## Review

# Mangrove forests policy implementation: Case studies of Ngoc Hien and Can Gio mangrove forests in the Southern Viet Nam

Xuan Tuan Le<sup>(1,\*)</sup>, Thi Anh Dao Phan<sup>(2)</sup>, Thi Minh Hang Tran<sup>(3)</sup>, Cong Minh Nguyen<sup>(4)</sup>, Thi Thu Hoai Nguyen<sup>(5)</sup>

- (2) Center for Environmental Study, Viet Nam Institute of Meteorology, Hydrology and Climate change: daopat@gmail.com
- (3) Faculty of Environmental Sciences, University of Science, Vietnam National University, Hanoi: hangtm.vn@gmail.com
- (4) PhD Student, Central Institute for Natural Resources and Environment Studies, Vietnam National University, Hanoi: minh.nguyencong74@gmail.com
- (5) Center for Environmental Study, Viet Nam Institute of Meteorology, Hydrology and Climate change: nthoaimt@gmail.com
- \*Correspondence: tuan.mangrove@gmmail.con; <u>lexuantuan@hus.edu.vn</u>; <u>tel:+84-4988585568; +84-2435572605;</u> <u>Fax: +84-2438582069</u>

**Abstract:** This article explored how some state policies on rehabilitation, protection and utilization of mangroves are implemented at two locals; namely, Ca Mau provice and its sub-unit Ngoc Hien District as well as Ho Chi Minh City and its sub-unit Can Gio District and what are considered as emgerging issues in the implementation process. The study employed mixed research methods including document and thematic analysis, in-depth interviews, and group discussion. The findings showed that state policies would be adapted through the ways in which these two locals manage to silmultaneously orient their work toward accommodating the madates placed upon them and cope with the reality of socio-economic difficulties at their levels. The findings also showed some issues that need to consider addressing; namely, locals' struggles to fill the gaps between written and implemented policies in mangrove rehabilitation, conflict among sectors and stakeholders in mangrove utilization and protection, problems in guaranteeing adequate budget for in-need-locals, inconsistence in policies on "forest: water surface" ratio in mangrove-shrimp farm, and unintended consequences in forest thinning and exploitation regimes. Based on the finding analysis, the articles discussed lessons learned from the policy implementation process on mangrove rehabilitation, management and forest allocation to household in the south of Vietnam.

Keywords: Mangroves; Forests policy; Policy implementation; Rehabilitation; Management; Vietnam.

## 1. Introduction

Mangroves form a transition zone between land and sea which is influenced by both continental and marine conditions. Mangrove forests are not only coastal productive ecosystems but also very imprortant to environmental conservation and socio-economic development in the coastal areas. Scientists have shown that many commercially valuable marine species live their whole life or part of their life cycle in mangrove areas [51,45,69]. Mangroves provide foods and livelihood income for local communities [16,18,28,40]. Mangroves are widely used throughout the Southeast Asia for fuel, charcoal making and construction [9,48,68] and materials for man-made fibres [10]. Various economic acvitities have been conducting within mangrove areas around the world such as fishing, aquaculture of many species such as shrimps and crabs; mollusk farming of blood cockles and clams on the mudflats adjacent to the mangrove forest [23,45]. In addition, mangroves are also biodiversity conservation sites, providing materials for educational, recreational and ecotourism activities [48].



<sup>(1)</sup> Faculty of Biology, University of Science, Vietnam National University, Hanoi. 334 Nguyen Trai, Thanh Xuan, 100000 Hanoi, Vietnam: tuan.mangrove@gmmail.con; lexuantuan@hus.edu.vn

Given this important role of mangrove forest in environmental conservation and socio-economic development, attention has been paid to studying how multi-level governance affects the ways mangrove ecosystem is managed, planned, and developed [5,16,17,29,31,49,58,60]. These studies have shown that the institutional system and social action have great impacts on the development of mangroves in the modern time. The institutional system refers to the role that government plays in developing mandated policies and interacting with lower management levels in the implementation [12]. With respect to mangrove management, mangrove policies comprise of laws, sub-law documents, and regulations which guide the management of mangrove forests. These are usually regulations on forest and environmental protection, exploitation, as well as management tools in terms of socio-economic aspects. Research about the influence of government policies or state policies for mangrove development is extensive. Yet, little is known about how those state policies are implemented at the lower management levels such as that at provinces and districts.

Vietnam is Southeast Asian country rewarded with favorable natural conditions for mangrove development. Like many other countries in this region, although Vietnam government has issued multiple policies to foster the work of protecting and restoring mangrove forests, the forest area has continued to decrease as mangroves are exploited and converted to agricultural land, shrimp ponds, or for urbanization purposes [45]. Back to 1943, mangrove forests were widely distributed along the coast of Vietnam with a total area of about 408,500 hectares concentrated in the south of Vietnam [36] but affected by herbicides during Viet Nam war [53]. However, mangroves forest areas decreased to 329,000 hectares in the early 20th century [36], to 250,000 hectares in 1975 [7] to 145,349 hectares in 2017 [37]. This puts forth an inquiry about the interplays between policies as written at the state level and policies as implemented at locals in supporting mangrove development in the south of Vietnam. How do the state policies, concerning mangrove rehabilitation, protection and utilization are implemented at the lower management levels in the south of Vietnam? What are challenges, if any, the locals encounter while enacting the state policies? How do the locals cope with the challenges?



Figure 1. Area of mangrove forests in Vietnam from 1962 to 2017

(Data source: Year 1962[53], Year 1975,1983[7], Year 1995[53], Year 1995[43], Year 2000-2017[37])

This study is to address these questions. The study was undertaken in two study sites in the south of Vietnam, where people live in mangrove forests; namely, Ca Mau province and its sub-unit Ngoc Hien District and Ho Chi Minh City and its sub-unit Can Gio<sup>1</sup> District.

<sup>&</sup>lt;sup>1</sup> Can Gio district was named Duyen Hai in the period of 1978-1991; we refer to the name of Can Gio district throughout this paper



Figure 2. Location of the studied sites

Currently, mangrove forests in Ngoc Hien, Ca Mau are managed by the state in the three forms: National Park, strictly-protected forest, and partially-protected forest. Mean-while, Can Gio mangrove forest is the protection forest of Ho Chi Minh City under the influence of some state policies. Can Gio and Ca Mau mangroves are also Biosphere Reserves of southern Vietnam. The aims of this study are to examine current status and area changing of Ngoc Hien and Can Gio mangroves, analyze historical ultilization of these mangroves and examine mangrove forest institutional systems during the period of 1975 – 2018 in order to identify how certain state policies have been implemented in locals and how locals managed their work to respond to the policies. The lessons learned provide suggestions to assist policy-makers and reseachers to improvemangrove management within the specific environmental and socio-economic context of the south of Vietnam.

#### 2. Materials and Methods

This study was conducted between August 2018 and November 2019 in the mangrove forests of Ngoc Hien District, Ca Mau Province and Can Gio District, Ho Chi Minh City. These two districts are located in the Southeast and Southwest coastal areas of Vietnam. These districts were chosen because they have the largest areas of mangroves in the southern Vietnam and have the common things such as being biosphere reserves, and management type of protection forests, production forests. In these districts, local people live in the mangrove forests and their livelihoods depend on mangrove ecosystems.

To achieve the study aims, the research methodology was designed with the guidance of "Pressure" - "State" – "Response" (P-S-R) framework [39]. The P-S-R framework assists us in identifing cause - effect relationships between human and natural systems, bridging the gap between scientific disciplines and linking science to policy and management. Specifically, in our research, "pressure" represents anthropogenic factors and socioeconomic activities of research sites; "state" refers to status of mangrove forests" and "responses" represents the ways in which policy have been developed and responded to the changes of mangroves as well as targeting mangrove management, reforestation, protection and ultilization.

