younger women);
- One FGD with women over 30 years of age (older women);
- One FGD with men 18–30 years of age (younger men);
- One FGD with men over 30 years of age (older men).

Table 2. Numbers of key informant interviews at the study sites

ID	Key informants	Thanh Hoa	Thai Binh	Quang Ninh	Total
1	Government agencies				
1.1	Provincial level	1	1	1	3
1.2	District level	1	1	1	3
1.3	Commune level	1	2	1	4
2	Women's unions; farmers' associations; youth's unions; civil society organizations	2	6	1	9
3	Village heads	2	1	2	5
Total		7	11	6	24

Table 3. Sample sizes for FGDs and household interviews at the study sites

#	Province	Study village	No. of FGDs	Mangrove management regime	Area of mangrove management (ha)	Total participants for FGDs	No. of interviewed HHs
1	Thanh Hoa	Dong Tan	4	State owned	220	38	100
		Ninh Phu	4	State owned	70	42	100
2	Thai Binh	Hung Long Nam	4	State owned	170	41	101
		Thuy Lac	4	State owned	150	39	101
3	Quang Ninh	Thuong	4	State owned	600	39	103
		Bon	4	State owned	677	41	99
Total		6	24			240	604

Participants were also selected to represent different village's demographics, including ethnic diversity, occupational diversity, household well-being, and experience with mangroves. Each FGD took approximately two hours and covered topics similar to discussions with key informants.

Household interviews. In total, 604 households took part in in-depth interviews (Table 3). Random sampling was used to select households

for the interview from a list provided by village leaders. The interview template covered: general information about the household; use of mangroves; local governance structures (characterization, roles and acceptance); local perceptions on the status of the mangrove ecosystem; potential for participation in conservation measures such as PES; and other relevant concerns about mangrove management in the area.

Table 4. Characteristics of households interviewed at the study sites

Province	Thanh Hoa		Thai Binh		Quang Ninh	
	Dong Tan	Ninh Phu	Hung Long Nam	Thuy Lac	Thuong	Bon
Village						
Number of interviews (households)	100	100	101	101	103	99
Respondents – female (percentage)	73	80	46	69	81	57
Household head – female (percentage)	22	18	11	14	24	9
Age of respondent (percentage)						
under 30	6	7	2	8	15	12
31 to 60	59	60	61	73	66	77
over 60	35	33	37	19	19	11
Age of household head (percentage)						
under 30	3	0	1	1	7	8
31 to 60	61	66	59	77	70	80

Table 5. Characteristics of households at the study sites

Provinces	Thanh Hoa		Thai Binh		Quang Ninh	
Villages	Dong Tan	Ninh Phu	Hung Long Nam	Thuy Lac	Thuong	Bon
Settlement status of household head (percentage)						
Local	33	80	86	83	42	12
Immigrant	67	20	14	17	58	88
Household head's highest education level (percentage)						
No education	3	6	2	1	5	20
Incomplete primary	14	22	8	6	19	28
Completed primary	9	10	7	7	10	9
Incomplete junior high	20	19	12	10	22	17
Completed junior high	32	27	50	55	31	17
Incomplete senior high	10	4	7	3	1	2
Completed senior high	10	10	9	10	5	4
College/university	2	2	5	8	7	2

The villages of Dong Tan in Thanh Hoa, Thuong and Bon in Dong Rui were established under the migration policy and the construction of new economic areas beginning in the late 1970s and early 1980s. As such, most villagers are migrants.

Education among household heads in the six study villages is generally limited. The number of household heads that have completed high

school or higher is very low (less than 20%). In Bon village, populated by Dao people, around 20% of household heads do not know how to read and write, and around 28% did not finish elementary school. In general, female interviewees account for a small percentage of the sample. Most people who took part in these interviews are older people (Table 4 and Table 5).

3 National and provincial mangrove distribution and policies

3.1 National mangrove area and distribution

Mangrove forests account for just 1.5% of the country's total forest area (14.4 million ha). However, they play an important role in biodiversity and coastal protection, particularly in mitigating and adapting to climate change. As regards to flora diversity, Vietnam's mangroves contain 36 true mangrove species belonging to 20 genera of 14 families and 77 associate mangrove tree species (Sam et al. 2005). The area of mangrove forests in Vietnam decreased significantly from 408,500 ha to 155,290 ha between 1943 and 2000 (Sam et al. 2005). This loss can be attributed to numerous drivers, including the use of Agent Orange during the war; conversion of mangroves to agriculture crops and aquaculture; sea encroachment; and urbanization (Sam et al. 2005). Despite these drivers, there have been many incentives to restore mangroves. Mangrove area increased by 164,701 ha between 2000 and 2017 (MARD 2018).

The Mekong River Delta accounts for about 78% of Vietnam's total mangrove area, followed by the Northeast (13%) and the Red River Delta (6%). The central region of Vietnam (North Central Coast and South Central Coast) accounts for about 1.5% of total mangrove area in the country (MARD 2018). Out of 63 provinces, around 28 coastal provinces have mangrove distributions. As of 2017, the top 9 provinces with the largest area of mangrove are Ca Mau, Ho Chi Minh City, Quang Ninh, Tra Vinh, Dong Nai, Soc Trang, Bac Lieu, Kien Giang and Thai Binh. Mangroves in these provinces account for 93% of total mangrove in Vietnam (Table 6; MARD 2018).

The Law on Forest Protection and Development (2004) and the Forestry Law (2017) state that forests are divided into three types according to

management purposes: special use forests (national parks and protected area), protection forests (watershed, coastal and environmental protection) and production forests. Special use forests are designated for gene and biodiversity conservation; protection forests for protecting the watersheds and coastal areas; and production forests for timber and forestry products supply. State boards manage special use forests and protection forests. However, production forests are allocated to different actors, including private organizations and households. Protection mangrove forests cover the largest area, 106,414 ha, accounting for 73% of total mangrove forest area in the country. This is followed by production forests (about 13%) and special use forests (9%). Special use and protection forests are normally owned and overseen by the state through the management boards and Commune People's Committees (CPCs). Production forests, which can be combined with aquaculture, are managed by private organizations and individuals (VNA 2004, 2017).

The most predominant mangrove genera include *Rhizophora* (chi Duoc), *Kandelia* (chi Trang) and *Avicennia* (chi Mam). Mangrove species of *Rhizophora* genus are widely and naturally distributed in the Mekong River Delta, but have scattered distribution in the other eco-regions of Vietnam. *Kandelia* genus species are commonly and widely distributed in the North of Vietnam, especially in the Northeast and Red River Delta. The genus of *Avicennia* has four species distributed naturally across the coastal area of Vietnam (Hong 1993).

The above ground biomass (AGB) of mangrove varies greatly by species and region, ranging from 1.4–203 tons per ha. The highest average AGB, 203.5 tons per ha, was found in *Senneratia caseolari* forests. An AGB of more than 100 tons/ha is reported for *Rhizophora apiculata* (198 tons/

ha), followed by *Avicennia alba* (143.7 tons/ha) and *Avicennia officinalis* (109.8 tons/ha). An AGB of less than 100 tons per ha was seen in *Ceriops decandra* (70.5 tons/ha), *Lumnitzera racemosa* (40.8 tons/

ha), *Kandelia obovata* (65.9 ton/ha) and *Nypa fruticans* (1.4 tons per ha). On average, the AGB of mangrove in Vietnam is about 104.2 tons/ha; biomass carbon stock is 49 tons C/ha (Phuong et al. 2015).

Table 6. Mangrove area by province (as of 2017)

Order	Province	Eco-region	Area in 2017 (ha)	Share (percentage)
1	Ca Mau	Southwest	65,469	39.75
2	Ho Chi Minh City	Southeast	32,442	19.70
3	Quang Ninh	Northeast	19,426	11.79
4	Tra Vinh	Southwest	8,043	4.88
5	Dong Nai	Southeast	6,881	4.18
6	Soc Trang	Southwest	5,494	3.34
7	Kien Giang	Southwest	4,782	2.90
8	Bac Lieu	Southwest	4,435	2.69
9	Ben Tre	Southwest	3,581	2.17
10	Thai Binh	Red River Delta	3,209	1.95
11	Hai Phong	Red River Delta	2,601	1.58
12	Nam Dinh	Red River Delta	2,568	1.56
13	Ba Ria - Vung Tau	Southeast	2,054	1.25
14	Thanh Hoa	North Central Coast	968	0.59
15	Tien Giang	Southeast	808	0.49
16	Ha Tinh	North Central Coast	661	0.40
17	Ninh Binh	Red River Delta	512	0.31
18	Nghe An	North Central Coast	341	0.21
19	Binh Dinh	South Central Coast	92	0.06
20	Long An	Southwest	90	0.05
21	Khanh Hoa	South Central Coast	60	0.04
22	Thua Thien Hue	North Central Coast	47	0.03
23	Quang Nam	South Central Coast	46	0.03
24	Quang Tri	North Central Coast	36	0.02
25	Phu Yen	South Central Coast	22	0.01
26	Quang Binh	North Central Coast	17	0.01
27	Binh Thuan	South Central Coast	13	0.01
28	Quang Ngai	South Central Coast	3	0.00
Total			164,701	100.00

3.2 Provincial mangrove distribution

In Thanh Hoa province, the mangroves are mainly plantations established by domestic and international projects and programs. The province still has 827 ha of mudflats allocated for mangrove plantation and around 200 ha for tree planting in sand. The species planted in this area are mainly *Sonneratia* (chi Ban), *Kandenia* (chi Trang), *Rhizophora* (chi Duoc) and *Avicennia* (chi Mam) (Thanh Hoa DARD 2017). Before 2000, mangrove forests were scattered across mudflats and estuaries throughout the province. Between 1998 and 2010, 5MHRP supported the planting of new mangroves and the protection of existing areas. At the same time, international donors such as CARE and the Japanese Red Cross also invested in the rehabilitation and protection of mangroves. Mangrove area reduced from 2,319 ha to 1,174 ha over 2008–2012. According to the report of MARD (2017), the current mangrove area of Thanh Hoa is 968ha.

In Thai Binh province, according to Thai Binh DARD (2013, 2014), the mangrove area was 6,752 ha in 2000, covering mostly the estuaries and mudflats of Tien Hai and Thai Thuy districts. In 2010, mangrove area increased to 7,054 ha as a result of the significant effort made to rehabilitate mangroves under the 5 Million Hectare Deforestation Program. Mangrove area then decreased to 5,592 ha in 2012 after a strong typhoon (Son Tinh Typhoon) in 2012. Between 2013 and 2017, mangrove area gradually increased due to strong provincial rehabilitation programs. However, according to the national forest inventory, the area declined again slightly; in 2017, it measured 3,209 ha, excluding 654 ha of new plantation. The most

popular species planted in the province belong to the *Sonneratia* genus (*chi Ban*) and *Kandelia* genus. The rest is a mix of *Sonneratia* (*chi Ban*), *Kandelia* (*chi Trang*), *Rhizophora* (*chi Duoc*) and *Avicennia* (*chi Mam*) genera (Thai Binh PPC 2014). Mangroves in Tien Hai include pure plantations of *Sonneratia* genus, *Kandenia* genus and mixed plantations.

In Quang Ninh province, mangrove species include Ban chua (*Sonneratia caseolaris*), Trang (*Kandelia obovata*), Vet du (*Bruguiera gymnorrhiza*), Mam bien (*Avicennia marina*) and Su (*Aegiceras corniculatum*). According to provincial government agencies, Quang Ninh had a large area of mangroves in the 1980s, mostly found in coastal areas. However, due to major economic development and resident movement programs around that time, the province's mangrove forests were severely degraded and reduced. Many projects and programs of both the Vietnamese government and international donors have invested in the rehabilitation and conservation of mangrove forests, as well as livelihood improvements for local people. The main international and national initiatives that have significantly invested in mangroves in Quang Ninh include the PAM Program, 5MHRP, Red Cross and Japan International Cooperation Agency (JICA) programs. According to the report of MARD (2017), the current mangrove area of Quang Ninh is 19,426ha (MARD, 2017).

3.3 Key policies and institutional setting for mangrove governance

In recent years, various important policies to promote the management and development of mangrove forests have been prepared and issued (Box 1).

Box 1. Key policies on mangrove protection and development in Vietnam

Decision No. 1719/QĐ-TTg of the Prime Minister dated 4 October 2011, approving criteria for assessment of projects under the Supporting Program on Responding to Climate Change (SP-RCC). This provides priorities for 12 sectors and inter-sectors and 7 eco-regions. Of those sectors, reforestation and afforestation of mangrove forests, as well as integrated coastal management, are high priorities for project investment.

Decision No. 1206/QĐ-BNN-TCLN dated 8 April 2016, announcing economic and technical cost-norms for seedling production, and the planting, maintenance and protection of mangrove forests.

Decision No. 38/2016/QĐ-TTg dated 14 September 2016, providing regulations and government support, particularly financial, for forest protection, the planting of forests (special use and protection forests) and forest certification, as well as support for infrastructure development in forested areas.

Box 1. Continued

Intended Nationally Determined Contribution (INDC). The Intended Nationally Determined Contribution (INDC) of Vietnam affirms the significance of mangroves in addressing climate change. The INDC, for example, proposes the restoration and development of mangroves as both a mitigation and adaptation strategy (MONRE 2016a). It also reports that the forestry sector contributes considerably to emission reduction by reducing deforestation and forest degradation, and by enhancing removal through forest restoration and development. The total GHG mitigation potential generated by the forestry sector for 2021-2030 ranges from 82.2 to 156.3 million tons CO₂, of which GHG mitigation potential from mangroves is estimated at 4.4 million tons CO₂ (Phuong et al. 2018). The INDC is being updated, as the NDC and National Development Strategy (NDS) include seven mitigation options in land use, land-use change and forestry (LULUCF). Mitigation options focus on conservation of forest areas (including mangroves), forest restoration and the enhancement of degraded natural forests and mangroves, improvements in the productivity of plantations for saw log supply, the scaling up or replication of successful agro-forestry models, and sustainable forest management. Annual GHG mitigation from these options is estimated at 7.6 million tons CO₂ for 2021–2030, with national budget support alone. This could reach 13.9 million tons of CO₂ if Vietnam were to receive external support for mitigation. The GHG mitigation potential of LULUCF accounts for 21% of GHGs in the Business as Usual scenario (Phuong et al. 2018).

Decree No. 119/2016/ND-CP dated 23 August 2016, focusing on management, protection and development of mangrove forests in response to climate change. This policy regulates the management of mangrove forests, including investment, protection, allocation, benefits, and the responsibilities of government and other organizations. It affirms a government commitment to invest its own resources in the conservation and restoration of mangroves, especially the incentive payment for forest protection and promoting allocation of mangroves to local communities for protection and management.

Decree No 99/2010/ND-CP (now is regulated in Decree No. 156/2018/ND-CP), stimulating payments between service providers and users. Service user groups are required to deliver payment for the following services : i) soil protection, reduction of erosion, and sedimentation of reservoirs, rivers and streams; ii) regulation and maintenance of water sources for production and domestic uses; iii) forest carbon sequestration and retention, reduction of GHG emissions through prevention of forest degradation and loss of forest area, and through sustainable forest development; iv) protection of the natural landscape and conservation of forest ecosystem biodiversity for tourism services; and v) provision of spawning grounds, feeding sources and natural seeds, and use of water from forests for aquaculture. Since this policy was put into practice, it has generated about USD 70 million annually to pay forest owners through contracts for protection. This policy has not been applied to mangrove forests as there is no regulation at the present. However, it is being piloted in a mangrove area of Dat Mui national park in Ca Mau province.

National REDD+ Action Program^a. This program replaced the national REDD+ action plan issued by *Decision No. 799/QĐ-TTg* in 2012. Objectives include increasing forest cover to 42% by 2020 and to 45% by 2030, and contributing to emission reduction targets set in the INDC. These emission reduction targets aim at 8% with Vietnam's own resources compared to BAU, and up to 25% with external support. This program also provides details of policies and measures for REDD+ implementation until 2030. It focuses on the drivers of deforestation and forest degradation, including loss of mangroves.

Revised Forestry Law 2017, passed by the National Assembly on 15 November 2017, addressed the following areas: i) strict management of conversion of natural forests; ii) allow permit-only logging in natural forests that fall under certified sustainable forest management (SFM); iii) focus on forestry as environmental services and limit logging from natural forests; iv) promotion of forestry business; v) improve forest tenure to clearly identify forest owners/users; vi) national forestry planning; and vii) control of forest products through Voluntary Partnership Agreements (VPAs)/Forest Law Enforcement, Governance and Trade (FLEGT), and multisector engagement. This law provides strengthened forest governance and clearer laws on how to solve deforestation, with more emphasis on involving local communities in protection.

Box 1. Continued

Decision No. 120/QĐ-TTg of the Prime Minister dated 22 January 2015, approving projects for the protection and development of coastal protection forests to respond to climate change. This aims to protect coastal forest area of 310,695 ha (forests in sandy areas and mangrove forests), restore 9,602 ha of degraded forest, and reforest 46,058 ha (of which 29,500 ha is mangrove forest). This project covers 28 coastal provinces and the total budget is VND 5,415 billion for 2014–2020 (70% from state budget) (see Table 8). As of 2017, 42 sub-projects were approved for implementation from 2015 onward, across the country. About 89,000 ha of mangrove forests was restored.

Decision No. 886/QĐ-TTg of the Prime Minister dated 16 June 2017, approving the national program for sustainable forestry development over 2016–2020. This program aims at improving and finalizing policies and capacity, as well as ensuring infrastructure and applying science to achieve sustainable management of the forestry sector. The budget for implementation is VND 59,000 billion, including about VND 14,000 billion from the national budget. This program will support forest protection, forest regeneration and enrichment, local communities in the buffer zone of special use forest areas, forest certification and capacity building. Financial support will follow guidance in *Decision No. 38/2016/QĐ-TTg*.

a Prime Minister 2017. Decision No. 419/QĐ-TTg of the Prime Minister dated 5 April 2017, approving the national REDD+ program.

