EVALUATING POLICY EFFECTIVENESS ON COASTAL MANGROVE MANAGEMENT: CASE STUDY IN KIEN THUY AND DO SON DISTRICTS, HAI PHONG CITY

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SUMMARY

This study aims to investigate relevant policies in study site from 1990 to 2016 using multi-temporal Landsat images; to assess the effectiveness of policies on coastal mangrove management using three major indicators; and then to propose feasible solutions to enhance the policies in this area. Three remarkable policy periods have been investigated and assessed by using a set of three significant indicators, including ecological, economic and social indicators. As a result, from 1990 - 1997, mangrove rehabilitation and restoration projects had been implemented, but they were not effective. From 1997 - 2005, the implementation of many policies and projects had improved the quantity and quality of mangroves. Hence, the increase of mangrove extent considerably contributed to local incomes and livelihoods improvement. The period from 2005 to 2016 has been well-known as mangrove development and protection stage. This study also suggests that the communes should adapt communities - based management (CBM) to enhance the mangrove quantity and quality in the long term.

Keywords: Community-based management, geographic information system, Landsat, local livelihoods, mangrove management, policy effectiveness.

I. INTRODUCTION

In Vietnam, mangrove systems are vital to the livelihoods of coastal communities (Orchard et al., 2016). It provides an important ecosystem service of safeguarding human societies from natural disasters along tropical coastal zones as well as economic values (Sanford, 2009). Management of mangroves in a sustainable ecological and economic way is a difficult proposition which needs multi-disciplinary intervention (Dat and Yoshino, 2013). The process of developing a broadly integrated management effort will need to incorporate a richer set of performance measures. Institutional evaluation, an understanding community dynamics, and policy assessment all play a central role (Bowen and Riley, 2003). An integrated wetland research framework suggests that a combination of economic valuation, integrated modeling, stakeholder analysis, and multi-criteria evaluation can provide complementary insights into sustainable and welfare-optimizing wetland management and policy (Turner et al., 2000).

In Vietnam, although the importance of assessing policies and their effectiveness on sustainable mangrove management have been well recognized, accurate and reliable assessment process is unanswered, including Hai Phong in general and Dai Hop and Bang La communes in particular. Hence, this paper initially aims to build up a set of indicators for policies effectiveness assessment to apply on coastal mangrove management in Vietnam.

II. MATERIAL AND METHODS

2.1. Study site

Study site belongs to two districts, including Kien Thuy and Do Son. Specifically, it only belongs inside frontier of two communes. They are Dai Hop (in Kien Thuy district) and Bang La (in Do Son township) as shown in fig. 01.

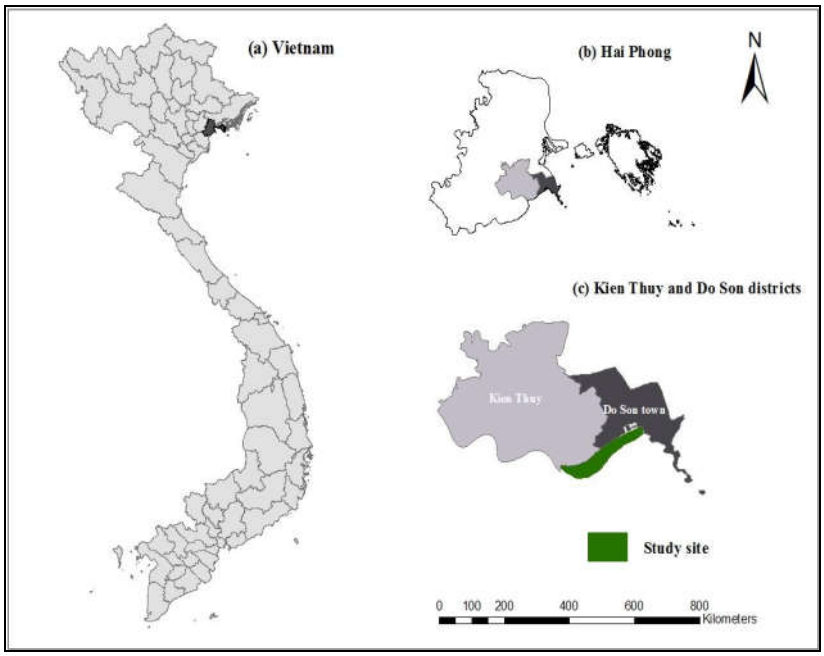

Figure 01. Study Site (a) Vietnam (b) Hai Phong city (c) Kien Thuy district and Do Son township and the distribution of mangroves in study site