Following this framework, our first step was to identify characteristics of Ngoc Hien and Can Gio mangrove forest areas which was then followed by analyzing socio-economic activities of Ngoc Hien and Can Gio Districts. Then, mangrove management policy was analysed at both state and local levels to understand the policy development and responses to the changing practices of mangroves and their targeting purposes of mangrove management, reforestation, protection and ultilization. Afterward, issues emerging from mangrove-related policy implementation practices in the two research sites were analyzed and the lessons learnt were drawn from the success and failure in the process. The results of the study would provide some suggestions for future mangrove management in study sties in particular and in Southern Vietnam in general.

The study employed mixed research methods including document analysis, in-depth interviews, and group discussion [3,8,22,27,41]. Fist, a document analysis was carried out in chronological orders to understand how mandated forest policies from 1975 to 2018 were developed at state and local levels and aspects of institutional frameworks for mangrove management, mangrove policy implementation, historical change in mangrove areas in study sites, history of management and reforestation and protection in the south of Viet Nam and the study sites, and socio-economic activities, utilizations in mangrove forest areas in the study sites.

Second, in-depth interviews were conducted with the elderlies, the commune and district leaders, the retired forestry leaders, and the working forest protection officers and forestry officers in the two districts who had knowledge and experiences about the related issues appeared from 1975 to 2018 as indicated in the following table 1:

Target respondents	Main interviewing topics
Elder villagers	History of management, plantation, protection of mangrove forest, and involvement of local people in these activities; Main socio-eco- nomic stage and activities in mangrove forests in the district; Under- standing of policies applied in management, plantation, protection of mangrove forest and difficulties of local communities; Change in ac- cess rights, utilization and conflicts over mangrove forests of the com- munities
The commune and dis- trict leaders/ Working forest protection offic- ers/ forestry officers	Recent forestry policies and implementation in management, refor- estation, protection of mangrove forests; Anthropogenic factors cause pressures on mangrove forest; Human resources, budget and technical tools; Recent issues, difficulties and collusions in management, refor- estation, protection of mangrove forests
Retired forestry leaders	Historical institutional and management issues over time (mangrove forest owners, mangrove forest users), and history of management, re- forestation, protection of mangrove forests (main stage, activities, hu- man resources, budget, technical tools, etc.); History of local policies, their implementation, difficulties, challenges and solutions related to management, reforestation, protection of mangrove forests

Table 1. Target respondents and main interviewing topics

Third, two focus group discussions with 10 participants including men and women who were between 40 to 70 years old were held in Can Gio and Ngoc Hien Districts. The discussion was about the historical timelines, changes of natural resource exploitation under mangrove forest canopies, mangroves management, forest violation, access rights, understanding of selective forest policies applied in the study sites, forest allocation to households, difficulties appeared in mangrove forest protection and utilization and solution.

## 3. Results

#### 3.1. Overview of study sites

Southern mangrove forests locate in seven coastal provinces of Mekong Delta and two provinces in the Southeastern region. Like other regions of the country, mangrove ecosystems in Southern Vietnam have been degraded during the Vietnam war due to herbicides used, especially in Ngoc Hien and Can Gio. Between 1965 and 1970, Can Gio mangroves were intensively poisioned due to the influence of herbicides and defoliants, resulting in the breakdown of the ecosystem [38]. Similar to Can Gio, during 1963-1971, the herbicide and defoliant chemical devastated 44,918 ha of forests in Ngoc Hien, including mangrove forests. At the same time, overexploitation and mangrove conversion for the purposes outside the protection have also been affecting the quality mangrove development.

## 3.1.1. Ngoc Hien mangrove forests

Ngoc Hien, is a district of Minh Hai<sup>2</sup> Province till 1996 and of Ca Mau Province in 1996 when it was part of Minh Hai Province with the coastline approximately 98 km. The total district's area is 70,855.14 ha with total population of 78,740 people [56]. The district is divided into seven administrative units including six communes and one town.

In 2018, the gross output of Ngoc Hien district was VND 8,120 billion. Fishery – Forestry – Agriculture sector made up 56.2% of the district's economic structure. Fishing practice is characterised by near shore small scale fishing and artisanal fishing on the mudflat. Shrimp farming has been the major aquaculture practice of the district. In 2018, shrimp farm area was 24,050 hectares and shrimp aquaculture production were 13,698 tons. Integrated shrimp-mangrove farming system is the predominant model for aquaculture throughout the district, in which black tiger shrimp (*Penaeus monodon*) is stocked in mangrove forests with no additional feeding. However, depletion of fisheries and mangrove resources has been observed and awared by local communities in terms of reduction in stock and catch size.

The total natural area of Ngoc Hien is 70,855 hectares of which 92.6% are forest land. The total forest area of Ngoc Hien district is 33,789.51 hectares, in which mangrove forest accounts for the majority. The predominant mangrove species include *Avicennia alba* Blume, *Avicennia marina* (Forssk.) Vierh., *Avicennia officinalis* L., *Rhizophora apiculata* Bl., *Bruguiera parviflora* Wight & Arnold ex Griffith, *Ceriops zippeliana* Blume and *Nypa fruticans* (Thunb.) Wurmb. The mangrove forest and its adjacent mudflat are also home to diverse species of fish, crab, shrimp and bivalve that provide nutrition as well as fishery resources for livelihood of local communities. Major economic species include *Scylla paramamosain*, *Portunus pelagicus, Harpiosquilla harpax, Anadara granosa, Meretrix lyrara, Pseudapocryptes elongatus, Periophthalmodon schlosseri, and Scatophagus argus*.

According to Tran Thi Van et al.(2015) [59] and image interpretation results, the area of mangroves in Mui Ca Mau (all of Ngoc Hien District and a small part of Nam Can District of Ca Mau Province) reduced from 71,336 hectares to 49,418 hectares despite of efforts in afforestation during the Vietnam war time (15,000 hectares in the province of Ca Mau). Right after 1975, the Ca Mau forestry company started the forest replanting in areas that were sprayed by herbicides during the war. As a result, the afforestation area in Ca Mau was very large, especially during 1976-1977 (14,000-15,400 ha in the whole province). In Ngoc Hien, there are 3 type of mangrove forest as production forests, protected forest and special forest (Dat Mui National Park) as indicated in Figure 3.

<sup>&</sup>lt;sup>2</sup> Ca Mau will be used throughout the rest of this paper to present Minh Hai before 1996



Figure 3. Mangrove areas in Ngoc Hien District (Data source 1992-2007 [34], 2017-2018[57])

## 3.1.2. Can Gio mangrove forests

Can Gio district locates in Ho Chi Minh City. The district is divided into seven communes, one town with total population of 57,649 people. The main economic sectors of Can Gio district are fishery (fishing and aquaculture), forestry (planting and protecting forests), agriculture and salt production. In 2018, the gross output of the district was VND 8,169 billion. Fishery - Forestry - Agriculture sector made up to 47.1% of the district's economic structure [57]. The fisheries sector includes coastal fishing, in-mangroves fishing and offshore fishing. Among 2,576 hectares of shrimp aquaculture, there is about 474 ha of intensive shrimp aqualculture in Can Gio Dictrict. Raising mud crab (for meat), shedder (soft shell) crabs, oysters, clams and a few other local species bring economic effectiveness and benefits for local community. Ecotourism has developed robustly in recent years, focusing on major tourist spots such as Lam Vien (Forestry Park), Dan Xay Eco-tourism Area, Vam Sat Eco-tourism Area.

In 2016, the area of Can Gio protected forest was 34,451 hectares and made up 48.3% of the total natural area of the district [24]. The area of mangroves accounted for 96.7% of the total area of Can Gio forest land in 2005, of which natural forests occupied 35.1% and planted forests 61.4%, and the proportion of natural forest area increased to 39.2% in 2017[33]. Can Gio mangrove forest has 105 species of mangroves belonging to 48 families, 25 species of mammals, 204 species of benthic species, 184 fish species and 139 bird species. *L.littorea* species recorded in the Red Data Book of Vietnam is found in Can Gio mangrove area.