Table 7. Financial support given for forest protection and management policies

ID	Type of support	Amount of support
1	Investment of state budget in the planting and protection of special use forests	VND 30,000,000/ha
2	Local contracts for forest protection	VND 300,000/ha/year
3	Naturally-assisted regeneration of forests	VND 3,000,000/ha/six years
4	Assisted regeneration with additional planting	VND 6,600,000/ha/six years
5	Construction of new nurseries for seedling production (minimum area is 0.5 ha)	VND 300,000,000/nursery
6	Improving existing nurseries for seedling production	VND 75,000,000/nursery

Table 7 summarizes the main financial support for forest protection and development in relation to mangrove forests.

In Vietnam, various national and provincial-level agencies and organizations manage mangroves and their relevant issues, leading to overlapping mandates and responsibilities. The Ministry of Agriculture and Rural Development (MARD) has had a long history of establishing and managing protected areas (special use forests), including mangrove ecosystems. MARD also manages water surfaces as they are related to irrigation, fishery and aquaculture. However, the Ministry of Nature Resources and Environment (MONRE) manages biodiversity within, and the land under, terrestrial and mangrove forests. Additionally, each federal

Table 8. Budget allocated to activities under SP-RCC 2014–2020

ID	Activities	Investment (VND billion)
1	Forest protection	412.7
2	Forest restoration	288.1
3	Reforestation	2,960.6
4	Scatter planting of trees	235.0
5	Other	1,292.4

department has a provincial counterpart, namely the Department of Agriculture and Rural Development (DARD) and the Department of Nature Resources and Environment (DONRE). In many cases, it is

not clear who is in charge of managing a special mangrove forest, and how to manage it effectively.

3.4 Major international initiatives aimed at mangrove restoration

A number of programs and projects, both national and international, have invested in mangrove protection and restoration over the last 20 years. Major mangrove reforestation programs include the following (Que et al. 2012):

- Red Cross Japan provided financial support to mangrove restoration in Quang Ninh province for 1996–2005.
- PAM project 5325 helped Thanh Hoa province restore mangrove forests in 1996/1997, while PAM project 4304 was implemented in Thanh Hoa during 1992–1997.
- Other organizations, such as ACTMANG of Japan, KVT (Netherlands), the Danish Red Cross and UNICEF of United Kingdom provided financial support to mangrove regeneration in Thai Binh, Nam Dinh and Ninh Binh provinces during 1990–1993.
- GIZ funded a project in Kien Giang and Bac Lieu provinces for the restoration and development of coastal protection mangrove forests during 2006–2010.
- The World Bank funded a project on the protection and development of coastal wetland areas in the South of Vietnam during 2002–2007.

These programs have provided the following valuable lessons on mangrove management:

- **Appropriate site assessment** is essential for successful restoration and replantation of mangrove forests, but has not been properly done in the past (Marchand 2008; Que et al. 2012; Phuong et al. 2016). Such an assessment requires good understanding of the biophysical conditions of the area planned for restoration and existing forest area intended for improvement. This includes soil properties, soil maturity, tide regime (depth, duration and frequency of tidal inundation) and water salinity, which are key factors influencing the growth of mangrove trees. Understanding biophysical conditions is the foundation for assessing the suitability of mangrove tree species according to their ecological requirements. Site assessment also applies to forested areas where the intention is to enhance and protect

forest functions, such as improving forest canopy, diversifying tree species, and increasing tree density.

- **Ensuring quality seedlings is critical for forest restoration.** Depending on site conditions and silvicultural interventions, seedlings differ in term of ages, top height and collar diameter. The sources of seeds are also important to ensure quality seedlings. Lessons to date shows that seedlings should be produced locally to better fit local conditions.
- **High costs for mangrove restoration are documented** in sites affected by strong sea waves, eroded coast, deep and frequent tidal inundation, and sandy soils. The cost of planting 1 ha of mangrove in such sites vary greatly from area to area: from VND 90–500 million per ha (USD 4,000–22,700) compared to USD 1,000–2,000 per ha as suggested from key stakeholder interviews. The cost of setting up supporting construction items (e.g. sea-wave break fence and sedimentation traps, or putting soils into the sandy area to improve soil particle contents) is very high. For example, sea wave break fencing in Kien Giang under the GIZ project was VND 350–400 million (USD 16,000–18,000) per km (Que et al. 2012).
- **Mangrove management needs to generate and sustain livelihoods for forest-dependent people and communities.** Many people depend on mangrove forest areas for their livelihoods and income. Livelihood development models should be built on the consensus of local communities and their experiences.
- **Local communities and CSOs must be engaged in forest management.** Local communities and unions for women and young people play a central role in the success of mangrove forest management and development. However, local communities still manage or jointly manage only a limited area of mangrove forests. Several good examples of co-management of mangrove forests are in Hai Phong (Sam 2014); in Dong Rui, Quang Ninh (Phuong et al. 2016); and especially the community-based approach to management and restoration of mangrove forests in Da Loc, Thanh Hoa (Reed et al. 2014).
- **Monitoring and evaluation (M&E) of mangrove restoration projects is critical** for the long-term sustainability of mangrove forests. However, in most past programs, M&E was insufficient. A poor database of mangrove

forests and restoration projects has led to poor planning for mangrove forest management and development.

3.5 Mangrove forest governance across the studied sites

Residents of the six studied villages in the three provinces are not assigned management of a specific forest area; instead, they manage and protect the forest within the boundaries of their village. Data on mangrove forest area and governance were found to be inaccurate at a village level. As such, forest management policies and regulations at research sites were drawn from district and commune levels, rather than the village level. As elaborated below, villages disseminate forest protection regulations and remind people to implement them.

3.5.1 Thanh Hoa province

According to a key informant from Hau Loc district, over the period of 2013–2020, the district's mangrove forests are being managed by Hau Loc District People's Committee (DPC), represented by its Project Management Board for Forest Protection and Development. The Board is headed by the Vice Chairman of Hau Loc DPC and other members are representatives of district local authorities and forest rangers. Prior to 2017, the Board contracted the border guard station located in Da Loc commune to protect mangroves within the boundary of the commune (paying VND 200,000/ha/year). From 2018 onwards, the Board is expected to contract and allocate forest protection funds to the Border Guard Station for protection of over 200 ha and Da Loc CPC for protection of the remaining 100 ha (at a contracted cost of VND 450,000/ha/year). The two villages studied in Da Loc commune (Dong Tan and Ninh Phu) will primarily be responsible for forest protection and, in collaboration with the FPG of the commune, protect the mangrove forests.

3.5.2 Thai Binh province

Mangrove in Hung Long Nam village is under the protection of the Forest Protection Group (FPG) of Dong Long commune, established in 2004.

The FPG consists of seven people (one leader, one deputy leader and five members, including members of the commune police), selected by Dong Long CPC, based on conditions such as their proximity to the mangrove forest area or their ownership of ponds near the forest, with roles distributed equally across commune villages. The amount of operational budget covered by the annual state budget for forest protection depends on the size of mangrove area managed by each commune. Since 2016, the FPG have received funding from a Korean project implemented in the commune, rather than government funding. In 2017, the FPG's total received budget was VND 87 million. The group retains about 15–20% of these funds for expenditure like gasoline for patrolling activities and visitor receptions; the rest is spent on forest protection. One FPG member is paid a monthly average wage of VND 500,000–1,000,000 for their forest protection duties. Although they are expected to provide comprehensive mangrove protection, this compensation is low, meaning that FPG members combine their responsibilities with other income-generating jobs (e.g. aquaculture). Dong Long commune has signed a 10-year contract with the FPG for the protection of 2.5 ha of coastal lagoons, with the aim of increasing the area of mangroves and providing extra income for local people. The FPG has invested its funds in renovating and building houses, planting *Casuarina* and introducing shrimp farming. Protected mangrove is spread across two areas in the north and south of Hung Long Bac and Hung Long Nam. The FPG holds weekly summary and action planning meetings, assigning members to patrol and inspect their area of responsibility (depending on water conditions). Weekly, the leader and deputy team leader examine the mangrove forests and encourage members in their work.

Thuy Lac village. Nam Phu CPC undertakes overall management duties for Con Vanh's forests; under the CPC, mangrove and *Casuarina* forest are co-managed and managed respectively by the Con Vanh Ecotourism Area management board, which does not receive funding for forest protection. The Forest Protection Sub-department (FPD), a sub-department of the provincial Department of Agriculture and Rural Development (DARD), establishes annual forest protection contracts with

the CPC to look after the whole forest. The local Forest Protection Group (FPG), established by the CPC, has six members, including three from the Commune Police and authorities; the rest are selected from villages near the mangroves. Operating costs amount to VND 50 million/year, which covers forest protection and the prevention of activities like illegal logging and bird capture. From their annual funding, the team deducts VND 1–2 million for general activities (once or twice per year). Previously, the team was involved in forest plantation; this responsibility was later assigned to agricultural cooperatives which hired farmers; now the team is responsible solely for forest protection. The group works closely with the border guard station to undertake its forest protection duties.

3.5.3 Quang Ninh province

The mangroves in Dong Rui Commune were allocated to village communities in 2006, under the decision of Tien Yen District People's Committee. All 2,177 ha of mangrove within the commune is protected, and are under the general management of Dong Rui CPC. Each of the

commune's four villages has a FPG made up of three to five people, operating under locally-approved regulations developed in accordance with commune guidelines. Mangrove forest co-management initially began with UNDP support, under a project that included activities like mapping and demarcation. Dong Rui CPC does not receive state funding for forest protection, as the provincial budget is limited; priority is given to forests that are vulnerable to fire and are easily destroyed. Protection activities focus on mangrove control or conversion.

3.6 Economic evaluation of mangrove environmental services in Vietnam

Many studies have estimated the economic value of environmental services of mangroves in Vietnam between 1998 and the present day (Table 9). These studies show that provisioning services in Vietnam have the highest economic value — up to USD 1,791/ha — followed by cultural services. However, these various services have different values across Vietnam, due to different governance regimes, mangrove quality and quantity, and local livelihoods (Table 10).

Table 9. Economic valuation of environmental services provided by mangroves in Vietnam (USD/ha/year)

Services	Specific services	Observations	Means	Max	Min	Standard error	Standard deviation
Provisioning services	Sub-total value		1,791.55	5,128.58	184.44		
	Timber	15	58.00	332.37	0.77	24.36	94.33
	Firewood	18	12.05	92.63	0.55	5.07	21.50
	Medicinal plants	5	7.74	30.61	0.85	5.78	12.91
	Seafood harvesting	20	267.83	1,013.07	2.33	59.21	264.81
	Aquaculture	15	1,436.82	3,627.45	179.74	323.76	1,253.91
	Other direct use	5	9.12	32.43	0.20	6.01	13.44
Regulating services	Sub-total value		959.38	4,122.81	64.89		
	Soil protection value	2	6.81	8.87	4.75	2.06	2.92
	Water regulation value	0					
	Coastal protection value	6	845.98	3,896.53	26.50	614.67	1,505.63
	Carbon value	4	106.59	217.40	33.64	37.10	82.95

continued on next page

Table 9. Continued

Services	Specific services	Observations	Means	Max	Min	Standard error	Standard deviation
	Sub-total value		1,462.25	3,881.62	1,100.16		
Cultural services	Landscape value	2	17.42	26.62	8.23	9.19	13.00
	Tourism value	11	334.93	2,726.45	0.69	242.64	804.75
	Micro-climate stabilization value	1	1,029.41	1,029.41	1,029.41	-	-
	Option value ^a	1	45.21	45.21	45.21	-	-
	Existence value ^a	2	35.28	53.93	16.63	18.65	26.38
	Total value		4,213.19	13,133.01	1,349.49		

Sources: Tri 1998, 2000; Hang and An 1999; Nhuan et al. 2003; Sam et al. 2005; Thang and Bennett 2005; Phuong 2009, 2013; Truong 2010; Wilson 2010; Tuan and Kuenzer 2012; Hang and Thanh 2013.

a In the theory of Total Economic Value (TEV) of a forest ecosystem, 'Option value' reflects the value people place on a future ability to use the forest, 'Existence value' reflects the value people get from understanding that a special resource is needed for future generations (eg biodiversity).

Table 10. Geographical differences in the economic value of mangroves in Vietnam (USD/ha/year)

Author(s)	Year	Study location	Timber	Firewood	Medicinal plants	Seafood harvesting	Aquaculture	Other direct use	Soil protection	Water regulation	Coastal protection	Carbon value	Landscape	Tourism	Micro-climate stabilization	
Tri et al.	1998	Xuan Thuy NP, Nam Dinh	NA	7.35	NA	95.68	641.89	NA	8.87	NA	231.74	NA	NA	53.45	NA	
Hang et al.	1999	Can Gio, HCM City	0.77	0.55	NA	7.91	NA	4.75	NA	NA	NA	NA	NA	NA	NA	
Tri	2000	Can Gio, HCM City	44.67	6.50	NA	2.33	NA	0.20	NA	NA	NA	NA	8.23	NA	NA	
Nhuan et al.	2003	Bach Dang river estuary	4.59	1.98	NA	65.36	394.02	NA	NA	NA	NA	NA	NA	NA	0.92	NA
		Van Uc river estuary, Hai Phong	5.81	3.23	0.97	104.87	589.87	NA	NA	NA	NA	NA	NA	NA	0.69	NA
		Ba Lat river estuary, Nam Dinh	6.92	5.52	1.11	179.74	179.74	7.97	NA	NA	NA	NA	NA	NA	0.88	1,029.41
		Kim Son tidal flat, Ninh Binh	7.11	5.06	0.85	88.43	713.07	NA	NA	NA	NA	NA	NA	NA	1.01	NA
		Tien river estuary, Ben Tre	9.93	5.83	NA	363.40	2,569.61	NA	NA	NA	NA	NA	NA	NA	12.42	NA
		Ca Mau southwest tidal flat	8.57	8.80	NA	724.58	3,345.39	NA	NA	NA	NA	NA	NA	NA	170.49	NA
		Dong Rui commune, Quang Ninh	4.55	2.12	NA	86.60	3,627.45	NA	NA	NA	NA	NA	NA	NA	NA	NA
		Nghe An	4.48	1.26	NA	110.78	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		Can Gio, HCM City	NA	NA	NA	NA	3,539.22	NA	NA	NA	NA	NA	NA	NA	88.24	NA
		Tra Vinh and Soc Trang	10.21	5.15	NA	1,013.07	1,275.82	NA	NA	NA	NA	NA	NA	NA	176.14	NA
Sam et al.	2005	Quang Ninh	NA	7.59	NA	285.44	NA	NA	NA	NA	NA	NA	NA	NA	NA	
		Ben Tre	129.22	7.91	NA	573.07	NA	NA	NA	NA	NA	NA	NA	NA	NA	
		Ca Mau	159.49	34.18	NA	474.18	NA	NA	4.75	NA	NA	NA	NA	NA	NA	
Phuong	2009	Xuan Thuy NP, Nam Dinh	NA	NA	NA	NA	NA	NA	NA	NA	50.13	NA	NA	NA	NA	
Truong	2010	Xuan Thuy NP, Nam Dinh	NA	NA	NA	156.76	892.55	32.43	NA	NA	26.50	34.92	NA	NA	NA	
Wilson	2010	Kien Giang	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
ADB	2010	Quang Tri, Thua Thien Hue, Quang Nam	NA	NA	NA	NA	NA	5.14	409.78	2,615.36	NA	NA	NA	NA	NA	
Tuan et al.	2012	Can Gio, HCM City	332.37	NA	NA	385.97	2,124.26	NA	NA	NA	3,896.53	217.40	NA	2,726.45	NA	
Phuong	2013	Ca Mau	NA	16.34	NA	399.90	511.90	NA	NA	NA	504.59	33.64	26.62	NA	NA	
		Kien Giang	NA	92.63	NA	154.92	879.29	NA	NA	NA	366.37	169.40	NA	NA	NA	
Hang	2013	Thua Thien Hue	NA	NA	30.61	NA	NA	NA	NA	NA	NA	77.61	NA	453.51	NA	
Thang et al.	2005	Ca Mau	141.29	4.83	5.15	83.57	268.24	0.24	NA	NA	NA	NA	NA	NA	NA	

NA = no information available

4 The role of mangroves and drivers of mangrove deforestation and degradation

4.1 Local perceptions of the importance and benefits of mangroves

Results from FGDs show that mangroves play an important role in local livelihoods and provide both monetary and non-monetary benefits (Table 11 and Table 12). Household survey results also show that local people across the study sites understand well the importance of mangrove systems in terms of environmental protection and livelihood support. Regarding environmental protection, most locals stated that high quality mangroves could protect their houses, agricultural crops, fish ponds and coastline from typhoons, powerful tides and wind. Many local people have experienced the damaging impacts of typhoons, powerful tides and wind when the coastline has not been protected by mangroves. Local people believe they have a responsibility for mangrove protection and maintenance, and that in return, mangroves will protect their lives.

FGD participants across the six villages frequently refer to the environmental benefits of mangroves, such as providing habitats for birds and fish, along with fresh air. Social benefits highlighted in most villages studied include: ensuring people’s safety through protection of the dyke system, creating social venues for young people, maintaining the beauty of the landscape, and providing migrants

with stable income from fishery activities. This is consistent with the survey, in which 90% of 604 households indicated that mangroves could significantly reduce the impact of typhoons, powerful wind and tides on their houses, crops, fishponds and the dyke. Mangroves were also seen as providers of stable aquatic stocks, such as fish, clam, shellfish, crab and sea worm. Only certain older households who were unable to access the forest, particularly in Bon village, did not consider mangroves important for their lives (Table 12).

Mangroves also bring economic benefits to local communities through generating income for local people. Income sources include bee farming, tourism activities, firewood collection, hunting birds, fishery, and prawn and clam farms. For example, in Hung Long Nam village, about 70–80% of households (500 households) sell aquaculture produce (e.g. clams, crabs, shrimps) (Hung Long Nam F+, F-) and 50% of villagers harvest wild seafood daily. The young men’s group in Dong Tan village also highlighted that 80% of households harvest seafood from mangroves, primarily for sale. Each person receives approximately VND 500,000/day from selling these resources.