2.2. Methodology

Data collection

Literature review is the main method to collect the secondary data, including documents related to policies and projects, published documents, papers and case studies. The data collected from this study includes socioeconomic conditions of study sites; geographic information system layers; land use and land cover maps; technical steps of processing Landsat image; data related to the dynamics of coastal mangroves; relevant policies on coastal mangrove management in Dai Hop (Kien Thuy) and Bang La (Do Son) communes; social – economic reports from communes.

The multi-temporal Landsat images are used in this study to assess the dynamics of the coastal mangrove area before and after the policies introduced (table 01).

Table 01. Landsat data used in the study

ID	Landsat image code	Date	Resolution	Path/Row
1[1]	LT51260461990234BKT01	22/08/1990	30 m	126/46
2[1]	LT51260461997157BKT00	06/06/1997	30 m	126/46
3[1]	LT51260462005099BJC00	09/04/2005	30 m	126/46
4[1]	LE71260462016154EDC00	27/06/2016	30 m	126/46
5[2]	Map of Mangrove Status	2000, 2008, 2010	1:50 000	

Sources: *[1]http://glovis.usgs.com, [2]Hai Phong Institute of Oceanography*

Primary data in this study was mainly obtained from both structured interview method and the semi-structured interview, which is used as a support for certain types of information. Total sample sizes for interview is 55 households in diverse groups of age, jobs, genders and social well-being (rich, middle and poor families). Primary data was then used to assess social and economic indicator and as support information for accuracy assessment.

Data analyses and processing

Landsat images classification and processing: the visual interpretation and unsupervised classification methods are used to map the coastal mangroves extent since 1990. In the combination with data collected in the field, the accuracy can be assessed using ground truthing approach. The visual interpretation and unsupervised classification methods are used to map the coastal mangroves extent in 1990, 1997, 2005 and 2016. After using unsupervised classification, two map layers were overlaid to get dynamic maps over periods. Two layers were added together in ArcGIS 10.2. The final result is the dynamics map of coastal mangrove in three periods, namely 1990 – 1997; 1997 – 2005; and 2005 - 2016 with four main categories classified as no forest; forest loss, forest gain, stable forest.

Data collected from interviewing local people were analyzed by R (Statistic sofwares). Descriptive statistics were then used for social and economic indicators assessment. Besides, raw data after processing with Microsoft Excel, were used to draw graph to illustrate the trends and changes of different variables in this study.

III. RESULTS AND DISCUSSION

3.1. Institutional frameworks and policies on coastal mangrove management

Natural resources policies in Vietnam were influenced by many factors, such as historical development; political system – historical context; land use property system; etc. At the beginning eras of policies in Vietnam, coastal mangroves management had not been focused. In study site, Policies on coastal mangroves management started in 1990s and could be divided into three significant periods: 1990 to 1997; 1997 to 2005; and 2005 to 2016. The following fig. 02 shows the institutional framework of mangrove management.