The Municipal Committee and the City People's Committee have actively and diligently rehabilitated Can Gio mangrove forests since 1978. Mangroves (mainly *Rhizophora*) were planted the most in the period of 1978-1982 with 10,643 hectares [35]. The survival rate in 1978 was 93%. From 1984 onwards, some other species such as *Intsia bijuga, Ceriops tagal, C. decandra, Lumnitzera racemosa, Xylocarpus granatum, Thespesia populnea* have also been cultivated. From 1978 to 2017, the total planted forest area in Can Gio was 23,079 ha.



Figure 4. Area of planted mangrove forests in Can Gio District (Data source [35])



Figure 5. Mangrove area in Can Gio District (Data source: 1978-1998 [64], 2001-2018 [35])

3.2. Development and implementation of mangrove-related policies

3.2.1. State forest policies related to mangrove management

The impetus of forest policies derives from various related state policy development and have been applied for mangrove management, protection and reforestation. The illustration of this development is presented in table 2 below.

Table 2. Selected state policies about mangrove management, protection and reforestation

State policies	Description
Forest Protection Act No 147/LCT dated	Forest protection (expired)
September 11, 1972	
Circular No 3984/LN-KL dated 15 October	Administrative violation punishment on forest protection (ex-
1977	pired)
Decision No 184, dated November 6, 1982	Promoting land and forest allocation to individuals and organ-
of the Council of Ministers and Circular	isations for forest plantation (expired on 4/Jan./2000)
46/TT-HTX dated 13/Dec./1982 issued by	
Ministry of Forests	
Circular No 37/LN-KL dated December 27,	Authorisation and decentralisation of forest management (ex-
1986	pired)

State policies	Description
Decision No 1171/QD dated December 30,	Regulations on the management of the special use, protection
1986 by Ministry of Forests	and production forests (expired)
Law on Forest Protection and Develop-	Forest Protection and Development (expired on 1/April/2005)
ment 1991	
Decision No 327/1992/CT and Decision No	Policies for the development on barren lands and hills, coastal
556/TTg dated 12/9/1995 signed by The	flats and water bodies in lowland areas (327 Programme)
Chairman of the Council of Ministers	
Decision No 773/1994/QD-TTg signed by	Program of exploitation and use of abandoned land, riverside,
the Prime Minister	and coastal mud flats and water surface in delta areas
Decree No 01/1995/CP and Decree	Regulating organizations, households and individuals in rela-
02/1994/CP signed by the Prime Minister,	tion to forestland allocation for long-term forestry purposes.
and Circular No 06/LN-KL dated	
18/June/1994 by Ministry of Forests	
Decision No 661/QD-TTg dated July 29,	Objectives, tasks, policies and implementation organisation of
1998 signed by the Prime Minister	the 5 million hectares programme
Decree No 163/1999/ND-CP signed by the	Allocation and lease of forestland to organisations, households
Prime Minister	and individuals for long-term forestry purposes (Expired on
	16/Nov/2004)
Decision No 178/2001/QD-TTg dated No-	Benefits and responsibilities of households and individuals
vember 12, 2001 signed by the Prime Min-	with allocated forests and forest lands under contract in the lo-
ister	cal contexts (expired on January/1/2019)
Decision No 178/2001/QD-TTg signed by	Responsibilities and rights to economic benefits of households
the Prime Minister	for managing allocated, leased and contracted forests and for-
	estland (expired on January/1/2019)
Law No 29/2004/QH11	Law on Forest Protection and Development, replacing the Law 1991 (expired)
Decree No 23/2006/ND-CP signed by the	Enforcement of the Law on Forest Protection and Development
Prime Minister	(expired on January 1, 2019)
Decision No 186/2006/QĐ-TTg signed by	Issuance of the Regulations on Forest Management (expired on
the Prime Minister	December 15, 2016)
Decision No 26/2008/QD-TTg signed by the	Mechanisms and policies to support socio- economic develop-
Prime Minister	ment in Mekong River Delta provinces through 2010, including
	protection and expansion of mangrove forests in the region
Circular No 78/2011/TT-BNNPTNT dated	Detailed guideline to implement Decree No 117/2010/ND-CP
11/11/2011	dated December 24, 2010 for management of the special use
	forests
Decision No 120/QD-TTg dated January 22,	Approval of the project on coastal forest protection and devel-
2015	opment for climate change adaptation for the period 2015 -
	2020 with the budget of VND 5,215 billion, including mangrove
	forests
Decision No 17/2015/QD-TTg dated June	Regulations on forest protection and management (expired on
09, 2015	1/January/2019)
Decree No 119/2016/ND-CP dated August	Policies on protection, management and sustainable develop-
23, 2016	ment of special use forests in the coastal and island areas for
	climate change adaptation
Decision No 1206/QD-BNN-TCLN dated	Issuing economic - technical norms for nursing, planting, care
8/4/2016 issued by MARD	and protection of mangroves
Decree No 156/2018/ND-CP	Specifying the implementation of some articles of Forestry Law
	2017

First, to assert Vietnam Government's special commitment to forest protection, Forest Protection Act No 147/LCT was introduced in 1972. Due to socio-economic reform in the

"renovation" period when there was a shift from centralised to market-oriented economy in Vietnam, this Act was revised in 1982 and 1986, focusing on decentralising the management of forest and agriculture lands to local levels; allocating forest and forest land to cooperatives, armed forces, forest enterprises and other economic sectors; contracting with households to plant and protect forests; and encouraging people and armed forces to plant forests nationwide and regreen coastal sandy lands. After mandating Forestry Law in 1991, government allowed the State to manage most of the special use and protection forest areas that have high biodiversity value [61]. Establishment of protection and special-use forests is one of the measures in southern coastal zone to protect coastal mangroves as well as to protect the coast.

Second, agro-forestry enterprises were no longer subsidized and they were suffered from failure in investing and managing forest land, and in early 1990s, there was a shift from centralized and collective management mechanism to the socialised forestry mechanism, thus, the revisions of related policies. For example, in 1994, the state policies on forest allocation was issued to provide long term access rights to organisations, house-holds and individuals in order to improve forest management and development, such as Decree No 02/1994/CP, Decree No 01/1995/CP, Decree No 23/2006/ND-CP, and Decision No 186/2006/QĐ-TTg. For forest development and regreening of bare lands, many national programmes on forest protection and development was also established such as 327 programme, 5 million hectares programme including mangrove forests.

Third, although huge policy and efforts were made in forest restoration but not specific to mangroves [19, 50], and the area of mangroves still decreased in Vietnam (see Figure 1). Therefore, in the period of 2008-2015, the project on "Coastal Mangrove Restoration and Development" developed by the Ministry of Agriculture and Rural Development (MARD) was issued and asked to be implemented, which directly addressed mangrove issues. Following up and responding to the demands of climate changes and searise levels and threats to mangrove [21] was the issuance of the Prime Minister Decision No. 120/QD-TTg, in 2015, approving the Project on "Coastal Forest Protection and Development". This project set up a background, then became an impetus for the mangrove restoration in the coastal ecosystem throughout the country. In addition, to encourage the private sectors to participate in the management, protection and development of coastal and island mangrove forests, the state issued Decree No. 119/2016/ND-CP on management, protection and sustainable development of special-use forests and coastal and island protection forests in responding to climate change in 2016.

Fourth, protection and expansion of mangrove forests in the Southern region were particularly mentioned in another policy document, such as Decision 26/2008/QD-TTg. This document outlined the mechanisms and policies to support socio- economic development in Mekong River Delta provinces through 2020.