The FGD findings are confirmed by the household survey, in which over 90% of

Table 11. Local perceptions of the importance of mangroves based on the HHs interview results

Province	Thanh Hoa		Thai Binh		Quang Ninh	
	Dong Tan	Ninh Phu	Hung Long Nam	Thuy Lac	Thuong	Bon
Importance of mangrove for households (percentage)						
Yes	100	100	97	95	96	91
No	0	0	3	5	4	9

Table 12. Local perceptions of the benefits of mangroves based on the FDG results

Provinces	Thanh Hoa		Thai Binh		Quang Ninh	
Village	Dong Tan	Ninh Phu	Hung Long Nam	Thuy Lac	Thuong	Bon
Environmental benefits	Habitat for seafood (F+); fresh air (F-); habitat for newly migrating birds (M+, M-); silt and sedimentation control (M+).	Attracts birds (F+, M-); typhoon prevention (F-, M-); fresh air (F-, M+, M-).	Clean environment and fresh air (F+); habitat protection for birds and other wildlife/biodiversity (F+, F-); reduced waste (F-); reduced damage due to waves and wind (F+).	Fresh air (F+); habitat for seafood (M+, M); habitat for birds (M+); soil protection against landslides (M+, M-).	Fresh air (F+, M-); habitat for seafood (M+); landscape preservation (M+); decreased soil erosion (M+).	Fresh air (F+); environmental habitat for seafood (F-, M-, M+).
Social benefits	Dyke protection (F+), landscape beauty	Protection of people's lives from floods and storms (F+); dyke system protection (F-, M+).	Mangrove forest protects dykes, and breaks strong waves or storms (F+, F-, M+); landscape beauty (F-, M+).	Mangrove forest protects dykes, and breaks strong waves or storms (M+, M-, F+); Landscape beauty and ecotourism services (F-, M+); Some migrants come back with families to work as fishers (F-); storm shelters for boats.	Mangrove forest protects dykes, and breaks strong waves or storms (F+, F-, M-); Landscape beauty (M-).	Landscape beauty (F+). Green place for social events (F-); people dating (F-). Mangrove forest protects dykes, and breaks strong waves or storms (F+, F-).
Economic benefits	Income from catching fish, bee keeping, hunting birds and firewood (F+).	Income from bee keeping and catching fish (F+, M+); Firewood supply (F);	More income for villagers (F+, M+).	Tourism opportunities (F+); increased income for shrimp farm owners; firewood and timber.	Increased income for shrimp farm owners (F-); ecotourism potential (M-, F+).	Potential for ecotourism (F+, F-); bee keeping (F-).

Sources: FGDs; Notes: F+ refers to FGDs with older women; F- refers to FGDs with younger women; M+ refers to FGDs with older men; M- refers to FGDs with younger men.

households interviewed said that mangroves play an important role in their lives (Table 11).

Men, women, younger and older people tend to agree on the majority of benefits provided by mangroves. Some benefits, however, are only perceived by particular groups. For example, the younger women's group in Thuy Lac believed that mangroves provide incentives for migrants to come home and work in the area.

Mangroves provide a home for seafood sources to settle and breed, according to the studied communities. Local people who benefit from the harvesting of fish, clam, crab and sea worm, for example, argued that without mangroves, these stocks would run out quickly. In contrast, if mangroves are in good condition, seafood stocks are stable.

A small portion of the local communities did not understand the role of mangroves; this was particularly the case among some ethnic groups. This could lead to violation of regulations and rules set up by the communities. For example, Bon village has a group of Dao Thanh Y migrants from Ba Che district and Dai Duc commune, Tien Yen district, who arrived under the government migration policy of 1998/1999. According to household interviews, Dao migrants in Bon village were supported with residential land, agricultural land and house construction. The livelihoods of this group depend mainly on agriculture and near-shore capture fishery. The education level of the Dao group is low, as most do not finish primary school; some are illiterate and do not speak Vietnamese. We observed during our field trips that Dao people and Kinh people in Bon village are separated and do not have regular interaction with each other. Livelihood options and perceptions about social context are also different between the two groups. The Dao people depend more on seafood harvesting in mangrove forests than Kinh people in the village. They also use more rudimentary methods of extraction. According to some interviews with Kinh households, the Dao people often use a hoe to turn the roots of mangroves, as well as using more destructive fishing methods. However, in recent years, thanks to awareness raising and implementation of fishery regulations, the Dao people have also reduced destructive fishing methods.

4.2 Changes in mangrove area over time and drivers of mangrove deforestation and degradation

Table 13 shows that changes in mangrove forest area were different among the three provinces. In Dong Tan and Ninh Phu villages, the area of mangrove forest was previously quite small. As a result of restoration projects, this area is now increasing considerably. The story of Thuy Lac village, Thai Binh province, is almost the same. However, after about 10 years of reforestation, a plan for aquaculture, based on a district and provincial policy, initiated a loss of mangrove area in this region. Although aquaculture areas were recovered through afforestation, this area has been since converted to aquaculture again. The mangrove area therefore has decreased significantly. In contrast, the mangrove area in Thuong and Bon villages was quite large before 1990. Despite this, after a master plan to convert mangrove to aquaculture was implemented, about 1,000 ha of mangroves were destroyed. In 2005, mangrove rehabilitation projects began to be implemented (e.g. ACTMANG, UNDP). As a result, local perceptions changed and mangrove area has since increased considerably.

Across all research sites, mangrove development includes several stages, from deforestation to recovery (Table 13). With the exception of Thuy Lac, mangrove forests are being rehabilitated in all villages. Overall, interviews at all sites indicate a significant improvement in forest cover and quality, but a decreasing availability of fish and invertebrates (see Figure 2).

Most respondents (66–98%) across five study sites agreed that mangrove ecosystem in their regions had improved in quantity and quality, compared to the last 5 years (Figure 3). This is the result of projects and programs to plant new mangroves, and maintain and protect existing mangrove systems. In contrast, 77% of respondents in Thuy Lac village, Thai Binh province said that mangrove ecosystem had decreased due to activities such as the conversion of mangroves to fish and shrimp ponds, poor management and maintenance (Figure 3).

In Thuy Lac village (Nam Phu commune, Thai Binh province), 70% of respondents indicated that mangrove area had decreased. This was

Table 13. Changes in mangrove area over time according to FGDs

Province	Thanh Hoa		Thai Binh		Quang Ninh	
Village	Dong Tan	Ninh Phu	Hung Long Nam	Thuy Lac	Thuong	Bon
	Before 2005, there was a small area of mangrove forest (F+, F-, M+).	Before 2005, the area of natural forest was small (F-).	Before 1975, there was a small area of mangrove forest (F+, F-, M+).	Before 1975, natural mangrove was limited (F+, M+).	Before 1978, there was still a lot of natural mangrove (F+, F-, M+, M-).	Before 1990, there was a larger area of native mangrove (F-, M+, M-).
	Typhoons occurred. The biggest was in 2005 (F+, F-, M+, M-).	Typhoons occurred. The biggest was in 2005 (F+, F-, M+, M-).	In 1986, an extreme storm occurred (M+, M-).	In 1986, an extreme storm occurred (F+, M+).		
	In 2006–2010, many mangrove restoration projects were implemented (Red Cross, CARE) (F+, F-, M+, M-).	In 2006–2010, many mangrove restoration projects were implemented (Red Cross, CARE) (F+, F-, M+, M-).	From 1991, many mangrove restoration projects were implemented (Danish Red Cross, Program 327, PAM) (F+, F-, M+, M-).	In 1975, a mangrove restoration project was implemented (Danish Red Cross, PAM) (F+, M+).	In 1988, deforestation occurred due to transforming mangrove into a shrimp pond (F+, F-, M+, M-).	In 1992, implementing a master plan to convert mangroves to aquaculture destroyed thousands of hectares of mangroves (F+, F-, M+, M-).
	Mangrove forest area increased significantly (five times larger than in the past) (F+, F-, M+, M-).	Mangrove forest area started to increase and be well protected (F-, M+).	Mangrove area increased (F+, F-, M+, M-).	Mangrove area increased (F+, M+).	Loss about 1,000 ha of mangrove (M+).	
			In 2000, bidding for shrimp farms started (M-).	In 1989, a plan for aquaculture areas got underway, based on a district and provincial policy (F+, F-, M+, M-).		
				Mangrove area decreased (F+, F-, M+, M-).		
	From 2011 to date, some mangrove restoration projects continued (5MHRP) (F+, F-, M+, M-).	From 2011 to date, some other mangrove restoration projects continued (F+).	In 2017, a mangrove restoration project began (AFoCO) (F+, M+, M).	In 2009, some aquaculture areas were recovered for afforestation. However, this area was converted to aquaculture again (M+).	From 2009 to date, many mangrove restoration projects were implemented. (F+, F-, M+, M-).	In 2005, mangrove rehabilitation projects were implemented. (ACTMANG, UNDP) (F+, F-, M+, M-).
	Stable increase in mangrove forest area (F-) due to good protection.	Mangrove has grown rapidly in size and quality (F-, M+).	Mangrove is protected and developing better (F+, M+, M-).	The mangrove area has decreased.	Mangrove area has increased considerably (F+, F-, M+, M-).	Mangrove forest area has increased considerably.

Sources: FGDs; Notes: F+ refers to FGDs with older women; F- refers to FGDs with younger women; M+ refers to FGDs with older men; M- refers to FGDs with younger men.

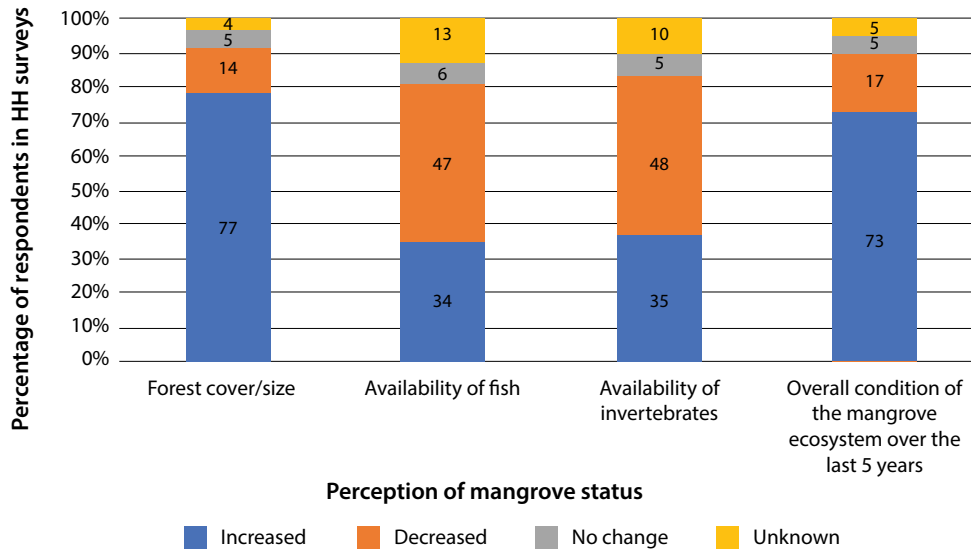


Figure 2. Overall condition of mangroves at all study sites

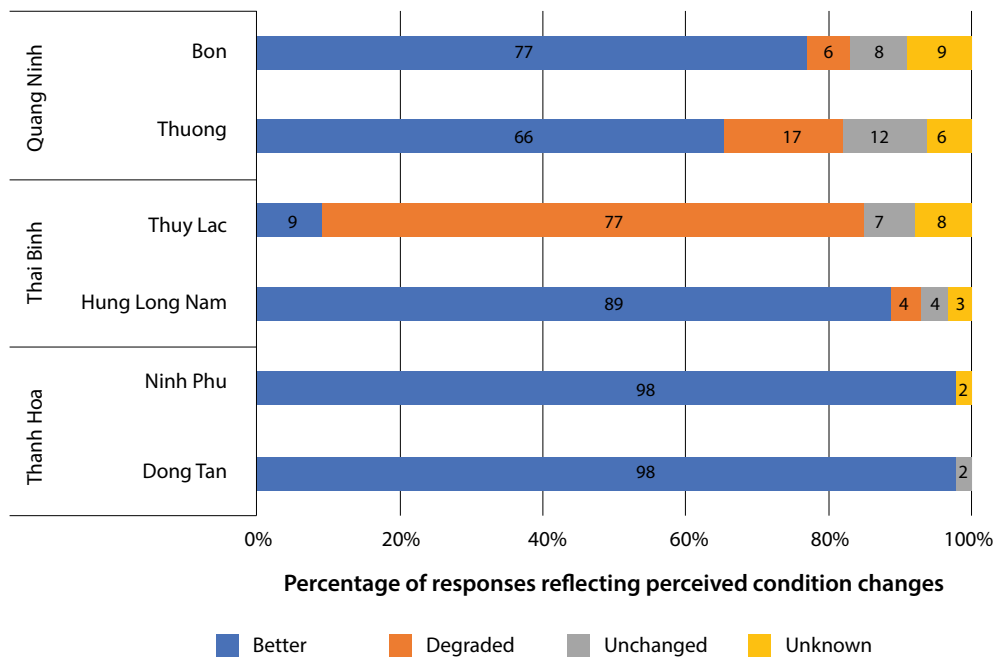


Figure 3. Overall condition of the mangrove ecosystems over the last 5 years

due to activities such as the conversion of mangroves to fish and shrimp ponds, as well as poor management and maintenance. Only 15% of respondents said it had increased; 6% said it had not changed. Most respondents (78–98%) across five study villages (Dong Tan, Ninh Phu, Hung Long Nam, Bon and Thuong) said that mangrove cover had recently increased (Figure 4). This increase was due to programs and projects supported by the government and international

donors, such as JICA, the Red Cross, the EU and AFoCO, which aimed to rehabilitate, enrich and protect mangroves. Another reason is increasing local awareness, which motivated people to help rehabilitate and protect mangroves.

Most people in Thuy Lac village stated that prior to the establishment of Nam Phu commune in 1980, both mangrove quantity and quality were good. At that time, seafood stocks such as fish, crab, shrimp

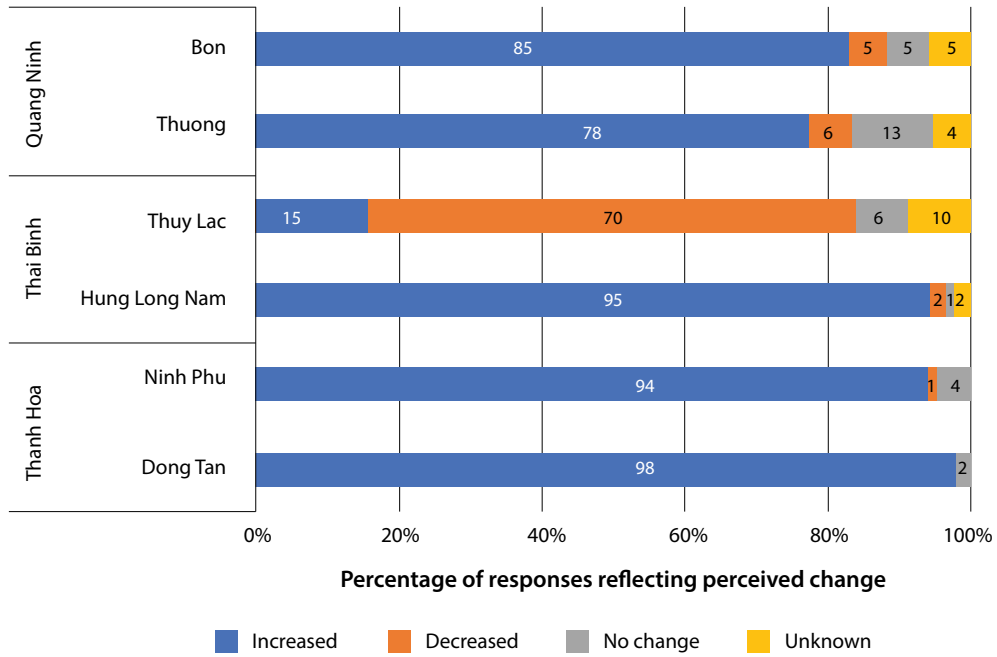


Figure 4. Local assessment of mangrove forest-cover change over the last 5 years

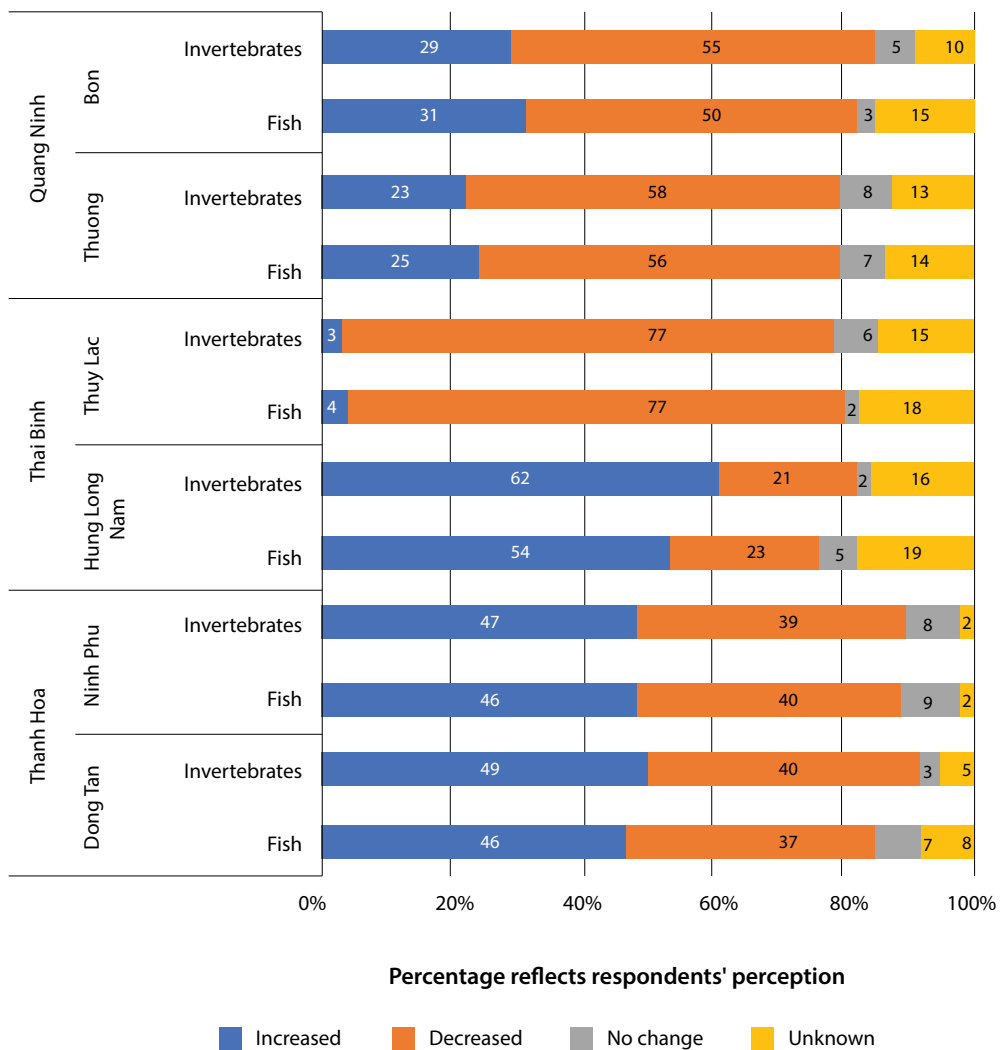


Figure 5. Local assessment of the availability of fish and invertebrates over the last 5 years

Note: Invertebrates are crab, shrimp, mussel, cuttlefish, sea cucumber, etc

and clam were readily available. Unfortunately, since then, the conversion of mangrove into fish and shrimp ponds has rapidly and severely damaged and degraded the mangroves (Figure 5).