To sum up, from 1972 to 2016 up to now, in Vietnam, many important policies about forest policies have been developed at the state level and applied for mangrove management, protection and reforestation. These policies have served as state-mandated provisions for people at lower management levels, such as provincial and city administrators to promulgate and guide specific local activities for mangrove protection and reforestation.

3.2.2. Mangrove-related policy implementation in Ca Mau Province and Ngoc Hien district

The responses of local system were conditioned by what happened at the province and district level following the guidance of state policies. Pursuant to the policies provided by the Central Government, Ca Mau Province People's Committee (PPC) has issued various decisions and guidelines related to mangrove management, protection and reforestation for the local context including its sub-unit, Ngoc Hien district. The illustration of these responses is presented in table 3 below.

Legal policy documents	Description
Decision No 57/QD.UB dated	Temporary regulations on mangrove management, protection, and aquacul-
6/3/1985 (PPC)	ture practice applied to households and Forestry-Fisheries Enterprises (in-
	cluding allocated mangrove land for protection from destruction and reha-
	bilitation) – expired.
Decision No 389/QD.UB dated	Temporary regulations on allocation of mangrove and forest land to house-
8/11/1988 (PPC)	holds for production and protection – expired.
Decision No 64/QD.UB dated	Guidelines for management, protection, forest ultilizations, forestry land
28/3/1991 (PPC)	and water surface in forest land (To replace the Decision No 389/QD.UB).
Official letter No 410/CV-UB in	Finishing reallocation people living on mudflat to their homeland
1996 (PPC)	
Decision No 24/QD-UB dated	Project on reforming structure and management of forest and forestry lands
12/9/2002 (PPC)	in Ca Mau Province (including the benefits from and consumption of forest
	products).
Decision No 133/QD-UBND	Promulgating design and appraisal norms for afforestation, forest exploitation, ren-
dated 14/3/2006 issued by PPC	ovation and thinning
Decision No 10/QD-UB dated	Regulation on implementing policies on forest development and protection
22/9/2010 issued by PPC	in Ca Mau Province (To replace Decision 24/QD-UB/2002 and expired on
	10/December /2019)
Decision No 06/QD-UB dated	Adjustments and supplements on the implementation of forest protection
11/7/2013 issued by PPC	and development policies (expired on 10/Dec/2019)
Decision No 01128/QD-UBND	Approving technical norms in forest development and exploitation in Ca Mau Prov-
dated 13/7/2017 issued by PPC	ince.
Decision No 04/2020/QD-UB	Issuing Regulations on coordination in construction, protection and devel-
dated 18/3/2020 issued by PPC	opment of Ca Mau Cape National Park (Replacing the Regulation according
	to Decision 21/2006 / QD-UBND dated May 11, 2006 which has expired)

Table 3. Local policies about mangrove management, protection and reforestation of Ca Mau Province and Ngoc Hien district

Analysis from table 3, secondary data and interview results shows that there are four periods of mangrove forest management in Ca Mau Province and Ngoc Hien district; namely, Reforestation, Collective management, Turning into social forestry, and Special use, protection, production forests management.

From 1975 – 1980: Reforestation

Right after the end of the war in 1975, Ca Mau Forestry Department focused on forest replantation in the areas that were destroyed during Vietnam war. The *Rhizophora apiculata* planted forest area during this period was fairly large [15]. However, in this period, expansion of agricultural areas were encouraged by the government, leading to the conversion of mangrove forest to agriculture lands. At the same time, as indicated by one of retired forestry leaders in Ca Mau, Mr. Nguyen Van Loc (pseudo name), forestry management tools carried out by Ca Mau authorities were incomplete. Therefore, the mangrove management and protection activities in this period were very limited in Ca Mau.

From 1981 – 1990: Collective management

From 1980 to 1987, for the whole nation, the state policies about forest management were operated at three lower management levels including provinces, districts and communes. This mechanism was applied in Ca Mau and Ngoc Hien. The forestry department was responsible for guiding technical aspects and managing an agroforestry enterprise namely Dat Mui in Ngoc Hien district. Specifically, since 1987, some agroforestry enterprises have been established in Ngoc Hien district and operated by district authorities. The communes were responsible for managing remaining forest lands.

At the time, Ca Mau prioritized the economic development. There was a boom in conversion of forest land into farming and aquaculture land. Mr. Ma Van Tien (pseudo name), an elder who lives long in Dat Mui Commune, Ngoc Hien District, told us that in

late 1982, shrimp aquaculture was initiated in an area of Ngoc Hien district named Ba Thanh Canal in and then widely expanded in the whole area. This economic development brought high income for local people who farmed the shrimp while destroying the mangrove forests because people from other provinces came to the areas for shrimp farming on a large scale, also according to Mr. Ma Van Tien. Ca Mau Province as well as Ngoc Hien district have long maintained these issues out of control for a long time.

From 1990 – 2003: Turning into social forestry

As local people and the migrants from other provinces continued encroaching Dat Mui Commune (a commune of Ngoc Hien District) for their special uses of forests and broke the forests protection policies, the local and state authorities issued various decisions and implemented management measures to deal with forest land invasion, to reforestate and protect mangrove forests. The results from our interviews and group discussion showed that as the migrants occupied and used the land for their business in Dat Mui Commune while claiming that they have a right to own that land, the authorities had to compromise and gave them the ways with forest land allocation or land certifications. At this time, households and organisations received contract investments from various sources for mangrove plantation and regeneration. According to Mr. Nguyen Van Loc, at this period, mangrove protected forest was allocated not only to organizations but households. Although the mangrove protection measures have been seen as the transformation from the conventional forest management to social forestry in Ngoc Hien District, in the realities, mangrove forests continued being degraded both in quality and quantity in this period [15].

From 2003 - now: Special use, protection, production forests management

After Forestry Law in 1991 was mandated, government regulations allowed the State to manage most of the special use and protection forest areas that have high biodiversity values (To and Tran, 2014). Establishment of protection and special-use forests is one of the follow-up measures in Southern central coastal zone to protect coastal mangroves as well as to protect the coast. In 2003, the Vietnam government established Ca Mau National Park and the adjacent protection mangrove forests. Ngoc Hien set forth three types of forests, including special use forest (Dat Mui National Park), protected forests (critical protected forest and protected forests) and production forests. In line with the new orientation of the state policies, some aqua-forestry state enterprises and forest management boards were transformed into Forestry Companies and Protection Forest Management Boards. Inteviewed leaders told us that aquaculture and forest harvesting is allowed in the protected forests and production forest areas in Ngoc Hien district being replanted, restored and managed alongside the slight increase of under the state investment and other sources.

3.2.3. Mangrove-related policy implementation in Ho Chi Minh City and Can Gio district

In responding to the state policies mentioned in table 3, Ho Chi Minh City People's Committee and the People's Committee of Can Gio District issued their local-level policies to manage, develop and protect Can Gio mangrove forests (Table 4).

Table 4. Local policy about mangrove management, protection and reforestation of Ho Chi Minh City and Can Gio District

Legal policy documents	Description
Decision No 1789/ QD-UB dated	Unified management of forest products in Ho Chi Minh City (expired on
29/12/1977 issued by the Ho Chi Minh	August 21, 1998)
(HCM) City People's Committee (CPC)	
Decision No 874/ QD-UB dated 31/5/1978	Temporary regulations on unified management and protection of forest
issued by HCM CPC	plants and animals (expired on 21/8/1998)
Directive No 1165/LN dated 3/10/1980	Control of illegal firewood transportation and sale; Prohibition of de-
and Announcement No 378/LNKL dated	forestation, firewood purchasing, selling, transporting and usage
15/4/1981 issued by Forestry Department	

Legal policy documents	Description
Decision 441/OD LIB dated 20/12/1082 is	On forest and forestland allocation to state owned write collectives
sund by HCM CPC	and households to be in charge of planting, caring and protecting for
sued by field ere	and nouseholds to be in charge of planting, caring and protecting for-
Directive No 2/CT LIB dated 16/1/1986	On completion of forest and forestland allocation and promotion of
issued by Can Cio District Poople's Com	forest protection and forest production business
mittae (DBC)	forest protection and forest production business
Desision No 2020 UB dated	En anno sin a maite and individuale to see fellow an anno d land and
Decision No 200/QD-OB dated	Encouraging units and individuals to use failow of unused fand and
25/11/1987 issued by People's Committee	water surface for production activities
OF HCM City	Develotion of the second sector of the line in the second se
Decision No 269/QD-OB, dated	Regulations on the management mechanism and application of pro-
26/11/1987 Issued by HCM CPC	forme forester forme and fishing ground in Can Cia
	Provide the state of the state
Official letter No 18//LN_K1 dated	Procedures for mangrove thinning for the second time
27/1/1988 issued by Forestry Department	
Directive No 53/CI-HDB1 dated	Can Gio Mangrove Forests are defined to be Protection Forests by the
21/2/1990 by the Coucil of Ministers	State
Decision No 173/QD-UB dated 29/5/1991	Approval of Pre-feasibility project of environmental protection for-
Direction NL 22/CT LIB 1 + 11/C/1002	
Directive No 23/CI-UB dated 1/6/1992	Enhancing measures for forest management and protection and de-
	forestation stop (expired on 17/1/2009)
Official letter No 364/LN-Q1, dated	Procedures for Rhizophora mangrove caring and thinning in Can Gio
15/11/1993 issued by Department of Agri-	for the 3 <sup>rd</sup> time.
Circular No 01/NN_KH/K1 dated on Jan-	Guiding the implementation of Decision No 556/11g dated 12/9/1995
uary 3rd 1996 issued by Department of	of the Prime Minister
Agricultural and Kural Development	
(DARD)	Descriptions on contracting for forest land all settion for much sting proving
Decision INO 5/00/QD-OD-KTININ dated	Regulations on contracting for forest land allocation for protection, zoning
4/8/1993 FFC	or familing and forest planting in the Environmental Protection Porest,
Decision No 2172/OD LIB CNNI dated	Barning the thinning of Can Cia Protection Forest
02/6/1999 by HCM PPC	banding the thinning of Can Gio Protection Porest
Degision No 7506/1999/OD LIB CNIN dated	Dromulating regulations on contracting for forest allocation protect
8/12/1000	tion going for agus forming, regeneration and planting of protec-
6/12/1999	tion, zoning for aqua-familing, regeneration and planting of protec-
	(navment for forest land allocation for protection)
Decision No 65/2000/OD LIB NIN dated	Iscuing regulations on management of protection forests of Can Cio dis
28/11/2000 by HCM PPC	trict Ho Chi Minh City
Degision No 95/2003/OD LIB dated	Adjusting the under contract narmont for protection of contracted
21/6/2003 issued by HCM PPC	allocated protection forests in Can Cie district (avaired on 1/1/2006)
Decision No 159/2003/OD LIB dated	Adjusting the under contrast normant for matasticn of matasticn forests
3/9/2003 issued by HCM PPC	Aujusting the under-contract payment for protection of protection forests
Decision No: 27/2006 (OD LIBND dated	A direction of the context and the context of the sector o
8/3/2006 issued by HCM PPC	Aujusting the under-contract payment for protection of protection forests in Can Gio district (expired on 10/5/2007)
Decision No 07/2010/OD-URND dated	Approving the plan for unified management of anyironmental protection
29/1/2010 issued by HCM PPC	forests. Can Gio Mangrove Riocobere Reserve
Decision No 05/2008/OD LIBND dated	Issuing the Regulation on management of Can Cia Management
21/1/2008 issued by HCM CPC	Receive
Directive No 02/2000/CT LIBND dated	Enhancing the management and protection of Can Cia Protection
4/8/2009 issued by Cap Cio District Poo	Forests
nle's Committee	1010303
pie s commutee	

Legal policy documents	Description
Decision No 31/2010/QD-UBND dated	Adjusting the under-contract payment for the protection of protection forest
18/5/2010 issued by Can Gio DPC	of Can Gio district (expired on 27/1/2013)
Directive No 11/2011/CT-UBND dated	Enhancing measures for conservation and sustainable development of Can
18/3/2011 issued by Can Gio DPC	Gio Mangrove Biosphere Reserve
Decision No 03/2013/QD-UBND dated	Adjusting the under-contract payment for the protection of protection forests
17/1/2013 issued by Can Gio DPC	in the city

Analysis from table 3, secondary data and interview results show that there are three periods of mangrove forest management in Can Gio; namely, Reforestation, Forest and forest land allocation to state owned units and households, and Protection forests.

#### From 1975 to 1982: Reforestation

As presented above, Can Gio mangroves were mostly devastated after the Vietnam war. Thus, right after taking over the coastal district in April 1978 from Dong Nai Province, the Municipal Committee and the People's Committee of the Ho Chi Minh City mandated Decisions on mangrove management (Table 3), and actively and diligently rehabilitated Can Gio mangrove forest. The area of planted forest was quite substantial during this stage as shown in Figure 4. Mr. Phan Van Khoi (pseudo name), a retired forestry leader in Ho Chi Minh Chi Minh City said that the massive local communities and youth forces had been involved in forest plantation, and with proper policies from Ho Chi Minh City and great investment made by the authorities at all local management levels, Can Gio mangroves has been well-replanted.

### From 1982 to 1990: Forest and forest land allocation to state owned units and households

In Can Gio, this measure began with the allocation of mangroves to agro-forestry enterprises, local households and district People's Committee for management during this period. Then, in 1985, mangrove thinning was carried out for the 1<sup>st</sup> time and it has been recognized effective in terms of improving productivity and quality of mangroves (Can Gio EFMB, 1991). In 1988, the 2<sup>nd</sup> mangrove thinning measures were reconducted. The total area of planted forests in the Can Gio district being less than 250 hectares in the period of 1983-1985 and since 1986, the afforestation almost stopped. In this period, State owned units with allocated land and forests did not well perform the forest protection and they paid much attention on aquaculture (Dao, 2001).

From 1990 - now: Protected forests

Can Gio Mangrove forests had been recognized as environmental protected forests by the State in the Instruction No 53/CT-HDBT on February 21<sup>st</sup> 1990 with 34,000 ha in Can Gio District and managed by the Environmental Protection Forest Management Board (EPFMB), under Department of Agriculture and Rural Development of Ho Chi Minh City. Regulations on protection forest management, strategic plans for Can Gio Mangrove Biosphere Reserve, cost norms for mangrove protection, and zoning and development have been mandated by Ho Chi Minh City People's Committee (see Table 4). Thinning of Can Gio forest was, then, taken place for the third time to improve the mangrove productivity but the City People's Committee has stood for the stances of stopping forest thinning in Can Gio mangrove forests since 1999. From 2000 to present, Can Gio mangrove forest has become Can Gio protected mangrove forests and been managed by Can Gio Protection Forest Management Board (PFMB), under the management of People's Committee of Can Gio District. At present, Can Gio mangroves are strictly protected by district management units and households contracted to forest protection.

### 3.3. Issues of mangrove-related policy implementation in Southern Vietnam

The sections above examined the characteristics of state policy development and its relations to the implementation carried out by the lower level management of mangrove forests in Southern Vietnam in two study sites (Ca Mau Province and Ho Chi Minh City and their respective sub-units Ngoc Hien and Can Gio districts) over the time from 1975 up to now. This examination reveals many issues that have affected and will affect the

protection and development of mangrove forests in Southern Vietnam. The issues include locals' struggles to fill the gaps between written and implemented policies in mangrove rehabilitation, conflict among sectors and stakeholders in mangrove utilization and protection, problems in guaranteeing adequate budget for in-need-locals, inconsistence in policies on "forest: water surface" ratio in mangrove-shrimp farm, and unintended consequences in forest thinning and exploitation regimes—all need to consider either addressing or continuing.