Regardless of household survey results, all FGD participants across all six villages claimed that mangrove area had significantly reduced over time. Drivers of mangrove deforestation and degradation varied, as presented in Table 14; most noted was conversion from mangrove to aquaculture. According to FGD participants in Thuong village (M-), at least 30–60% of mangrove had been converted to shrimp farm.

The reduction in forest area has had many serious consequences. People perceived that the sharp decline in mangrove area (e.g. in Thuy Lac) was one reason for the decline in aquaculture stocks and income from tourism. The older women's group in Thuy Lac (Thuy Lac F+, M+) claimed that, previously, they harvested at least 10 kg of small crabs daily, per person; now they catch a maximum of 3–4 kg/day.

The results of the household interviews show that people are relatively aware of the causes leading to forest area reduction. In regions heavily affected by storms (Dong Tan, Ninh Phu, Hung Long Nam),

Table 14. Drivers of deforestation and degradation based on the FGD results

Province	Thanh Hoa		Thai Binh		Quang Ninh	
Village	Dong Tan	Ninh Phu	Hung Long Nam	Thuy Lac	Thuong	Bon
Natural drivers	Typhoon (F+,M+, F-).	Typhoon (F+, F-, M+, M-).	Typhoon (F+, F-).	Typhoon (F+, M+, M-).	Typhoon (F+, M-).	Typhoon (F+, M+, M-)
Socio-economic drivers	Little mangrove previously existed in Dong Tan (only about 2–3 ha); this area was not affected significantly by humans (F-).	Unclear ownership, leading to unrestricted harvesting (M+).	Illegal shrimp farming both within and outside of the commune (F+). Pollution and emissions from Thai Binh thermal power plant (F-).	District planning and policies to establish and expand aquaculture area near the coast (F+) (M+, M-). Pollution (F+, M-). Conversion of mangrove to shrimp farm (F-), and to paddy farm as CPC policies reinforce migration policies (F-). Grazing (M+).	Poverty and migration pressure from Hai Phong city (F+). Market demand from China for seafood exports (F+). Wastewater from shrimp farm may affect the mangrove (F+).	Shrimp farm development due to local government policies (F+, F-). Local policy destroyed a large area of forest (M+). A master plan led to conversion of mangrove to aquaculture (M-). Environmental pollution from Ba Che Paper Mills, Mong Duong thermal power plant (M-) and industrial fish and shrimp ponds (M-).

Sources: FGDs; Notes: F+ refers to FGDs with older women; F- refers to FGDs with younger women; M+ refers to FGDs with older men; M- refers to FGDs with younger men.

Table 15. Causes of deforestation and degradation of mangroves based on the HHs interview

Causes of deforestation and degradation of mangroves (percentage of respondents)	Dong Tan	Ninh Phu	Hung Long Nam	Thuy Lac	Thuong	Bon
Climate change	87	82	77	65	23	24
Logging mangrove trees	34	27	30	15	18	14
Fishing within mangroves	7	16	15	2	3	6
Changes in mangrove area use (i.e. from mangrove to fish ponds, both legally and illegally)	19	29	39	76	67	69
Infrastructure development	15	18	23	15	1	0
Public awareness and consciousness regarding forest protection	42	55	42	14	14	7
Poor management	35	42	39	21	6	1
Unsuitable planting sites (water is too salty, pests and diseases, etc.)	7	3	5	0	0	1
Polluted environment (plastic bags, chemicals from aquaculture ponds, dust and waste from thermal power plants, etc.)	7	4	4	1	8	4
Other (landslides, dead trees due to aging, tourism development, etc.)	1	1	1	1	3	0

Sources: Household interview.

the highest proportion of people chose extreme weather events as the cause of forest area reduction (Table 15). About 15–30% of interviewees thought that logging of mangrove trees also led to slight losses in mangrove area. This was a more common cause of deforestation 10 years ago, when people still used firewood for cooking; most people now cook with gas, with few still collecting firewood (according to all FGDs). A few cases were mentioned of illegal mangrove logging for fence piles (Dong Tan M+) or the collection of *Bruguiera* bark (Bon M-; Thuong F-). This shows high local awareness around mangrove protection issues in the surveyed areas.

Results in Table 15 elaborate further on the additional drivers perceived by households interviewed.

As discussed in Section 4.1, most local people recognize the important role of mangrove forests. However, in some areas (e.g. Hung Long Nam village), people believed they could not move easily through forests to harvest seafood or graze animals if the mangrove was too dense. In addition, when asked about the importance of mangroves, most interviewees in Dong Tan, Ninh Phu, Hung

Long Nam and Thuy Lac villages chose the first answer: ‘mangrove forest protects dykes, and breaks strong waves or storms’. Meanwhile, for the people in Thuong and Bon villages, Quang Ninh province, ‘supply of seafood to increase income’ was their first or even only answer relating to the importance of mangroves. This happens potentially because Thanh Hoa and Thai Binh provinces have experienced severe storms that seriously affected their lives. The people discovered that, without mangrove forest for protection, sea dykes were damaged by typhoons, while sea dykes with mangrove forest protection were not damaged (Dong Tan F+, F-). In Dong Rui, Quang Ninh, people saw that abundant mangrove forest led to plentiful seafood. Conversely, when mangroves were converted to aquaculture, seafood decreased due to habitat loss and environmental pollution (Thuong M+, F-; Bon M+, M-).

FGD and household interviews also pointed to migration as a driver of deforestation and degradation. As areas of land were made available for settlement, studied villages have a mixture of indigenous and immigrant residents. Each village differs, however. For two villages in Quang Ninh province and Dong Tan village, Thanh Hoa

province, immigrants made up 58–88% of the total population (Table 5). Initially, central and local governments planned and encouraged such movement, hoping to transfer people from overpopulated areas to spacious rural areas. However, unregulated movement followed this without authority control. This is most evident in Bon village, where most residents are Dao people who have moved from other areas; currently, Dao people are still moving from other districts to Bon village.

Immigrants can bring both advantages and disadvantages to their new settlements. On the one hand, they bring labor and probably new techniques, knowledge and experience of cultivation. On the other, these mostly poor immigrants need farm land and material to set up a new life. One negative impact of immigration is therefore reflected in mangroves being severely damaged and destroyed at the time of new settlements, as demonstrated in Bon and Thuong villages, Quang Ninh province.

FGDs in two of six villages also gathered local perceptions on the pros and cons of mangrove conversion to aquaculture, and vice versa. Table 16 shows that mangrove conversion to aquaculture can bring economic benefits to a small group of actors, but with greater costs and negative impacts for a bigger group.

Local people also perceived several limitations to aquaculture farming:

- Hung Long Nam villagers asserted that local people do not want to develop shrimp farming because it erodes the soil and irrigation system.
- Hung Long Nam (M+, M-, F+) and Thuy Lac (F-, M-) villagers felt that shrimp farming only benefits small (mostly elite) groups. Other people are able to harvest wild seafood along public mangroves, but not within private shrimp and clam farms (Hung Long Nam M+).
- The development of aquaculture has reduced the area of open access fishing, thus reducing villagers' income and affecting their livelihoods (Hung Long Nam M-; Thuy Lac F-, M-).
- The development of aquaculture also affects the development of mangroves. According to villagers, there is no available land for planting mangroves because coastal areas have been converted to aquaculture (Thuy Lac F-).
- People from outside the community winning the bid to establish fish and shrimp farms (Thuy Lac M+). People from Nam Dinh won the bid and then rented out the area to people from Nam Dinh; meaning Thai Binh people could not access the area (Thuy Lac M-). Similarly, winning bidders in Thuong and Bon villages were from Ha Nam Ninh province (Ha Nam, Nam Dinh, Ninh Binh) (M+); they migrated and occupied the area, before using their network and connections with local authorities to obtain land use certification (Thuong M+, Bon F+).

Table 16. Pros and cons of conversion of mangroves to aquaculture and vice versa

	Mangroves to aquaculture	Aquaculture to mangroves
CONS	<ul style="list-style-type: none"> • It reduces mangrove area, degrades the environment and pollutes water (Bon M+, M-); • Fish and seafood stocks decrease (Bon M+); • Impacts of storms, wind and tides increase (Bon M+, M-); • Most people are unemployed (Bon M+); • Most households have no area to harvest seafood (Bon M-); • Dams and dykes are damaged (Bon M-). 	<ul style="list-style-type: none"> • Takes time and is costly to restore the original landscape (Bon M+); • A group of people (Bon M-) lose income; • Restoration of lagoon areas is extremely expensive, in terms of time and money (Bon M-).
PROS	<ul style="list-style-type: none"> • Brings economic benefits to some individuals only (Bon M+, M-). 	<ul style="list-style-type: none"> • It increases mangrove area, creating a green and clean environment (Bon M+); • It increases fish stocks (Bon M+); • It reduces the impact of storms, winds and tides (Bon M+).

Sources: FGDs; Notes: F+ refers to FGDs with older women; F- refers to FGDs with younger women; M+ refers to FGDs with older men; M- refers to FGDs with younger men.

- Conflicts emerged between local people and aquaculture farm owners across the studied sites. In 2004, when the company of Nam Hai came to convert mangrove forests in Dong Tan village for shrimp farming, villagers raised concerns to the CPC and these companies had to stop work (F-). The older men’s group in Dong Tan village also asserted that they protected their mangroves and did not allow the company to encroach to farm shrimp and process seafood; together, the villagers worked to destroy the company. There have also been conflicts between villagers practicing open access fishing and the owner of the aquaculture farm: villagers say that shrimp and clam farms have affected their freedom of fishing and their livelihoods, whilst the aquaculture farm owners claim they have been licensed by the authorities and that other people are encroaching on the aquaculture area. This

conflict has been quite tense and local police have had to get involved (Ninh Phu M-).

- Massive aquaculture development leads to the loss of mangrove and loss of natural habitat for seafood species.
- Income from shrimp farming is not stable; people can have profitable businesses for a few years but then be unprofitable in subsequent years (Thuy Lac F+).
- Shrimp farms also pollute water in the area (Thuong F-).

4.3 Local livelihoods

Although local incomes across the six studied sites are primarily generated from both non-farming related and mangrove resources, agriculture and aquaculture also play significant roles in local livelihoods and incomes (Table 17).

Table 17. Local income sources

Province	Thanh Hoa		Thai Binh		Quang Ninh	
Village	Dong Tan	Ninh Phu	Hung Long Nam	Thuy Lac	Thuong	Bon
Small crabs	Not mentioned by any participants.	Not mentioned by any participants.	3–4 kg/person/day x VND 30,000/ kg (F+); 5–7 kg/person in daytime; 10–20 kg/ person at night (M+). Can earn 80,000 – 100,000 VND/ person/day (M-).	15–18 days/month (F+, F-); 3–4 kg/ day x VND 35,000–40,000/kg (F+); 16 days/ month at 3–10 kg/person/ day x VND 35,000–50,000/kg (M+); 10 days/month (M-).	20 days/month (M+). 1 kg/ person/day.	5 kg/day; price is not stable (F+).
Small-scale clam/ shrimp/ other seafood harvesting and fishing	25 days/ month at 4–5 hours/day x VND 200,000-300,000/day/ person (F-); Earning up to VND 500,000/ day (M-).	Earning VND 200,000–300,000/day up to a few million VND/day (F+); 20 days/ month at VND 200,000–300,000/day (F-); Koi fish: 15 days/ month x 1kg/person/ day x VND 180,000–250,000 (M-).	Not mentioned by any participants.	Koi fish: 3–7 kg/day x VND 50,000/kg; Other fish: 15 days/ month; Shellfish (clam/ shrimp): 2 kg/day/ person.	Fish and shrimp: 1–2 kg/person/day (F-); 10 kg/person/ day (M-). Squid and octopus: 1 kg/person/day (F-, M-);	Income is about VND 200,000/day (M+); 15–20 days/month and about VND 150,000– 200,000/ day (M-).
Honey farms	Bee keepers collect up to 20 tons of honey/ year (M+) and 2–3 tons/week x VND 120,000/ kg.	70 households in village have 700–1,000 bee hives yielding 1.8–2.5 tons of honey/year (F-).	Only a small number of households benefit from this (F+).	Only 3 households engaged in this (F-). VND 100,000 /650 ml bottle	Only 10 households (3% of total village) have approx. 20-30 bee hives (M+, M-), an estimated 1–2 hives/household; 20 bee hives can produce 100 liters of honey (M+).	Very few households participate, each have just a few hives (F+, M-) max 15–20 bee hives (M-); there is also a private bee breeding enterprise (M+).

Table 17. Continued

Province	Thanh Hoa		Thai Binh		Quang Ninh	
	Dong Tan	Ninh Phu	Hung Long Nam	Thuy Lac	Thuong	Bon
Hunting birds (illegally)	Local villagers don't participate, but outsiders do (F+).	Not mentioned by any participants.	Eggs and meat harvested for food (M-).	People do hunt birds (M-).	People often hunt birds (F).	Local people rarely hunt birds (M-).
Ecotourism	Not mentioned by any participants.	Wedding photo studio (F-, M-).	Not mentioned by any participants.	Con Vanh (F-).	Not mentioned by any participants.	Commune-led project (M+).
Large-scale clam and shrimp harvesting	Not mentioned by any participants.	Before 2015, clam farm owners had to pay 5 million/ha/year in tax. Since 2015, many have had heavy losses due to pollution and do not pay tax (F-).	Not mentioned by any participants.	Income fluctuates and depends on weather (F+, F-).	Helps villagers increase their income (F+).	Not mentioned by any participants.
Seagrass	Not mentioned by any participants.	Not mentioned by any participants.	Not mentioned by any participants.	Rarely harvested (M+).	Not mentioned by any participants.	Not mentioned by any participants.
Harvesting of shellfish other than clams, sa sung (seaworm, <i>Sipunculus nudus</i>)	Not mentioned by any participants.	Not mentioned by any participants.	Not mentioned by any participants.	Not mentioned by any participants.	VND 110,000–300,000/kg (F+) of shellfish; Seaworm: 2–10 kg/day/person (F-, M+, M-); 3–4 kg/day x VND 400,000/kg (M-) for Corrugate lucine.	Shellfish: 20–30 kg/day (F+); Sea worm: 2 kg/day x VND 100,000/kg (F+); Seasonal price VND 100,000/kg (F-).
Timber, firewood and Brugiera tree bark collection	Local people use timber and firewood daily (M+).	Not mentioned by any participants.	Not mentioned by any participants.	Not mentioned by any participants.	Local people have high demand for timber use (F-, M+).	Outsiders come to collect bark, firewood and logs, but villagers report them to commune police (M+).
Fruit	Not mentioned by any participants.	Not mentioned by any participants.	Not mentioned by any participants.	Not mentioned by any participants.	Bruguiera fruit: 2 seasons/year x 5–6 tons/season x VND 3,000–4,000/kg.	N.A.

Sources: FGDs; Notes: F+ refers to FGDs with older women; F- refers to FGDs with younger women; M+ refers to FGDs with older men; M- refers to FGDs with younger men.

According to Dong Tan younger women's group, seafood harvesting income can contribute up to 30–40% of total household income. Catching small crabs can provide the locals with income ranging from VND 50,000/person/day in Thuong village, to VND 80,000/person/day in Hung Long Nam village, VND 105,000/person/day in Thuy Lac village, and VND 1 million/person/day in Hung Long Nam village. There is a common pattern across the profession in all sites; older men

spend more time and earn more than women and younger men in wild seafood capture (Table 17). For example, younger men only collect 1–2 kg/person/day for less than 10 days in a month, and women collect 3–4 kg/person/day of small crabs, for 15–18 days in the month. However, older men harvest up to 20 kg/person/day for 20 days (Hung Long Nam and Thuong villages). Other income sources, such as clam collection in Dong Tan village (M-), can provide up to VND 500,000/day.

Results from FGDs across studied sites also show that many people depend on the fish and seafood stocks provided by mangroves in Dong Tan, Thuong and Bon villages (Table 17). However, in Thuy Lac village, findings show that only a small number of young people engaged in this activity due to limited fish and seafood stocks. There is also a different pattern in young people's engagement in seafood capture activities. Young people are less involved in fishing and seafood harvesting in Dong Tan village as they prefer to migrate. In contrast, a few young people in Thuy Lac village carried out fishing as their primary activity.

Many study site's households harvest resources (e.g. seafood, wood, honey) from nearby mangroves. However, the total number of households per village involved depends strongly on the distance between the village and the mangroves. For the villages close to mangroves, such as the two villages in Quang Ninh province, around 68–83% of households interviewed entered the mangroves to extract products. In contrast, only 28% of households in the village of Thuy Lac (Thai Binh province), which is far from the mangroves, extracted products from the mangroves.

The survey also shows that many households enter mangroves specifically to harvest aquatic products like seafood (Table 18, Figure 6). Particularly, in Bon village, about 83% of households go to the mangroves to collect aquatic products. Some households also use their own private ponds for aquaculture. Together, aquaculture and fishing generate 20% of total income in study sites in Thai Binh and Quang Ninh provinces; in contrast, this number is relatively low in study sites in Thanh Hoa province. Regardless, income generated from aquaculture and seafood harvested in the mangroves is common; any villager, whether older or young, male or female, can harvest from mangroves. Local access to mangroves is high and occurs almost daily.