3.3.1. Locals' struggles to fill the gaps between written and implemented policies in mangrove reforestation

Our review of the history of policy development about mangrove forests in Vietnam shows that the Vietnam's government tended to priorize mangrove reforestation to serve the forest restoration of the nation. Indeed, Vietnam has conducted more mangrove reforestation than any other country in the world [67] as a result of this priority. At the same time, however, the review indicates that, often, a state policy in Vietnam is highly scripted in the ways it expects the locals to achieve the intended goals. This creates challenges at local management levels. That is, the locals could be struggled to fill the gap evolving between policy as written at the state and policy as implemented at the locals.

One example concerns the local policy measure called planting mangroves of *Rhizophora apiculata* specy which was considered as a response of both Ca Mau and Ho Chi Minh City to the local and state policy about the forest restoration and that of their recognition of the importance of mangroves in the period of 1975s-1980s. This measure was to be accomplished by the districts Ngoc Hien and Can Gio. However, under the distinctive circumstances, the resulting outcomes differed from one district to other. With the advantage that the remaining mangrove area in Ca Mau is large, Ngoc Hien has favorable conditions for afforestation because of the available local sources of *Rhizophora apiculata* propagules as informed by Mr. Nguyen Van Loc. Meanwhile, about 4,500 ha of *Phoenix sp.* and 14,380 ha of shrubs (scattered shrubs with coverage less than 40% and height less than 2m) were remained in 1978 in Can Gio [35]. In fact, *Rhizophora apiculata* propagules were collected and transported from Ngoc Hien mangrove forests to Can Gio to be planted which showed that Can Gio did not accommodate the policy as expected.

Another example involves the diversity of mangrove plantation and natural mangrove forests in two districts. The forest plantation area in the period of 1980s – 1990s in Ngoc Hien was much lower than previous period due to limited land available for forestry and the conversion of forest land to shrimp farming [42] meanwhile in Can Gio, reforestation continued with diverse plant species (interviews with Mr. Phan Van Khoi). However, the planted area in Can Gio also reduced markedly after 1997 due to the decrease in available land for planting. Mr. Nguyen Van Loc shared in our interviews that in the stage of 1975-1990, Ca Mau authorities adapted their measures by taking an emphasis on mangroves replantation rather than on protecting existing natural mangrove forest areas as indicated. Given this adaptation, however, there were controversies, pertaining whether the importance of protection and development of natural forests was recognized in Ngoc Hien properly. Natural mangrove forests in Ngoc Hien are distributed in special forests and thin belt along the coast and natural mangrove areas in Ngoc Hien are smaller in comparition to those in Can Gio District as seen in Figure 3 and 5. The question still remained, considering scientific results that natural mangrove forests and diversed canopy of mangrove forest contribute to erosion control of riverbank and coast, windbreak, wave reduction [32, 55]. Therefore, it is very important to pay more attention to zoning for natural regeneration, enhancement of the diversity of protection forests and special-use forests, especially in riverside and coastal areas.

It was another issue on protecting the mangrove reforestation results in both Can Gio and Ngoc Hien Districts. That is, livelihood activities had affected the area of newly regenerated forests and newly planted young forests in Can Gio and Ngoc Hien. To prevent the destruction of planted mangroves, Can Gio Forestry Department was also adaptive by issuing the Directive 1165/LN in 1980 to control illegal firewood transportation and

trading which was followed by the announcement No 378/LNKL on the prohibition of deforestation, purchasing, selling, transporting and using firewood in Can Gio Forest dated on 15th April 1981. In addition, both Ca Mau and Ho Chi Minh had faced encroachment to practice aquaculture in 1980s-early 1990s, but it was seemly out of control in Ngoc Hien District. In that context, the Provicial People's Committee issued the Decision No 389 in 1988 and the Official Letter No 169 in 1990 on temporary regulations on allocation of mangrove and forest land to households for production and protection. However, the centrally managed mechanism that lasted for long time and unclear and unstable policies led to the serious loss of mangrove forest regardless the efforts of authorities to manage mangrove forest. In response to this, the Government had issued the Decision No 432/QD-TTg in 1995 and the Directive No 12/TTg in 1996 on the protection and development of mangrove forest and mudflat in Ngoc Hien District, which required the removal of households out of mudflat of Ca Mau to return habitat for the mangrove ecosystems. The Provincial People's Committee also issued the Official Letter No 410/CV-UB on resettlement of households and allowance for resettlement. Since 1993, households were allowed to be legally entitled lands that had been reclaimed for shrimp farming through land allocation mechanism in Ngoc Hien. Afterward, management of mangrove forest and forest land was gradually controlled by authorities in Ngoc Hien.

## 3.3.2. Conflicts among sectors and stakeholders in mangrove utilization and protection

Mangrove management involves multiple actors operating at multiple governance levels [30]. That can create conflicting policy objectives and implementation challenges [60]. Although there have been state policies and regulations on land and forest land allocation to individuals and households since November 1982, in the period of 1980s to early 1990s, agroforestry and forestry enterprises were given priorities in forest land allocation for protection and production in both Can Gio and Ngoc Hien districts. In Can Gio, only about 9,000 ha of mangrove forests were not allocated to households and managed by the District People'. Meanwhile, in Ngoc Hien District, only some agroforestry and forestry enterprises were set up and managed a small area of forest and forest land.

Conflicting or unclear policy objectives result in contradictory management decisions [5]. In our two study sites, there were conflicts between short-term economic development and long-term mangrove forest protection. In 1980s to early 1990s, short-term economic development was the main direction of the local government. Mangrove forests were considered as new economic zone resulting in massive migration of community to Ca Mau Province. As a result, mangrove forest was destroyed and converted to agriculture and aquaculture areas. Agriculture practices on mangrove forest land became failure after few crops [45]. Those converted land were not suitable for mangrove rehabilitation because of changes in soil property. In addition, in 1980s - 1990s as shrimp value was on a rapid rise in exportation, there was a boom in shrimp aquaculture. In Ngoc Hien, after 1985, mangrove forest clearance for shrimp aquaculture became uncontrollable [42]. During 1979-1992, about 38,252 ha of mangrove were converted to shrimp aquaculture and thus, 53.6% of mangrove forests lost in Mui Ca Mau region (covers all of Ngoc Hien District and part of Nam Can District of Ca Mau Province) [59].

Rapid development of shrimp aquaculture also had severe impacts on Can Gio mangrove forests. There were about 1000 shrimp dams (large and small size) owned by collectives and individuals in early 1980s in Can Gio (as estimated by Mr. Dang Tuan, retired forest protection officer of Can Gio). The expansion of shrimp ponds was mainly carried out by state owned units, agro-forestry enterprises. Later, many agro-forestry enterprises engaging in rearing shrimp were reallocated that their forest land was assigned to the local people who ran shrimp farming in traditional ways due to economic failure, according to Mr. Tran Van Ban (pseudo name) in Ly Nhon Commune, Can Gio District. Das-Gupta and Shaw (2013) [14] considered shrimp cultivation is the second largest anthropogenic cause of mangrove deforestation in Southeast Asia, but in our cases, shrimp cultivation is the first anthropogenic cause of mangrove deforestation. As indicated by Friess et al. (2016) [20], conflicting or unclear policy objectives exist at multiple tiers of state policy making mechanism resulted in contradictory decisions. In the case of Ngoc Hien and Can Gio, there is conflict in decisions of aquaculture and forestry sectors. In addition, forest land allocation to collective units for management and agricultural farming showed failure and poor management of local authorities in controlling the conversion of forest land to shrimp farming. That leads to coastal mangrove loss during the 1980s-early 1990s in both sites of our study areas in particular and in Southern Vietnam in general.

Coastal communities invaded the mangroves for their continual survival, and as a result, conservation and plantation initiatives could result in conflicts among the local governments, forest owners and mangrove-dependent communities [14]. In our study, during the forest land allocation to agro-forestry enterprises, conflicts occurred between the forest managing entities and local households. In Can Gio, government units were assigned with land use rights according to Decision 441/QD-UB in 1983. Results from group discussion in Can Gio showed that local people were not allowed to enter, cut down trees or do fishing in the aquaculture/farming sites of the units. The local communities, though actively engaging in afforestation, were restricted in using forest resources. Even for marine resources, which are considered "common resources", their rights to them were also limited after forests had been allocated to stated owned units. If the allocated land has already been used by local people before, the unit assigned with the land is allowed to recover the land and must compensate for local community until satisfactory achieved. In addition, these households should be given priority to work for the unit [48]. However, it is difficult to identify "satisfactory" compensation under a particular regulation. The conflict also leads to the increases of forest violation during 1982-1988 in Can Gio.

The success of mangrove rehabilitation also raises potential conflict in income distribution. As income from mangrove timber harvests is quite low compared to that from shrimp harvests, an equitable profit-sharing scheme has been devised to ensure that maximizing aquaculture production will not compromise mangroves' functional integrity [62]. In practice, many forest companies in Ca Mau were reluctant to share responsibilities, interests and benefits from the mangroves with the farmers. The property and ownership rights to forest remained in the hands small group of people, which negatively impacted the will to invest in mangrove sustainability [63]. Ha et al., (2014) [63] also indicated that successful long-term forest management requires strong, trustful and equitable linkages among stakeholders.

### 3.3.3. Mangrove forest allocation to household

Community involvement is critical to forest rehabilitation and protection success [65]. Dale et al. (2014) [12] mentioned that community involvement is especially important where communities rely on and value mangroves for their livelihood, as in developing countries. Since 1976-1978, a number of local people, youth volunteers and enterprises have involved in mangrove afforestation in Ngoc Hien and Can Gio districts. Since 1990s, the forestry sector and the authorities at all levels have identified that the key solutions to improve management is to socialize the forestry sector and extensively allocate forests and forest land to households.

In 1990-1991, only 34 households (with 227 people) in Can Gio agreed to contract for protection of 4,215 hectares forested area. Poor households living in the communes with forests are given priority while pursuing contract to protect mangrove forests. They were financially supported for house-making and granted loans for hunger eradication and poverty reduction. As a result, the number of households allocated for forest protection increased to 137 households in 1997 and 179 households in 2018 [35].

Forestry land allocation to households and individuals for management and utilisation has been implemented following to the Decree No 181/2004/ND-CP dated November 29, 2004 and the Decree No 43/2014/ND-CP dated May 15, 2014 on the implementation of the Land Law. Thus, Protection Forest Management Boards in Ngoc Hien also allocated forest land to people for protection and gaining benefits from controlled timber exploitation. Up to 2018, 626 households in Ngoc Hien district were allocated forestry land [57]. The group discussion in both districts indicated that after mangrove forest allocation to households, forest violation has gradually reduced. The reason was that, local fisherman or collectors would hesitate to violate the forests when owned by local people. In addition, when people perceive that their ownership, rights and benefits from mangrove management are secure, they are the great human resources to manage and conserve the forest [63].

## 3.3.4. Problems in guaranteeing adequate budget at the local

Budget is an important factor for carrying out forest protection and rehabilitation. As for Can Gio case, the allocated budget for mangrove protection and rehabilitation was considered well-accommodating. When the new measure were put into the practices in 2003, the State budget norms for forest protection used in early 1990s with the ranges from 50,000 to 80,000VND/ha/year for the planted mangroves and 30,000 to 50,000VND/ha/year for the natural forest have been adjusted to accommodate the actual conditions. In fact, this budget amount in Can Gio was even higher than that of the forestry sector level. Specifically, the average payment for forest protection gradually increased from 316,000 VND/ha/year in 2003 to 1,156,000 VND/ha/year from 2013. In Can Gio, the central budget contributed 200,000 VND/ha/year and the city budget invested about 956,000VND/ha/year for mangrove protection [35].

Meanwhile, in Ngoc Hien, the investment and paymen for forest protection are limited and lower than that in Can Gio. Budget for mangrove protection in Ngoc Hien is composed of 2/3 from state budget and 1/3 from provincial budget. Forest owner has been paid by 300,000 VND per hectares to protect mangroves in period 2016-2020. The research results showed that, according to stakeholders, this amount of payment for forest protection is quite low because it is not adequate to afford the offset opportunity cost to convert mangrove forests to aquaculture [44]. Moreover, there is still lack of buget for investment in motor boats with high capacity, GPS devices, equipments for communication and education on forest protection and management in Ngoc Hien, according what Mr. Vu Van Dung (pseudo name), the officer of Protected Management Board in Ngoc Hien shared with us in the interviews. It is necessary to supply more investment to ensure the effectiveness of forest protection.

3.3.5. Unintended consequences in implementing wood exploitation and forest thinning policies

As mentioned in our review of history of policy development about mangrove forests, a state policy usually has its intentions, purposively aiming to improve practices of forest protection. However, at times, when the policy is put into place, it extends far beyond its original intention. Although a state policy might affect the practices it is intended to address, it also has unintended effects never envisioned by the locals who implement the policy. This is the case illustrative in our two study sites, concerning problems involved in the implementation of forest thinning policies and forest exploitation regimes.

Mangroves belong to the critical protection forests, protection forests and production forests. Protection and production forests are allowed to be selectively clear cut down by band when tree each the suitable age (15-20 years old) for exploitation in Ngoc Hien. The protection forests cannot reach climax community, and the forest land is not covered fully by mangrove trees sometimes meanwhile mangroves play important role in storm protection, against wind damage [1.13]. The young forests or monogenous mangrove forests might have lower protection capacity compared to forests with species diversity which requires the development and implementation of the thinning policies.

Likewise, Can Gio protection forest was thinned from 1990 until 1999. After that, thinning activity was stopped up to now. The group discussion results in both districts indicated that old and thin forests of *Rhizophora apiculata* affect aquaculture practices and the reduction of productivity. Local people would like to cut down trees or do thinning, and they can have extra income from thinning products of mangroves. Otherwise, the

policy on stopping thinning in Can Gio is somewhat effective in forest management as it minimizes the impacts on the forest area. But it leads to an unintended consequence that in the high forest density, there was inadequate growth space, forest quality reduction, poor plant growth and pest attack [35].

On the other hand, Romañach et al. (2018) [52] indicated that the mangrove restoration measures would reach better effect if they get local people involved in direct benefits from, for example, regulated timber harvest. The thinning measures, therefore, would achieve their original purposes on improving the quality of plantations and increasing the effectiveness of forest protection if the local authorities orient their work toward operating the measures with a certain level of control alongside getting the involvement of local households in the for-profit activities [63].

#### 3.3.6. Inconsistence in policies on "forest: water surface" ratio in mangrove-shrimp farm

Mangrove management involves the implementation of multiple state policies at multiple levels. At one time, these policies are aligned with one another; at others, they are contradictory, event conflicting. That can create inconsistent objectives and guidance in the implementation process.