Regarding the most popular products extracted from mangroves, most surveyed households selected seafood (Table 19). Most also stated that without this income source, local people would struggle; they do not have access to other livelihoods. Particularly in Bon village, where most Dao people live, around 99% of respondents agreed that the majority of their livelihoods come from harvesting seafood in mangroves.

Two groups of local people harvest seafood from mangroves. The first relies on this activity for livelihoods: harvesting daily or weekly, depending on the tide. Local people collect fish and clams from the mangroves in the daytime, and at night collect crabs. After gathering mangrove products, they normally go directly to the market; some have market stalls to sell from. The second group of people only enter mangroves to harvest seafood for their daily sustenance; as such, they rarely sell seafood in the market.

In the study sites, local people find it easy to sell products they have harvested from mangrove forests. They can bring and sell their products to the seafood stores within the village; these stores then transport and sell onto other markets or restaurants. Local people can also sell products directly at village or commune markets. In many cases, intermediaries wait for harvesters at the dyke to purchase their products.

Household income also varies, both within study sites and across the six study sites overall. On average, Hung Long Nam village has the highest household income, at VND 100 million/year, more than twice as much as Dong Tan village, the study site with the lowest household income. There is also a big gap between the poorest and the richest households in different study sites; the poorest in one study site had a household income of VND 738.6 million annually; whereas in another study site, income for the richest households was just VND 2 million.

Study site income sources are diverse, ranging from agriculture to trade and pension. Almost all respondents (83–96%) replied that they cultivated crops and fed livestock, including pigs, buffalos and cows. However, income generated from agriculture and livestock is not high, and accounts for just 15–21% of total income. This implies that even though agriculture is a traditional livelihood and economically stable for farmers, its benefits are limited.

The most significant income comes from wages for labor. Out of the six study sites, more than half of households work in services. The income is valuable, reaching 22–36% of total income.

Although mangroves provide many income sources for local people, FGDs show that both

Table 18. Number of people engaged in different livelihood activities at the studied sites

Province	Thanh Hoa		Thai Binh		Quang Ninh	
Village	Dong Tan	Ninh Phu	Hung Long Nam	Thuy Lac	Thuong	Bon
Harvesting seafood (small crabs, clams and shrimp)	About 40 households (F-).	Not mentioned by any participants.	Around 30–40% of local people.	Only a small number of people participate in this activity.	50–70 people (both villagers and outsiders) harvest seafood on a daily basis (F-).	40–60% of the villagers and women account for 70–80% (M+; M-).
Honey bees	About 10 households (F-).	30–70 of 332 households living in the village (F-).	< 10 households living in the village (F+).	Only 3 households living in village benefit; most who participate are outsiders who bring bees from other places to feed during pollination (F+, M+, M-).	Only 10 households living in the village participate in this activity (M+, M-).	Only a few households participate, each having a few hives (F+, M-); there is also a private bee breeding enterprise (M+).

Sources: FGDs; Notes: F+ refers to FGDs with older women; F- refers to FGDs with younger women; M+ refers to FGDs with older men; M- refers to FGDs with younger men.

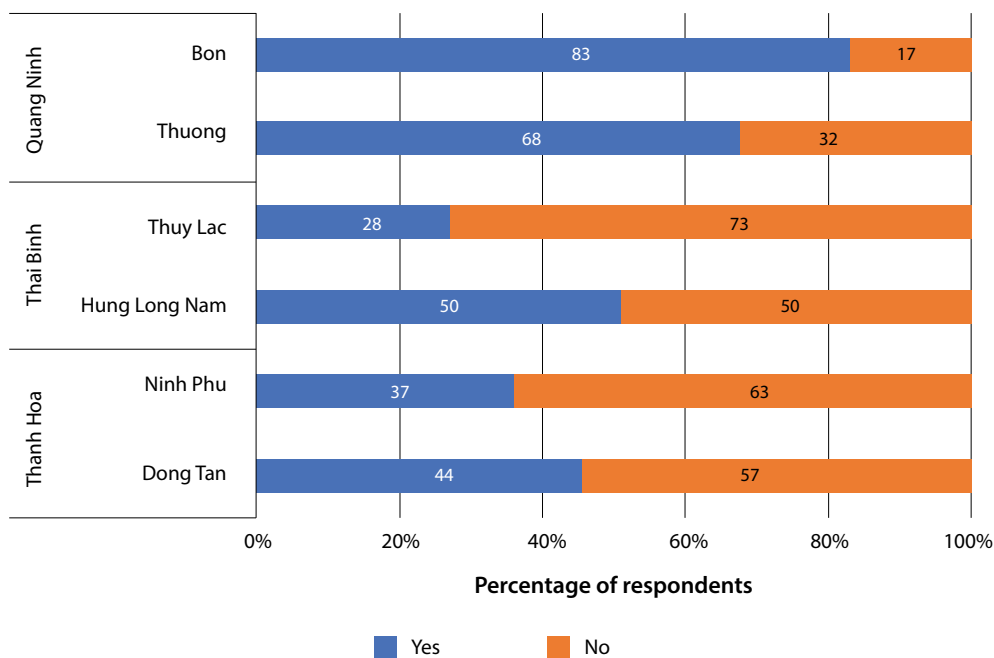


Figure 6. Percentage of households extracting products from mangroves

Table 19. Local use of mangroves

Province	Thanh Hoa		Thai Binh		Quang Ninh	
Village	Dong Tan	Ninh Phu	Hung Long Nam	Thuy Lac	Thuong	Bon
Number of households extracting products from mangroves (percentage)	N=100	N=100	N=101	N=101	N=103	N=99
Yes	44	37	50	28	68	83
No	57	63	50	73	32	17
Percentage of households extracting products from mangroves	N=44	N=37	N=51	N=28	N=70	N=82
Firewood	14	8	8	0	1	1
Seafood	100	100	100	100	100	99
Other (e.g. timber for fence construction, traditional medicine, livestock feed)	7	8	2	0	1	1
Frequency of seafood harvest from mangroves (percentage)	N=44	N=37	N=51	N=28	N=70	N=81
Daily	7	22	41	32	27	51
Weekly	20	22	39	46	36	30
Bi-weekly	30	22	8	11	21	10
Monthly	43	35	12	11	16	10
Ranked importance for local livelihood (percentage)	N=44	N=40	N=54	N=27	N=62	N=83
High importance	36	38	54	41	39	59
Important	27	40	31	44	31	30
Low importance	36	23	15	15	31	11

N= Number of interviewed households

the availability and accessibility of mangrove resources have declined over time (according to Thuy Lac's older women's FGD group). Dong Tan's young women's group also claimed that income from fishing activities is small, but still contributes to overall income. Dong Tan's younger men's group claimed that mangrove forest products contribute just 5–10% to living costs. As such, they must find other work, such as in construction and farming, to earn sufficient income.

4.4 Mangrove governance across levels

Table 20 provides an overview of mangrove governance structures in studied sites. It also documents differences among stakeholder groups' views on how and by whom mangroves have been and should be governed. Results show several governance challenges for mangrove management in these areas.

Overlapping and unclear mandates and responsibilities among government agencies. Due to the unclear roles and responsibilities of relevant agencies, mangrove management is complex and unsystematic in practice. For instance, in Thai Binh province, the Provincial People's Committee (PPC) established the Tien Hai Wetland Natural Reserve, following the preparation and submission of paperwork by DARD. The PPC is also considering a decision to establish the Thai Thuy Wetland Natural Reserve, with paperwork put forward by DONRE. Finally, the PPC is also considering establishing an economic zone that covers the wetland reserves of both Tien Hai and Thai Thuy. As a result, there is confusion and difficulty in managing the province's mangroves effectively. In practice, in some study sites, a number of agencies/organizations manage the same mangrove system. For example, three organizations manage mangroves in Con Vanh, Nam Phu commune, Tien Hai district, Thai Binh province: the PMU of the Con Vanh Ecotourism Area; Tien Hai Wetland Natural Reserve; and the PCC of Nam Phu commune. This shared management is confusing, difficult and ineffective.

Information gaps between government policies and on-the-ground implementation. Key informant interviews with provincial, district and commune government officers clearly map out the management structure related to mangrove governance in the studied sites (Table 20). However, there is lack of clarity at the local level (Table 21). For example, FGDs in Bon village show that local people referred to local government as the mangrove owner and manager. However, they do not know in details who exactly these actors are, or who has implemented policies to prevent mangrove deforestation. Basic information is lacking on rules and regulations, such as how people can obtain certification and permissions, how much do these processes cost and who should receive applications, such as in the case of Dong Tan village. Local people assert that they do not know who has established the rules and how laws have been enforced. For example, outsiders who want to establish bee farms in Dong Tan village must report to the commune authority for permission; however, local people do not know if they must pay fees or not. Similarly, people caught for illegal bird hunting in most villages studied were brought to border police, but villagers are unaware whether violators are then punished.

Figure 7 further indicates that villagers living close to mangroves have better knowledge on the local mangrove protection groups and their members (86% in Dong Tan, 67% in Ninh Phu and 76% in Hung Long Nam) compared with villages further from mangroves. According to interviewees, villages and communes often organize meetings for their residents, and if necessary, discuss mangrove issues such as rehabilitation programs, policy and regulations. Local people sometimes have opportunities to participate in technical trainings and workshops organized by domestic and international projects, to improve their knowledge on mangroves. In addition, the studied villages have their own broadcasting systems that deliver news and announcements twice a day for 15 minutes. These broadcasts can include information on the management and protection of mangroves. Some locals complained that the quality of the broadcast is poor.

Results from the household survey also show quite different patterns in the three other villages, where only a few people know the mangrove protection group or its members (17% in Thuy Lac, 37% in Thuong and 24% in Bon – Figure 7). Thuy Lac is far from the mangroves so not many people go there to extract products. Likewise, mangrove protection groups were seen as less important in Thuong and Bon villages; despite this, villagers were aware that anyone damaging mangroves would be fined.

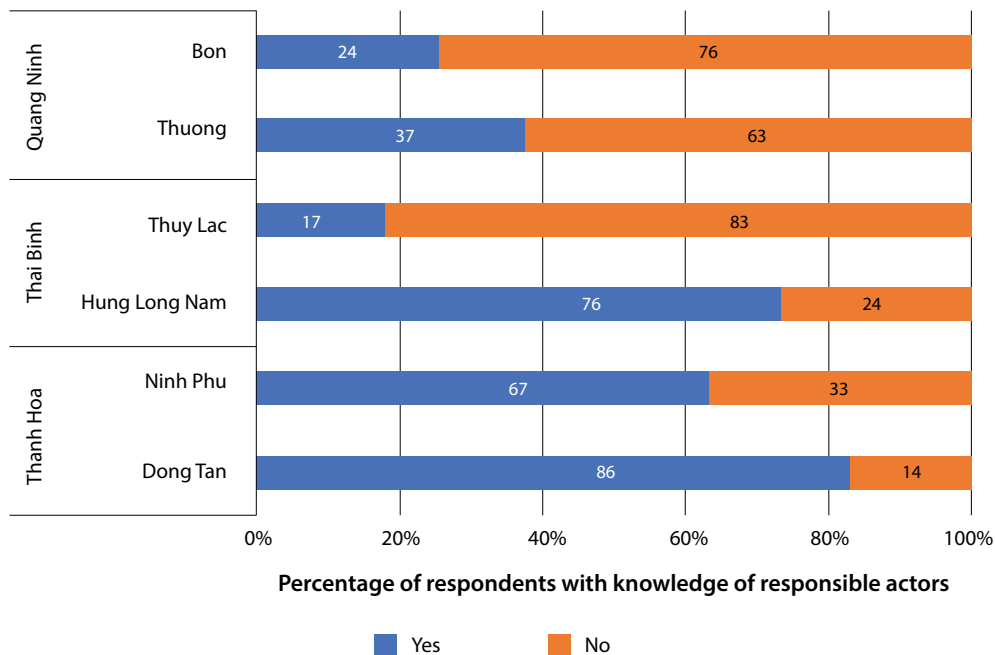
65–77% of respondents across five study villages (Dong Tan, Ninh Phu, Hung Long Nam, Thuong and Bon) know the rules and regulations regarding the management and protection mangroves, compared to just 37% of respondents in Thuy Lac. In Thuy Lac, many interviewees claimed not to know any rules and regulations related to mangroves. Any knowledge they did have was related to the conversion of nearby mangroves to fish and shrimp ponds, owned by individual firms. Overall 86–100% of interviewees across the studied sites knew the mangrove regulations set by the commune or village level; however, they were not aware of higher regulations set by the provinces or the national forest law (Forestry Protection and Development Law 2004, Forestry Law 2017). They did not understand or could not access information about national policies and national arrangements; some interviewees were not even aware where these rules and regulations come from (Figure 8).

Table 20. Rights and responsibilities on mangrove management

Level	Responsible parties, as identified by key informants	Area of responsibility
Province	Provincial People's Council (PPC)	Approves PFMB/DARD plans for mangrove forest protection and reforestation.
District	District People's Committee (DPC)	<ul style="list-style-type: none"> Manages the mangrove forest (through PFMB). The CPC and border guard station are contracted to provide forest protection; Has the power to take over the allocated forest area if local households or individuals do not use the land in accordance with regulations. The DPC can take back the ponds and mangroves and entrust the commune to manage it.
	Protection Forest Management Board (PFMB)	<ul style="list-style-type: none"> Has limited human resources; their main duty is detection of violations by local shrimp farm owners; Manages and protects the allocated mangrove forest.
Commune	Commune People's Committee (CPC)	<ul style="list-style-type: none"> Selects people with time to protect forests and forms a commune forest protection group (FPG); Collects an application fee from outsiders to harvest shrimp in the area, however, the application fee is very small (VND 1 million); Organizes shrimp pond bidding; bid winners sign a contract with the commune; Pays members of the Commune Forest Protection Group (CFPG); Addresses conflicts and violation reports submitted by local people; sanctions administrative violations; allocates land area to households for aquaculture, including mangroves; and oversees forest management; When deforestation occurs in the mangrove area, local people ask permission from the CPC to legalize and use the deforested area for other uses.
	Border guard station and forest rangers	<ul style="list-style-type: none"> Guide people to harvest in the right area; Regularly check and prevent acts that damage forest resources, such as deforestation.
	Commune Forest Protection Group (CFPG)	Patrols, detects violations and reports to the CPC for matters outside its responsibility.
	Marine police	Monitor activities happening in coastal areas.
Village	Village protection group	<ul style="list-style-type: none"> Supports local people to improve mangrove planting and livelihoods; Provides seeds and technical support for reforestation and new planting; Increases public awareness in mangrove forest protection.
	Clam and prawn farm owners	<ul style="list-style-type: none"> Aquaculture farm owners must register and pay fees to be granted certified use of a certain area (VND 3–4 million/year); Clam farm owners need to sign contracts with the district and pay VND 8 million/ha/year. However, the government compensates up to VND 40 million for crops lost to typhoons (Dong Tan F+).
	Farmers' association, women's union, youth union	Sign contract with government to protect forests, mobilize and encourage local people to take part in government reforestation programs.
	Villagers	<ul style="list-style-type: none"> Villages have regulations on the management and use of mangroves. However, these are basic, drawing mainly on CPC documents/regulations; Village management boards usually write village regulations and post them near mangroves; Villagers and outsiders can freely harvest products.
	Head of village	<ul style="list-style-type: none"> Often organizes meetings to inform local farmers on mangrove forest protection regulations; In Dong Tan village, people first report violations to village head, who informs commune and border police.

Table 21. Local management of mangroves (percentage)

Province	Thanh Hoa		Thai Binh		Quang Ninh	
Village	Dong Tan	Ninh Phu	Hung Long Nam	Thuy Lac	Thuong	Bon
Community leaders involved in conservation and management of mangroves						
Yes	55	63	18	0	42	21
No	45	38	82	100	58	79

**Figure 7. Local knowledge of actors responsible for mangrove management**

The CPC was most frequently mentioned by interviewees as having functions such as ‘protection of the mangrove ecosystem’, ‘enforcement of rules and norms regarding harvesting from the mangrove forest’, ‘punishment of those who break rules and laws regarding mangroves’, ‘resolution of conflicts arising from mangrove resource use’, ‘replanting of mangroves in degraded sites’ and ‘awareness raising on conservation of the mangrove ecosystem’ (50–97%) (Table 22). FGD participants and household interviewees explained that when a violation is detected, local people, the forest protection group or the village head must report the incident to the CPC to follow up.

In all except Dong Tan and Ninh Phu villages, Thanh Hoa province, the border guard station was selected as the most important actor for forest protection (30–70%). The older men’s FGD group in Dong Tan also asserted that the border guard station is the best protector, having the

most resources (personnel and facilities) to protect mangroves effectively.