Although there were provincial policies regulating pond aquaculture according to the Decision 389/QD.UB in 1988 and Decision 64/QD.UB in 1991 on that mangroves had to cover at least 80%, and there is also another policy on forest land allocation certificate that certifies "forest:water surface ratio" at 50:50, leading to difficulty in mobilizing community to involve in forest replantation. Moreover, the "forest:water surface" ratio which was set at 70:30 in 2002 according to a province-based decision (namely, Ca Mau People's Committee approval of the province's forest and forest land renovation) was changed to 60:40 in 2010s according to another set of policies (namely, Decision No 10/QD.UB and Decision 06/QD.UB). At present, regulations on "forest: water surface" ratio are implemented under a new state policy-the Decree 156/2018/ND-CP which regulates 60:40 ration for mangrove forests combining with aquaculture. In 2011, the "forest:water surface" ratio in mangrove-shrimp farm areas in Dat Mui area (Ngoc Hien district and a small area of Nam Can district) was around 52% [59], which doesn't meet the requirement. Given the fact that in production or protection forest land, the mangroves need to cover at least 60% of total area and the remaining 40% area should be used for pond aquaculture, all the most-recently-issued policies, in fact, have pointed those in charge of implementing the policies to multiple directions, thus, created inconsistent policy implementation in the lower management levels such as Ngoc Hien districts.

Local authorities in Ngoc Hien found difficulties in controlling this ratio as well as encouraging households to start rehabilitating mangroves earlier to increase the ratio to 60:40. The results of group discussions with villagers in Ngoc Hien suggest that when the trees are mature after 10 years with the high canopy cover, aquaculture productivity is decreased. Therefore, the community expressed their desire to have a ratio of 50:50 or 60:40 during group discusions to facilitate aquaculture. The "forest:water surface" ratio of 60:40 was evaluated to be favorable for shrimp development by farmers [63] and even of 30:70 [4]. Therefore, the farmers tended not to focus on forest management and protection and reduce replantation to ensure the correct proportion of forest area as regulated. Forcing to ensure the 60:40 "forest:water surface" ratio in Ngoc Hien has, in fact, posed a challenge for forest managers at the dictrict level.

## 4. Conclusions

The wide growth of mangroves in the coastal area of the southern Vietnam indicates their essential influence on the enronmental conservation and socio-economic development of the country. This signifies the importance of mangrove management in supporting the rehabilitation, protection and utilization of mangrove forests in Vietnam. How do the state policies, concerning mangrove rehabilitation, protection and utilization are implemented at the lower management levels in the south of Vietnam? What are challenges, if any, the locals encounter while enacting the state policies? How do the locals cope with the challenges?

This article intends to address these questions. Over the past forty years, policy makers at the Vietnam's government have issued multiple policies and prescribed multiple measures for mangrove management in the locals such as forest protection and restoration and the mobilization of community involvement in the process. Although these policies and measures have been regulative and scripted, their implementation have varied at the locals. In this article, we explored how some state policies on rehabilitation, protection and utilization of mangroves are implemented at two study sites; namely, Ca Mau province and its sub-unit Ngoc Hien district as well as Ho Chi Minh City and its sub-unit Can Gio district and what are considered as emerging issues in the implementation process. Out study was conducted by tracing the history of mangrove forest policies and their implementation in the study sites and employing group-focused interviews with related people in the forest management divisions.

We found the state policies do not explicitly focus on mangrove forests and they would be adapted through the ways in which the two locals manage to enact the established regulations they are charge with in various periods of time while struggling to deal with socio-economic challenges specific to their locals. The findings also reveals some issues emerged from that the adaptation process; namely, locals' struggles to fill the gaps between written and implemented policies in mangrove rehabilitation, conflict among sectors and stakeholders in mangrove utilization and protection, problems in guaranteeing adequate budget for in-need-locals, inconsistence in policies on "forest: water surface" ratio in mangrove-shrimp farm, and unintended consequences in forest thinning and exploitation regimes. These issues are not unique to mangrove management practices in the south of Vietnam; thus, they demand an intent consideration. In the following parts, we discussed lessons learned and recommendations for mangrove management in Southern Vietnam.

First, exploring the history of mangrove forest policy implementation is crucial to understand how the locals strive to marshal the gaps at the policy implementation process to accomplish their mangrove management. As mentioned above, policies on mangrove restoration and protection in Can Gio have been in place from 1978 up to now, even when neither has government recognized important role of mangrove forests in Vietnam's socio-economic directions nor they have issued specific policies supporting mangroves development. Similarly, mangrove forest in Ngoc Hien has undergone different stages of development followed by the segregation of state direction throughout the history. Research shows that anthropogenic drivers of mangrove forest loss, rehabilitation and protection are effectively addressed by policy interventions initiated at lower management levels [20]. Therefore, at the local level, it is recommended that there need to have more specific and localized orientations and policies on mangrove forests to effectively restore and protect mangroves.

Second, it can be seen that Ho Chi Minh City has invested and financially supported the protection of Can Gio forests using significant local budget while Ngoc Hien has been struggled to obtain adequate financial resources to carry out their forest protection measures. This suggests that among other factors, increasing the budget from the state budget or local budget is very important for good implementation of mangrove management policies. In addition to the funding, to improve capacity for policy implementation in forest protection, it is necessary to have quality human resources to implement forest protection, especially for special-use forests and protection forests.

Third, that involvement of local communities and equitable distribution of benefits from products of mangrove ecosystems are crucial to mangrove rehabilitation, protection and conservation success [2, 26]. Research in Can Gio and Ngoc Hien shows that the participation of local people in forest protection and appropriate exploitation of forests (including successful allocating forest land to local community in Can Gio) have been contributing to the effectiveness of mangrove protection. Good performance of awareness raising activities for the community is also an important factor in implementation of forest protection and development policies. Furthermore, policies on community-based forest management, community support, and in forest protection and development need to be further promulgated and applied to mangrove forests.

Fourth, many studies have also suggested that mangrove-specific policies, enhancement of institutional capacities, encouragement of community participation, as well as livelihood integration and improvement are needed to achieve sustainable mangrove management [11,17,25,54]. According to a study in the Ca Mau province [52], shrimp farmers may be able to plant, protect, and sustainably manage mangroves if they are given sufficient economic incentives, adequate legal rights, and full responsibilities over their allocated mangrove forests. This paper also shows that conflict between protection of mangrove forests and economic development of households could lead to decrease in the effectiveness of policy implementation and reduction in forest quality and quantity. To deal with the root cause leading to pressures on forest resources, it is necessary to increase the income and capacity of local communities. To discourage and reduce the use of forest products, first and foremost, it is important to further improve efficiency and sustainability in fisheries production as well as search for additional income, alternative livelihoods, or new financial support for forest protection for local communities as well as for forest protection staff.

Fifth, thinning should be done for planted mangroves located in planted protection and special-use forest areas to ensure growth space for forest trees as well as to improve the ecological function of mangroves. Thinning should only be stopped when there is enough growing space for the mangroves and for opptunity to reach mangrove climax community. Mangrove exploitation through clearing of fallen trees in protection forest area such as Ngoc Hien is not recommended as this could lead to a decrease in the protection function of the mangrove forest.

Sixth, creating evidence-based references backing up all of aforementioned recommendations is imperative to improve mangrove management. Thus, conducting scientific studies about, for example, the role of thinning in planted forest ecosystems or a regulated reasonable "forest: water surface" ratio in under-canopy aquaculture is essential before issuing any related policies. Policies should be scientifically formulated to minimize the risks in the implementation process. In the case of Ngoc Hien and Can Gio, policies of forest: water surface" ratio have been altered time after time. In order to address the consequences such policy change, it is necessary to provide forest owners with financial and technical assistance for additional planting to ensure that the proper proportion of forests is in accordance with the policy demands

In conclusion, this study shows that over the past fourty years, although there have been several state policies issued to regulate mangrove development in Vietnam, the lower management levels have still encountered challenges in their own practices. To cope with the challenges and to adapt to different directions, the locals have managed to find their own strategic orientations to achieve mangrove quality and quantity that are expected to have fitted the socio-economic conditions in different sites. Main challenges and obstacles in mangrove management can be overcome in future if there is consideration of technical and financial solutions, participation and coordination of stakeholders, limiting unintended consequences and balancing the state demand and local resources while enacting the policies as well as ensuring equity among stakeholders involved in mangrove protection and development in Southern Vietnam.

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