The Forest Protection Group (FPG) in the village was also mentioned by villagers interviewed as having responsibility for ‘protection of the mangrove ecosystem’ and ‘monitoring of illegal harvesting activities’ (20–93%). Especially in Hung Long Nam, Thai Binh province, local people strongly recognized the role of FPG in mangrove protection (87%). The head of Hung Long Nam village said the FPG has responded well to its significant responsibilities, and, in a key informant interview, explained that the FPG assigns tasks to each member, and often patrols across the mangrove forest. According to the team leader of Dong Long commune’s FPG, the team consists of seven people (one leader, one deputy leader and five members, including members of Commune Police). The CPC selects members based on several criteria for protecting

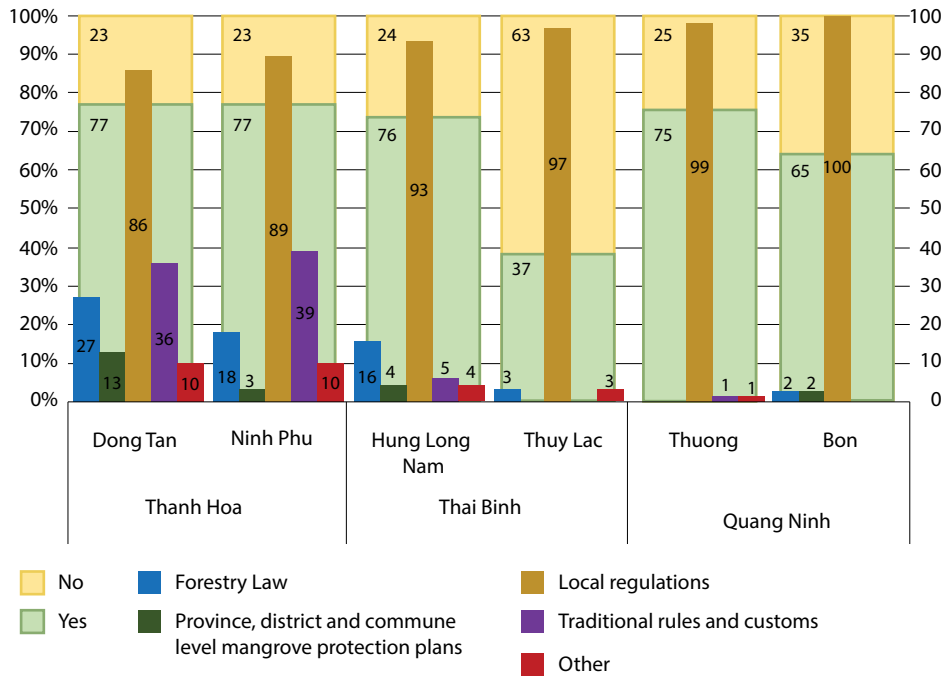


Figure 8. Percentage of interviewed households with knowledge of rules/regulations

Table 22. Local perceptions of bodies responsible for mangrove management

Province	Thanh Hoa		Thai Binh		Quang Ninh	
Village	Dong Tan	Ninh Phu	Hung Long Nam	Thuy Lac	Thuong	Bon
Protection of the mangrove ecosystem						
Commune PC	67	74	52	61	75	56
Head of village	44	33	12	3	38	52
Forest protection group	33	23	87	48	20	34
Border guard station	59	48	5	26	0	0
Enforcement of rules and norms regarding harvesting from the mangrove forest						
Commune PC	82	73	63	69	79	85
Head of village	34	30	11	3	18	29
Forest protection group	10	9	49	21	14	29
Border guard station	45	35	0	10	0	0
Monitoring of illegal harvesting activities						
Commune PC	60	67	38	41	69	69
Head of village	36	23	1	0	31	44
Forest protection group	30	29	87	93	24	27
Border guard station	68	35	4	19	0	0
Punishment of those who break rules and laws regarding mangroves						
Commune PC	78	88	78	92	96	90
Head of village	20	25	4	0	9	24

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Table 22. Continued

Province	Thanh Hoa		Thai Binh		Quang Ninh	
Village	Dong Tan	Ninh Phu	Hung Long Nam	Thuy Lac	Thuong	Bon
Forest protection group	3	7	34	16	13	19
Border guard station	67	33	0	0	0	0
Resolution of conflicts arising from mangrove resource use						
Commune PC	92	87	78	97	97	89
Head of village	31	42	8	0	14	38
Forest protection group	2	8	46	22	11	16
Border guard station	44	22	1	6	0	0
Replanting of mangroves in degraded sites						
Commune PC	44	58	45	60	72	53
Head of village	17	41	12	4	49	53
Forest protection group	35	16	57	8	0	3
Border guard station	18	7	0	0	0	0
Unions and/or associations	24	25	22	24	37	27
Organizing community meetings for mangrove management						
Commune PC	54	48	59	45	41	23
Head of village	66	77	59	59	84	77
Forest protection group	16	10	23	9	0	0
Border guard station	20	6	2	0	0	0
Unions and/or associations	13	16	14	23	14	14
Involvement of the local community in conservation of the mangrove ecosystem						
Commune PC	59	48	69	75	54	20
Head of village	54	73	45	43	81	73
Forest protection group	20	16	15	7	0	0
Border guard station	20	6	0	0	0	0
Unions and/or associations	15	22	20	21	13	18
Raising awareness on conservation of the mangrove ecosystem						
Commune PC	65	54	76	80	49	20
Head of village	41	69	29	32	78	71
Forest protection group	20	13	22	8	4	0
Border guard station	25	10	2	0	0	0
Unions and/or associations	16	18	14	24	18	18
Monitoring condition of the mangrove ecosystem						

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Table 22. Continued

Province	Thanh Hoa		Thai Binh		Quang Ninh	
	Dong Tan	Ninh Phu	Hung Long Nam	Thuy Lac	Thuong	Bon
Commune PC	64	65	44	63	68	80
Head of village	39	43	3	4	41	48
Forest protection group	36	29	67	67	11	0
Border guard station	50	28	0	4	0	0

Note: Figures reflect the percentage of respondents who highlighted the authority as having a particular responsibility

the forest. These include living near the mangrove forest area or having ponds near the forest, and membership is distributed among villages in Dong Long commune. Prior to 2016, the FPG received its annual budget for forest protection from the government; since 2016, it has been funded through a Korean project. In addition, the commune also signed a 10-year contract with the FPG to manage 2.5 ha of coastal lagoons for the cultivation and protection of mangrove forests, as reported by Dong Long's FPG. The FPG was not highly appreciated by the local people in Thuong and Bon village, Quang Ninh province (20–30%). The first reason was the lack of funding available for operations. In the past, the cost of forest protection was covered by the United Nations Development Programme, which helped the village reduce pressure on the mangrove forest. According to the head of Thuong village, when the project ended, the FPG received no further funding. Regardless, local people have a high awareness of the need for mangrove forest protection. In the opinion of those living in Dong Rui commune, the mangrove belongs to the forest community and everybody should take responsibility for forest protection.

The role of the head of villages was also recognized in forest protection (20–84%), especially for 'replanting of mangroves in degraded sites', 'organizing community meetings for mangrove management', 'involvement of the local community in conservation of the mangrove ecosystem' and 'awareness raising on conservation of the mangrove ecosystem'.

Household interviews also show that, in some areas, unions and/or associations play a role in replanting mangroves or improving awareness of conservation of the mangrove ecosystem. These

include women unions, youth unions or farmers' associations. For instance, in Dong Tan and Ninh Phu villages, the youth union have begun tree planting and waste collection initiatives twice a year (according to the older men's group in Dong Tan, and the younger men's group in Ninh Phu). Interviewees in Dong Tan village also mentioned the farmers' association as an organization which related to mangrove forest management. The older women's group of Ninh Phu village asserted that the farmers' association oversees additional planting. Likewise, according to the women's union of Dong Rui commune, when a project begins, the CPC usually chooses the women's union to carry out project activities.

Lack of information on non-state programs relating to mangrove protection and development. FGD results illustrates many non-state projects that have been implemented in the studied sites. However, all FGDs across the studied sites revealed a lack of, or ineffective, project efforts to communicate their objectives and activities to local people. FGDs also revealed that information related to these projects is not widely shared.

New form of governance and indicator of participatory approach. In 2000, Dong Rui commune wanted to rent out to non-villagers a certain area in Thuong village for the harvest of seafood (i.e. permitting only people who rent that area the right to extract), but villagers disagreed; this policy, therefore, could not be implemented.

People's perceptions on effectiveness of rules and regulation and institutional setting. In general, local people agree with the principles behind the rules and regulations applied in their villages (Figure 9). They all agree it is beneficial to protect mangroves as, in turn, the mangroves will support

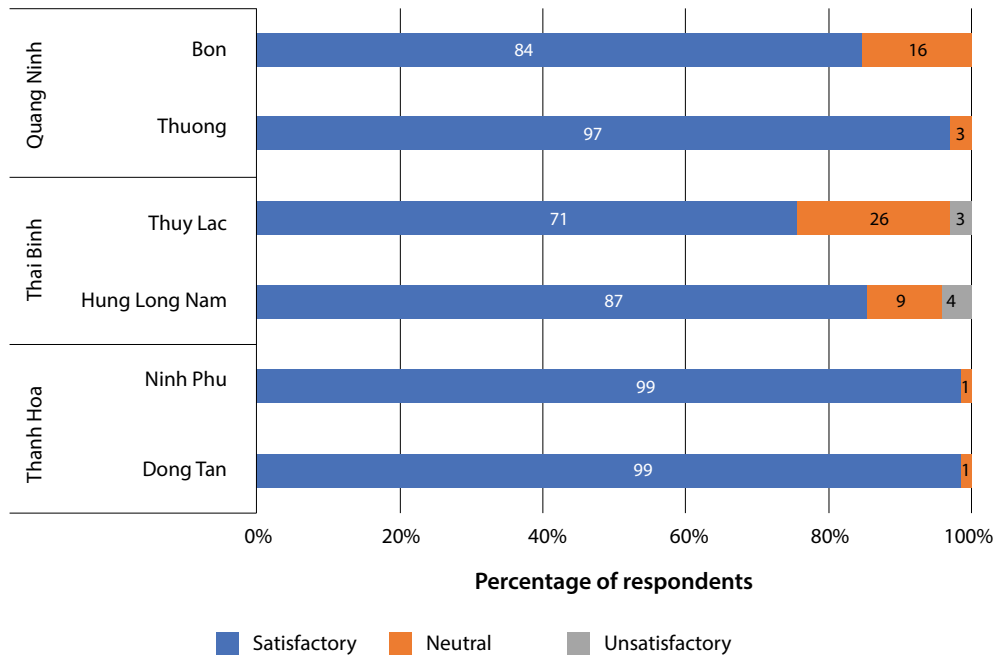


Figure 9. Local agreement with the rules and regulations

and protect the villages. Rules and regulations known by people include the Law on Forest Protection and Development (2004) instated by the central government; province, district and commune-level regulations; and mangrove protection regulations applied in each village. The main channel to promote rules and regulations is the daily broadcast in the villages. Likewise, mangrove management and protection are also mentioned in village meetings as a channel to promote local knowledge and understanding.

According to 34% of respondents in Dong Tan village, Thanh Hoa province, the border guard station should oversee mangrove management. In the villages of Ninh Phu, Thanh Hoa province, and in both villages in Quang Ninh province, about 40% of respondents believed it should be the community's responsibility. In both villages in Thai Binh province, 65% believed the CPC should manage mangroves (Figure 10).

The relationships between provincial, district and commune authorities and the villages are reasonably positive. In Thanh Hoa and Quang Ninh provinces, about 60–80% of respondents said that higher authorities consult local communities about the management and conservation of mangroves before pursuing activities. In Thai Binh province, however, this percentage is smaller; some people did not think higher authorities

had fulfilled their responsibilities in this regard (Figure 11).

Figure 12 shows that over 70% of local people in all three provinces respect provincial, district and commune authorities. In Thai Binh province, however, around 10% of respondents did not think that higher authorities were well respected.

Across the six villages, between 46% to 92% of respondents agreed that the rules were acceptable to the community and benefit conservation of mangroves (Figure 13). However, there are still problems and issues concerning mangrove management and protection in the region. In particular, the conversion of mangroves into fish and shrimp ponds severely damages mangroves.

Local perceptions on who should own and manage mangroves. In the studied sites, mangroves have not formally been assigned to communes or villages (except in Dong Rui commune, Quang Ninh province). DARD and DONRE implement mangrove and land management across the province. DARD and representatives of the PPC manage the mangroves, while DONRE manages the land upon which mangroves are found. The communes protect mangroves and implement related activities assigned by relevant district or provincial agencies. Most communities stated that the mangroves

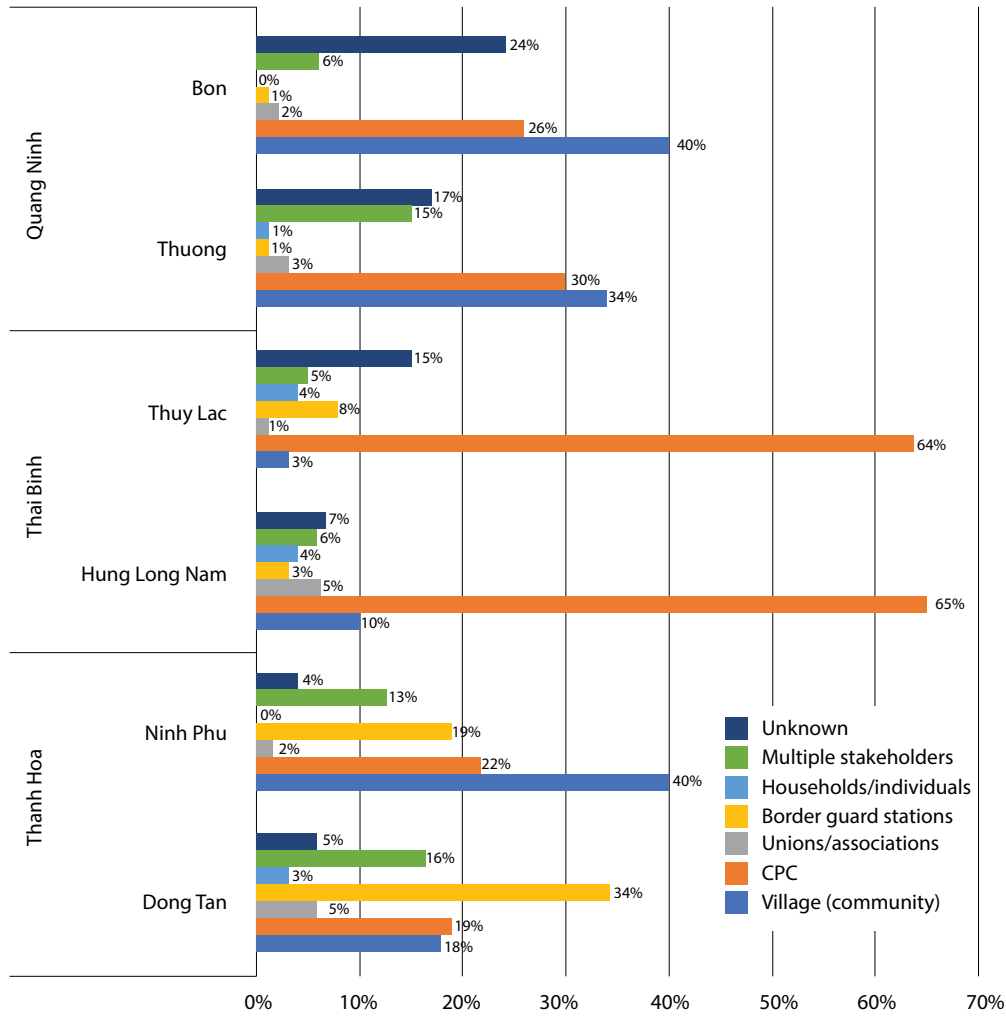


Figure 10. Interviewees’ views on who should manage mangroves

would be managed effectively if they were assigned to the communes.

Five of six village FGDs asserted that the commune still needs to manage the mangroves because if they belong to “all people” then no one would protect them. Only in Dong Tan village did people argue that mangrove could be allocated to the commune but would be best protected and managed by the border guard station, commune police and FPG, as these groups have resources and personnel to protect mangroves. People interviewed in the two villages in Quang Ninh province claimed that mangrove protection should be a task for the village head.

Responses in the survey of 604 households also show that villagers in different provinces offer differing solutions. In Thai Binh province, most villagers (64–65%) stated that the CPC would be the most suitable body to manage and protect

mangroves because it has enough staff and power. However, some villagers thought that villages and communities should have a right to manage and protect the mangroves because they live near, and rely upon, the mangroves.

Social norms in the studied sites also reveal differences, particularly the roles that women and men play in families. Women often stay home and directly engage in agriculture and aquaculture production, and hence, have direct access to mangrove resources. Conversely, men often go offshore fishing and migrate to cities for work (according to the older women’s groups in Hung Long Nam and Dong Tan). This is also partly reflected in FGD results, which show that women know of more mangrove-related programs than men. Our FGD findings are also consistent with the survey of 604 households in the area. In the six study villages, women seem to be at home more frequently than men, as women represent 60–80%

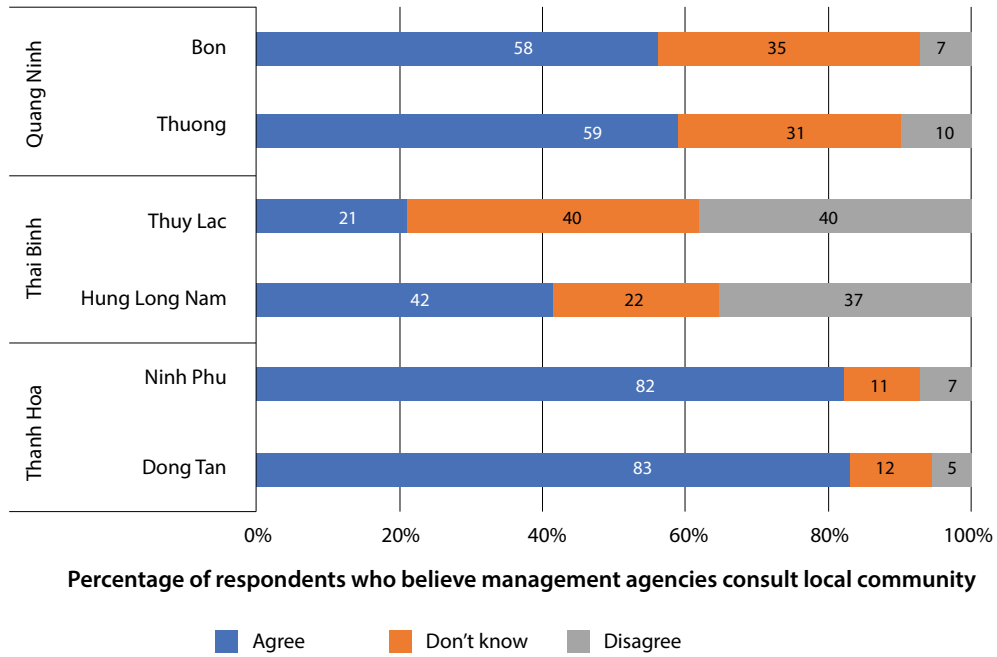


Figure 11. Management agencies’ consultation with local community on conservation and management of mangroves



Figure 12. Community respect for management agencies

of respondents. Based on discussions between interviewers and respondents, this gender split occurs because, in these areas, men normally work far from their homes to find higher and more stable income; whereas women work closer to home for

less income. Often, women look after their houses, property and children. In addition, it is considered easier for men to take on risky jobs that require manual labor, such as offshore fishing or working far away from their villages.

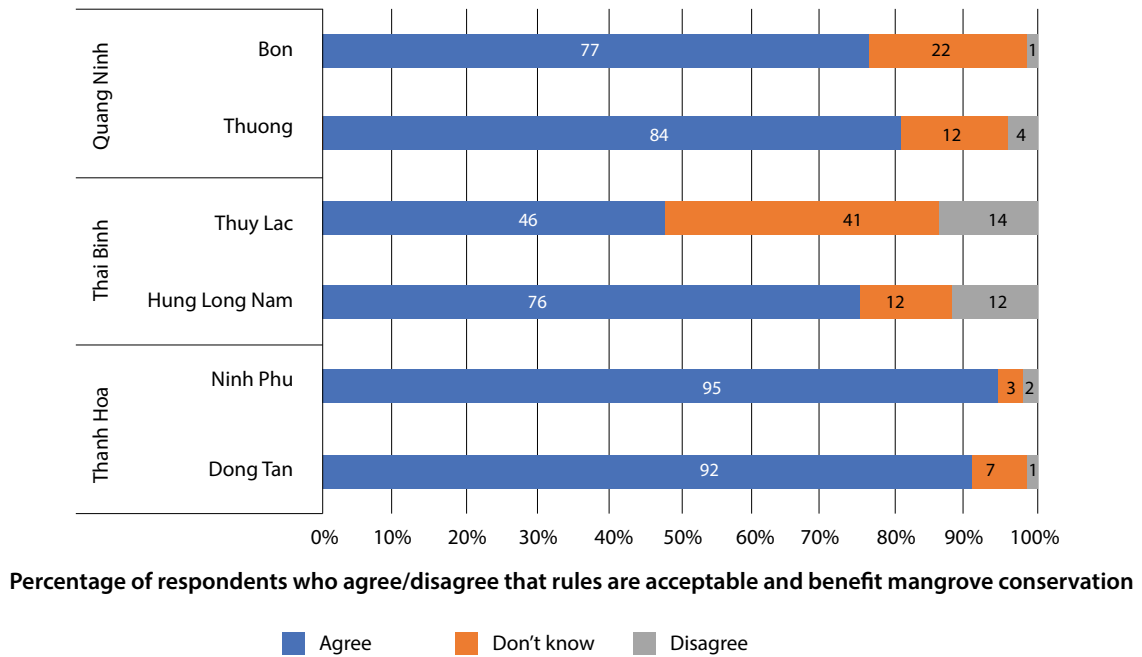


Figure 13. Acceptability of rules to the community and their benefit for conservation of mangroves

4.5 Incentives and disincentives for mangrove protection and development

FGD findings across the sites indicate that there are many state and non-state funded programs devoted to mangrove protection and development, targeting both climate change adaptation and mitigation (Table 23). In addition to state and non-state programs led by government and NGOs, several grassroots and community-based approaches are in place (Table 23 and Table 24). However, according to the younger women’s group in Thuy Lac, mangrove forest protection and development is mainly funded through the state budget.

Despite the number of available programs, not all people are informed and involved. Hung Long Nam’s older women’s group attested that only an elite group (village police) were fully informed about the projects and directly engaged in activities.

FGD findings also reveal these state and non-state programs have created both incentives and disincentives when it comes to encouraging local people to take part in mangrove protection and development (Table 24).

Table 24 shows that most designed programs to date (both non-state and state) focus mainly on covering the daily labor fees for protection, as well as providing training and agricultural inputs for local people. In Hung Long Nam village, money paid by both state and non-state programs to members of the women’s union partly contributes to the union’s fund; this goes to cover the costs of reforesting the mangrove, as well as organizing other activities such as study tours. However, such incentives are not widely communicated to local people, as the previous section has shown, and there are several limitations. First, Hung Long Nam’s younger women’s group asserted that the level of payment is low, creating limited incentives for local people to protect and plant mangroves. Previous PES-like projects invested mostly in forest mangrove plantation. However, according to Thuy Lac’s older women’s group, there is no land available in the area for the plantation of new mangroves. The plantation of new mangroves, according to this group, should be done in an area where eroded shrimp farms are located, and should be replanted to harmonize aquaculture and mangrove objectives. Equally, incentives to date aim solely at replanting mangroves; there are no strong incentives for protecting and maintaining standing mangroves.

Table 23. Past and current mangrove protection initiatives in the studied sites

Province	Thanh Hoa		Thai Binh		Quang Ninh	
Village	Dong Tan	Ninh Phu	Hung Long Nam	Thuy Lac	Thuong	Bon
State program	Thanh Hoa dyke management and flood control management program (F+); 5MHRP (F+, F-, M+); CPC program (F+); women's union, youth union; Central Disaster Fund (M-)	Farmers' association (F+) and youth union (M-); dyke management project; Thanh Hoa rural development project (M+).	Program 327 (F+); PAM (F+; M+); 5MHRP (F+, M+); DARD program (M+).	Youth union reforestation program (F+, F-); PAM (M+); commune project (F+).	Veterans association (F-); district training program on mangrove protection (F-).	PAM (F+).
Non-state program	Red Cross (F+, F-, M+); CARE International (F+, F-, M+, M-).	CARE International; Vietnam Forest and Delta Program (F+, M+); Red Cross.	Cooperative (F+); Red Cross (F+, M-); Korea project (AFoCO) (F+, M+); Danish forest protection groups.	Danish Red Cross (F+); Red Cross (M+); Danish project (M+); Japanese project (M+); self-formed initiatives; local unions (such as women's union).	Japanese project (F-); ACTMANG and KVT, Japan (M+); University of Hanoi (M+); JICA restoration program (M-).	Japanese project (F+); Dutch project (M+); UNDP project (M+, M-); ACTMANG project, Japan (M-)

Notes: F+ refers to information gathered from FGDs with older women's group; F- refers to younger women's group; M+ refers to older men's group; M- refers to younger men's group.

The monitoring and evaluation (M&E) systems and disincentives associated with these state and non-state programs also have major drawbacks, as highlighted by the villagers during FGDs:

- Neither state nor non-state projects have clear and well-enforced M&E, leading to low local compliance. For example, 80% of villagers still collect firewood and hunt birds although it is considered illegal. Table 25 indicates that more than half of households interviewed claimed they were not terminated from project jobs even if they didn't comply with the agreed terms of reference. Local authorities do not regularly monitor; likewise, 50% of Thuong's younger men's group claimed that although the forest protection group, with four people, were supposed to patrol two to three times/week, they did not. Disincentives imposed low penalty payments and did not require violators to replant forests. When violations did occur (e.g. in Hung Long Nam village), the CPC solely administered penalties and did not replant the affected forest area. Replanting is seen as the role of non-state actors (e.g. Red Cross) and not of the government.
- The CPC has issued regulations, but these are unclear in terms of the level of fines per violations. For example, regulation prohibits logging, but local people are unaware of the level of fine (according to Bon's younger women's group). It is also unclear for local people whether local shrimp farm bids bring any funding to the wider community; people must still contribute towards local public services such as roads despite the awarding of shrimp farms.
- Only a small number of villagers, perceived by local authorities as healthy and willing to protect forests, are included in FPGs and have an opportunity to access related payments

Table 24. Incentives and disincentives for mangrove protection in studied sites identified by key informants and villagers interviewed

Programs	Incentives	Disincentives
State	<ul style="list-style-type: none"> • Investment in seedlings and planting; • Payment of VND 120,000–150,000/day for labor); • Organization of waste collection activities; • Building of dykes and planting of forests. 	<p>Prohibition of the following activities:</p> <ul style="list-style-type: none"> • clearing forests for aquaculture • collecting firewood • logging trees • hunting birds • harvesting seafood using electricity. <p>Border police handle violators. Penalties include:</p> <ul style="list-style-type: none"> • each logged tree charged at VND 50,000–100,000. • cattle grazing in mangrove area, charged at VND 300,000/per incident. • police will burn Thuong villagers' harvesting tools if they cut down mangrove.
Non-state	<ul style="list-style-type: none"> • Planting of trees (people paid VND 20,000/day); • Support with purchase of seedlings; • Support with purchase of fertilizers and training on afforestation and deforestation; • Training on fruit harvesting, cultivation and tree plantation; • Establishment of forest protection team to patrol and address violators; • Provision of seedlings and training to plant mangrove forests; • Donation of livestock for poor households; • Some villagers signed a contract with the commune to plant Casuarina in a certain area, then hired other villagers to plant. These people are entitled to harvest the trees after a few years and must repay a portion of profits to the commune. 	<ul style="list-style-type: none"> • Zoning of mangrove area; people only allowed to harvest in the designated area.
Self-formed village initiatives	<ul style="list-style-type: none"> • People who report to local government on those who cut down trees or take tree bark are rewarded VND 200,000; • Each person will pay VND 5,000 for forest protection; • Many households plant mangroves around their shrimp pond in case of small storms. The small-scale nature of the mangrove limits its capacity to protect against storms; mangroves cannot survive because stagnant ponds are not suitable for their growth; • Every villager fishing in the ocean must pay VND 2,000/visit to the village for forest protection, as per village rules (Thuong F+). • Group of 5 households formed; each household taking a turn in raising livestock before income shared after selling. The idea was to pass on the livestock to the next family, but households did not follow the agreement and kept income for themselves. 	<ul style="list-style-type: none"> • Fine for logging is VND 50,000/tree (first offence) and VND 2 million (second offence).

Table 25. Local perceptions on the consequences of non-compliance

Provinces	Thanh Hoa			Thai Binh	Quang Ninh	
Villages	Dong Tan	Ninh Phu	Hung Long Nam	Thuy Lac	Thuong	Bon
Are you terminated from the project when you do not do your job? (percentage)						
Yes	49	37	36	30	36	27
No	51	63	64	70	64	73

(according to Hung Long Nam's older men's group). This disincentivizes other villagers from being actively involved in forest protection and development.

4.6 Local participation in mangrove-related projects

Mangrove development and protection is relatively popular in the study sites. In Thanh Hoa and Quang Ninh provinces, 73–84% of respondents said they were involved in mangrove development and protection (Figure 14). Normally, when a mangrove project arrives at a commune, the commune will assign activities to organizations like the farmers' association, women's association and FPG, amongst others. These associations will then call for members to participate in activities, and can keep a portion of the received payment for operations and further activities. Most of the budget will be paid to members according to their degree of participation.

In Thai Binh province, only 31–36% householders said they had participated in mangrove development projects and programs (Figure 14). This is because the area has invested in few mangrove projects. In the future, the commune intends to assign activities to associations or forest protection groups so they can be responsible for implementation and operation. Some stated that communes had previously assigned mangrove planting to a civil society organization; however, results were not positive as it was difficult to control and monitor operations and participation. As such, they have learned to select the right people for each activity within the mangrove project.

In most study site, 69–100% of respondents said that they participated in activities related to mangrove mainly through local communities. Only a few respondents, such as 4% in Dong Tan village, participated in activities through direct agreements with projects; 1% in Ninh Phu village and 4% in Thuong village participate in activities through private contractors (Figure 15).

Planting or enrichment of mangroves represent almost all activities. For all three provinces, planting made up 66–96% of activities (Figure 16). Awareness raising was only functioning well in Thanh Hoa province, where 13–16% of respondents were involved in this activity.

4.7 Willingness to pay and to participate in forest protection

FGD findings across the studied sites show that all participants wish to have mangroves and are willing to protect them. In villages such as Dong Tan, people are willing to contribute VND 5,000–10,000/person/month for a PFES fund, if it exists. However, this willingness to pay is also conditional and depends on several factors:

- Law enforcement must be stricter and the FPG must be committed and follow its mandates; those who benefit more should pay more; and the CPC must hold meetings to approve a fund (Dong Tan village).
- An appropriate method is needed to determine who benefits (Dong Tan village).
- There should be a comment box and banner on the way to forests to mobilize people to voluntarily pay the forest protection fee (Dong Tan village).

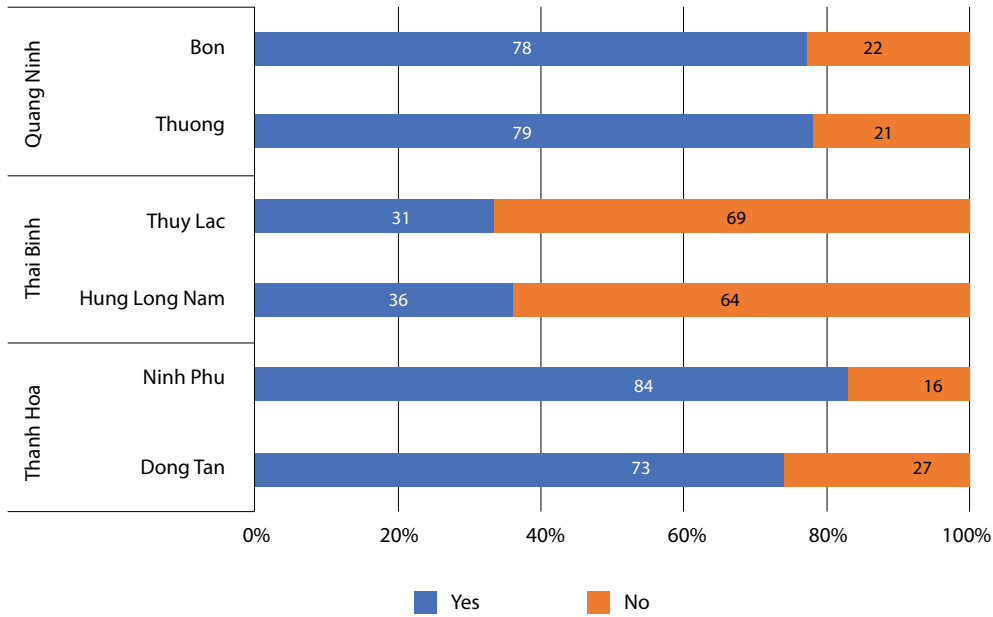


Figure 14. Percentage of interviewed households engaged in mangrove projects

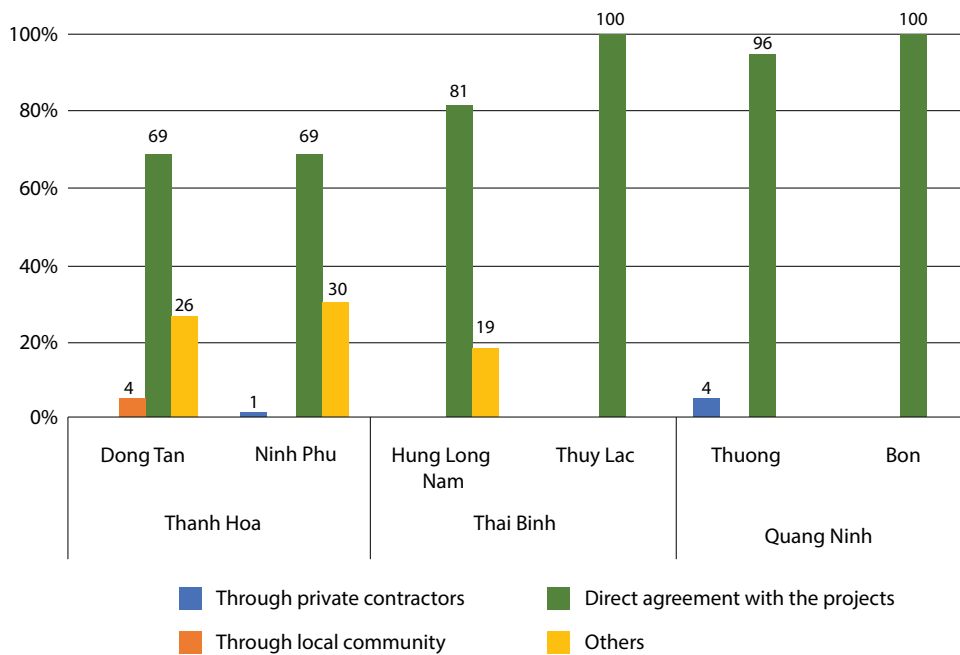


Figure 15. Percentage of respondents engaged through different pathways

- People are willing to participate in reforestation activities if the state gives them seedlings (Dong Tan village).
- Local people are willing to pay a PFES fee if they have a good business year.
- Seafood companies should pay as they have higher investment and return benefits compared with local villagers.
- Willingness of local people living in the village is higher compared with those who have to migrate to the city; those for whom mangrove does not provide any direct benefits are unwilling to pay for it.

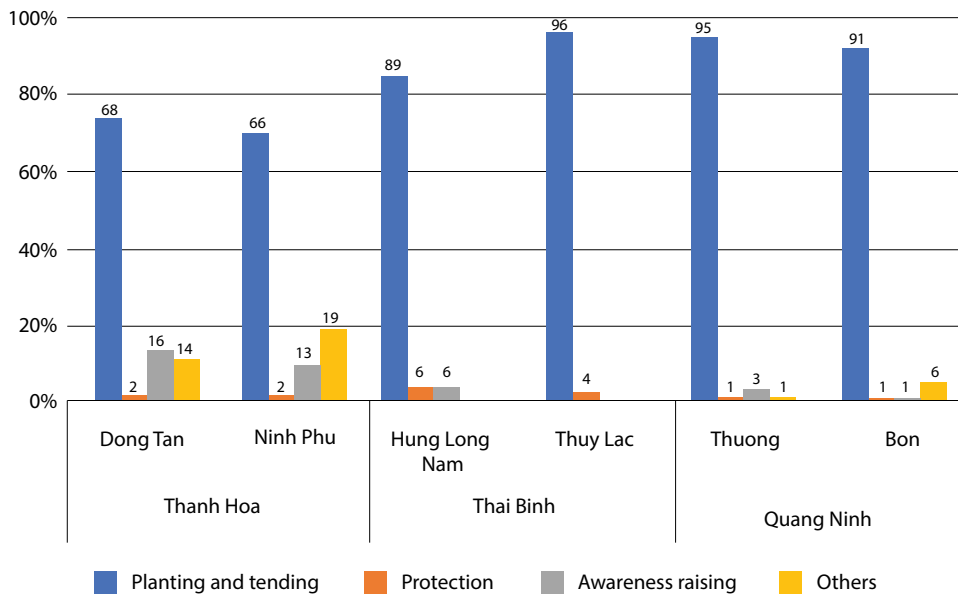


Figure 16. Percentage of respondents involved in mangrove related activities

Figure 17 shows a wide range of actors that local people believe should pay for mangrove forestation and development. This also indicates that 70% of villagers interviewed agree the state should pay for mangrove protection, as the owner and manager.

Most household respondents interviewed were willing to pay some money to develop and protect mangroves, depending on the benefit they receive from the mangroves and their actual economic conditions (61–85% of respondents agreed – Figure 18). The exception was Bon village, where only 34% of respondents were willing to pay for some of the mangrove management and protection

(Figure 18). Many respondents complained they do not have enough money to pay for mangrove protection and development; some said it was the responsibility of the government to pay for such activities.

Most respondents considered mangroves to be important for the environment and livelihoods and concluded therefore that people should contribute to protect and maintain them. Figure 19 shows that most respondents in studied sites are willing to pay VND 100,000–300,000 to protect mangroves in their area. Some households are even willing to pay over VND 1,000,000 to protect mangroves.

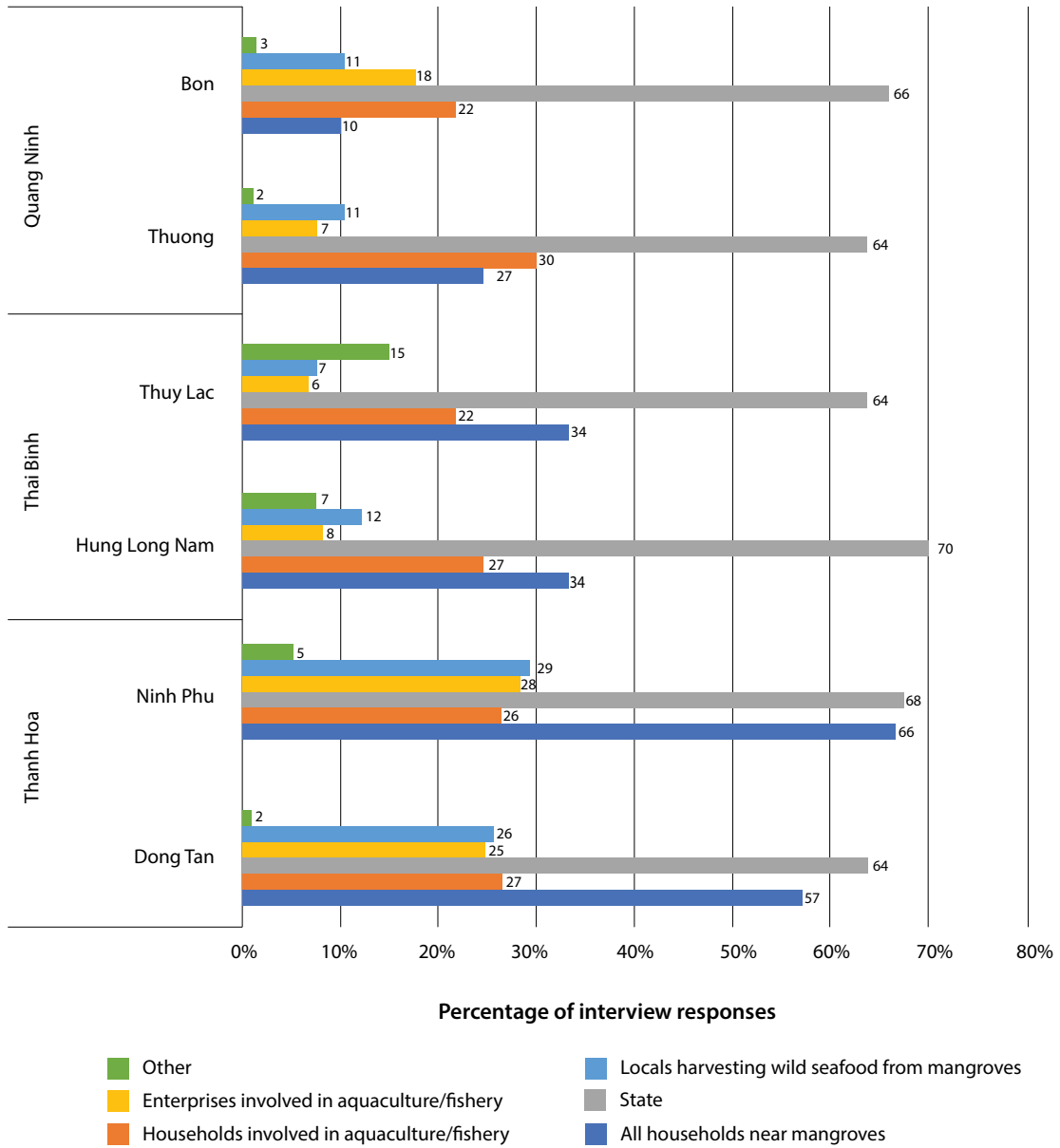


Figure 17. Who should pay for the benefits that mangrove forests bring?

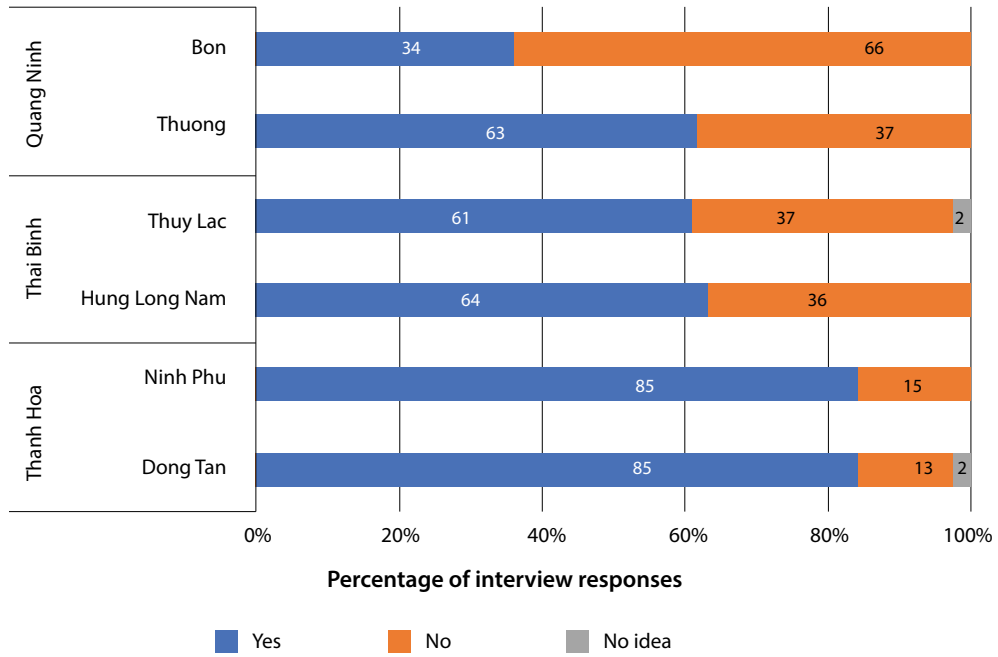


Figure 18. Willingness to pay for protecting and developing mangroves

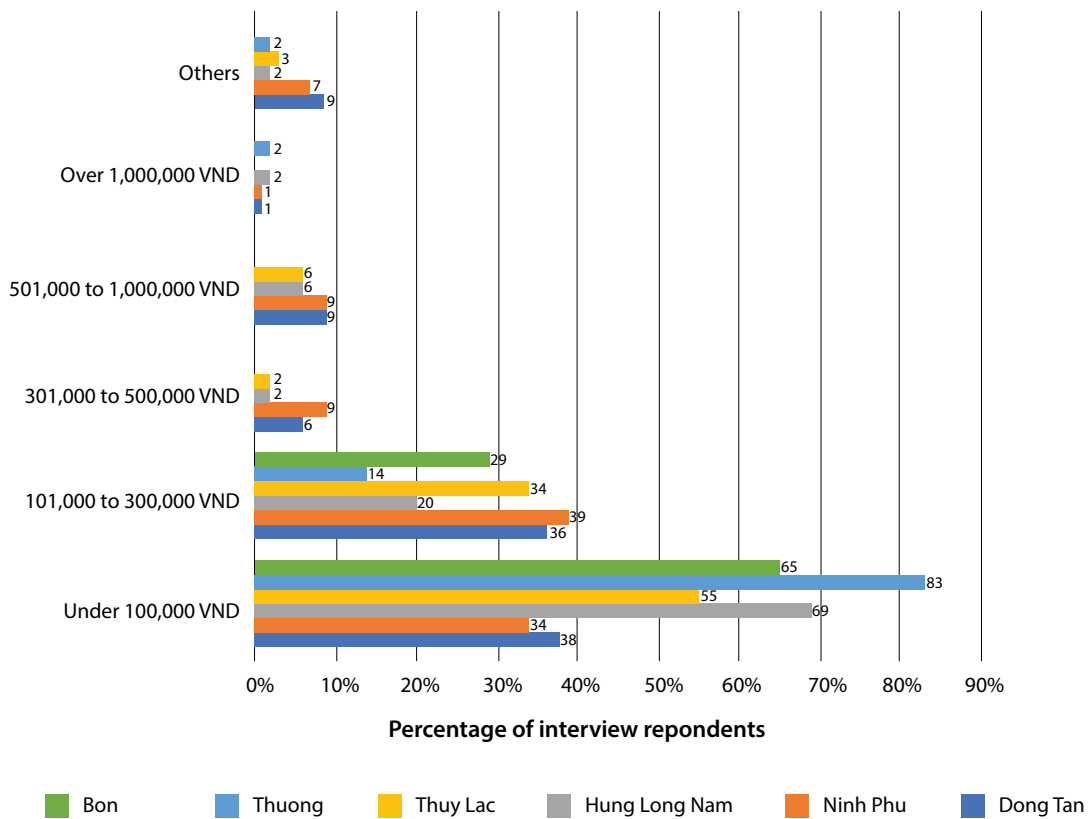


Figure 19. Local people willingness to pay on mangrove protection and development

5 Discussion

Most mangrove areas in Vietnam are in the south of the country. These areas, which are often large (20–30 ha), are managed by forest management boards and households. This study presents a perspective on mangroves in the north, which is characterized by small-scale mangrove areas. Mangroves are fully owned and managed by state agencies with limited involvement of local communities.

Findings confirmed previous studies such as Dat and Yoshino (2013), which identified shrimp aquaculture as a main driver for mangrove loss in the studied sites. It also confirmed findings in Jhaveri et al. (2018), which highlight that state, non-state and international projects on mangroves have often lacked long-term financing; incentives are thus inadequate to compete with alternative land uses.

Opportunities for mangrove protection and management

Our study found that local people appreciate the role that mangroves play in generating income, providing an attractive landscape, and providing shelter from climate change related flooding and storms. These important roles and benefits lead many communities's willingness to contribute USD 2–20 per year for a trust fund to protect their local mangrove forests. Many policies and projects promote mangrove conservation activities; mangroves are the core interest of most development projects in Vietnam. Mangrove protection policies have helped to strengthen law enforcement; raise local awareness of the role and importance of maintaining forests; and restrict conversion of mangroves to other economic activities. Government policies and development projects also provide capacity building, training and seedlings for mangrove reforestation activities in the studied sites. Equally, new financial

incentive mechanisms such as PFES are a potential funding source for mangrove protection and development. PFES could involve payment for carbon sequestration and GHG reduction through avoided deforestation and forest degradation, as well as payment for the application of organic shrimp farming practices (McEwin and McNally 2014). Developing and operating a domestic carbon market could pay for emission removals and reductions in the forestry sector. This, in turn, will help mobilize financial resources for forest management to achieve national targets on emission reductions, as set in the INDC. With support from the World Bank, Vietnam is developing its readiness for the carbon market (MONRE 2016b). In addition to the mandatory PFES, volunteer payment for environmental services in mangrove areas could facilitate responsible management of mangrove forests by stakeholders, particularly local communities (Dat and Yoshino 2013).

Collective action in mangrove protection is widely recognized and promoted among study sites. The Forestry Law of 2017 affirms the important role local communities play in forest management, and encourages a collaborative approach in forest management, including that of mangrove forests. Mangrove forest protection in study sites also demonstrates signs of reform, with local people self-organizing strikes and protests to oppose the conversion of mangrove to other economic purposes.

National policies and Vietnam's NDC recognize the importance of the conservation and sustainable management of mangroves in the context of climate change. A number of ongoing mangrove-related projects focus on mangrove restoration and enhancement for natural disaster mitigation; livelihood improvement for local communities; and enhancement of forest governance through collaborative forest management (Prime Minister

2012; MARD 2017; GCF 2016). These projects aim to engage local communities effectively to restore and manage mangrove forests, as well as develop livelihoods.

Constraints for mangrove protection and management

Drivers of mangrove deforestation and degradation are complex, and are often associated with provincial economic development strategies. Striking a balance between environmental protection and economic development priorities is challenging, and requires strong political commitment from government to address drivers of mangrove deforestation and degradation.

Many policies and projects offer social and economic incentives for mangrove protection. However, they are impeded by insecure tenure, land grabbing, elite capture and inequitable benefit-sharing. The institution setting for mangrove protection is also constrained by overlapping and unclear mandates, and unclear responsibilities among government agencies at central, provincial and multilateral levels. Access to information, on both policies and projects, is difficult for local people. Information on the effectiveness of non-state programs relating to mangrove protection and development is also lacking.

Findings from this study affirm those in previous studies (e.g. Hue and Scott 2008), which show that mangrove programs and projects may only benefit a certain elite group. In addition, projects and programs have been shown to lead to land grabbing (Hoang and Takeda 2015) as financially better-off aquaculture farmers often benefit more than poorer farmers who have already sold their ponds. Our study also echoes findings from Nguyen and Dang (2018) that both men and women depend on harvesting wild seafood around mangroves. Women have a good understanding about the role of mangroves and are associated with mangroves as much as men. So far, however, the role of women has been overlooked by government programs. Strengthening the participation of civil society and women in mangrove forest management, and developing gender-inclusive mangrove protection strategies and community-

based regulations, are essential to ensure women's participation in mangrove protection and development.

There are also major drawbacks to the incentives, disincentives and M&E systems designed by mangrove-related policies and projects. These include low enforcement and compliance, unclear penalty mechanisms and no requirement to replant mangrove forest after illegal logging has taken place. Our study reveals that local willingness to pay is conditional upon: effective law enforcement; transparent and accountable financial management; equitable benefit-sharing; equitable distribution of rights and responsibilities; co-funding from government or projects; level of annual income; and whether a person's livelihood depends directly on mangroves.

Policies and projects strongly emphasize and create incentives to replant mangrove forests, but not to maintain and conserve mangrove forest areas. Incentives are also designed to compensate local labor for reforesting mangrove or patrolling activities, rather than addressing direct drivers of deforestation and degradation. Local participation and engagement in mangrove conservation projects and programs are also limited due to unclear tenure security; most mangrove forests are managed by state organizations. Le (2008) also found that promotion of nationalization or privatization, rather than solving problems of resource degradation and overexploitation, has deprived many rural households of their livelihoods. Further research is needed to define what mix of economic incentives and state and community regulation will best achieve and maintain sustainable and equitable management of local resources.

Hoang and Takeda (2015) found that central government and local people have differing views on mangrove restoration in Vietnam. These authors show that while the central government sees mangrove restoration through the lens of ecological services, local people view mangroves as part of their culture and as a source of livelihood. This might partly explain why government policies in the study sites focus on mangrove reforestation and paying for local patrolling, while overlooking economic and social incentives to address local concerns. Future policies and projects need to consider local interests, so as to design appropriate incentives. They should also address tenure insecurity as a key factor influencing people's participation in mangrove protection (Ha et al. 2014).

Conclusions

Protecting mangrove areas requires a policy shift in land-use planning, so as to address drivers of mangrove deforestation and degradation. These drivers, supported by the national and provincial economic development agenda, include aquaculture expansion and migration. Cross-sectoral coordination needs to be further enhanced to improve effectiveness in law enforcement. Incentives designed by policies and projects should not only encourage local people to replant new mangrove forests; they must also maintain and sustain newly planted mangrove and old mangrove forests. Enhancing

local participation in mangrove forest protection and development also requires a gender-sensitive approach. It must ensure enabling conditions are in place; such as well-enforced policies, accountable and transparent benefit-sharing, inclusive decision-making and a combination of in-kind and in-cash payments. Innovative governance can offer lessons for future programs; innovative governance examples include village-level self-formed groups, to reward people for reporting violations, or to take collective action against the conversion of mangrove for other economic purposes.

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In Vietnam, mangrove forests have been threatened by economic pressures and climate change. This report aims to analyze both opportunities and constraints for mangrove protection and management in Vietnam.

The study found that local people appreciate the role that mangroves play in providing income, an attractive landscape and shelter from climate change related floods and storms. Many communities would be willing to contribute between USD 2-20 per year to a trust fund so as to protect their forests. A large number of policies and projects promote mangrove conservation activities. This has helped strengthen law enforcement, raised local awareness of the role and importance of maintaining forests, and restricted the conversion of mangroves to other economic activities. Government policies and development projects also provide capacity building, training and seedlings for mangrove reforestation activities at the studied sites. Additionally, new incentives such as payment for forest environmental services (PFES) are emerging as a potential source of finance to support mangrove protection and development in the future. Collective action for mangrove protection is widely recognized and promoted among study sites. People have self-organized strikes and protests to oppose converting mangroves to other economic purposes.

Many policies and projects offer social and economic incentives for mangrove protection. However, they are impeded by insecure tenure, land grabbing, elite capture, inequitable benefit-sharing, and unclear responsibilities among government agencies at central, provincial and multilateral levels. Access to information on both policies and projects is difficult for local people. The monitoring and evaluation systems, incentives and disincentives designed by policies and projects have low enforcement and compliance. Policies and projects strongly emphasize and create incentives to replant mangrove forests, rather than to maintain and conserve existing mangrove forest areas. Incentives are also designed to compensate local labor costs for replanting mangrove or patrolling activities, rather than addressing the direct drivers of deforestation and degradation.

Protecting mangroves requires a policy shift in land-use planning to address the drivers of mangrove deforestation and degradation. These drivers, in turn, respond to national and provincial economic development agendas, which focus on aquaculture expansion and migration. Cross-sectoral coordination also needs to be further enhanced to improve effectiveness in law enforcement. Enhancing local participation in mangrove forest protection and development requires a gender-sensitive approach and enabling conditions, such as well-enforced policies, accountable and transparent benefit-sharing, and inclusive decision making.



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