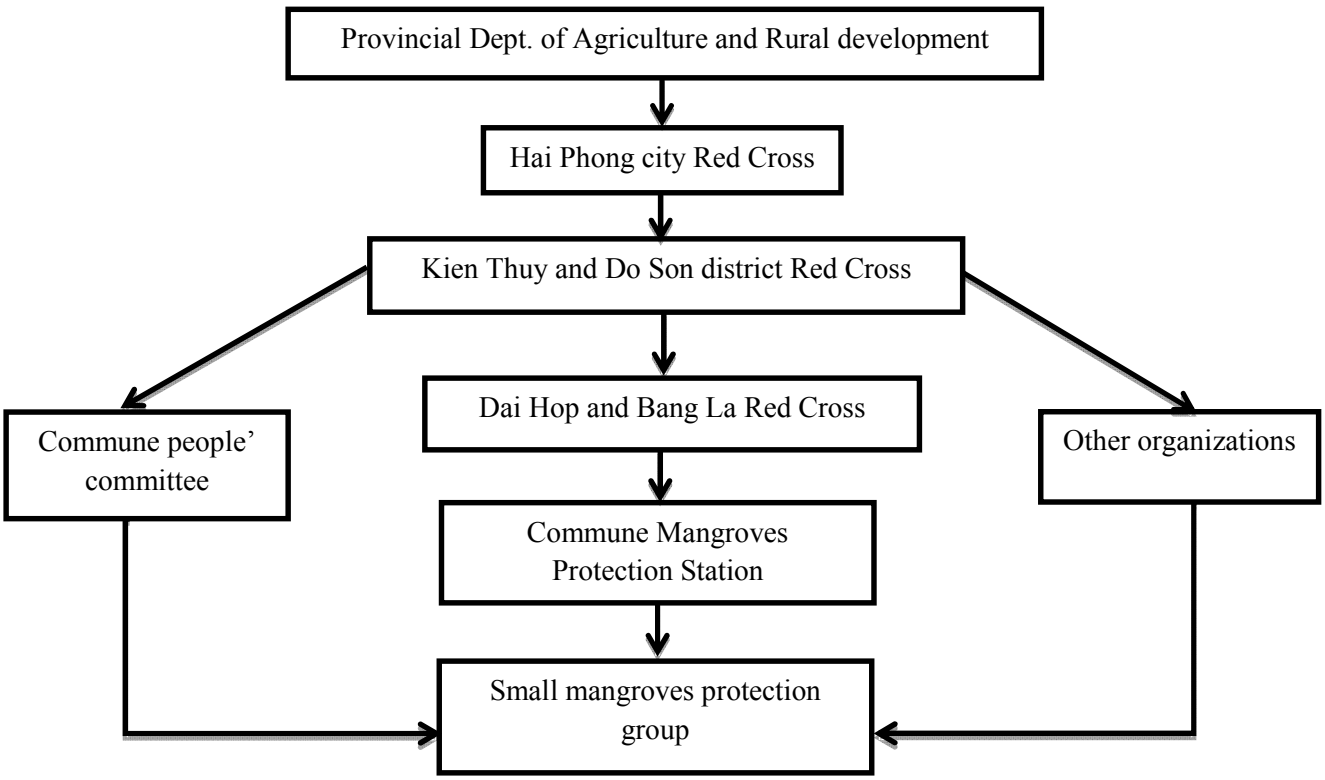

Figure 02. Provincial institutional structure for coastal mangrove management in Dai Hop and Bang La communes (Adapted from Cuc et al, 2008)

Policies related to coastal mangrove management from 1990 to 1997

In this stage, socioeconomic conditions of Vietnam got much change. The awareness of people about the values of mangroves was limited. Policies about management and development of mangroves were relatively poor, weak and only at primitive level.

Especially in Dai Hop and Bang La, reforestation and plantation projects had been applied including national program 327. However this project did not achieve the expected results. Most of new plants could not grow in the study area before 1997.

Policies related to coastal mangrove management from 1997 to 2005

In general, policies and projects systems were improved well in this period. Hai Phong became one of the eight coastal provinces (from Quang Ninh to Ha Tinh) implemented the plantation mangroves project by central of Vietnam Red Cross with support of Japanese Red Cross. Two major projects are project 661 and "planting mangroves, preventing disaster" funded by Japanese Red Cross.

Coastal mangrove management policies has been applied more detail since 1998. Research area located in both Dai Hop and Bang La communes... Hai Phong Red Cross managed directly mangrove area in two communes. Basically, two policy systems were relatively identical. Structure of specialized teams were essentially the same.

Policies related to coastal mangrove management from 2005 to 2016

After 2005, mangroves area in Hai Phong city increased dramatically: from 297 ha (1990) to more than 500 ha until now (According to Le Van Van, 2016). Projects and policies of the previous times focus on planting activities (dominant species is *Kandelia obovata*).

Both Dai Hop and Bang La maintain the forest ranger departments annually. However, there are differences about changing the awareness of local people. These differences result in the difference between mangroves quality in two communes. After 2005, local administrator and Red Cross of Hai Phong city continue to implement the last period of some projects.

3.2. Effectiveness of mangrove management policies

Ecological indicators: Coastal mangrove extents before and after policies

Mangroves extent is one of the most important indicators to assess the effectiveness of management policies (Mumby et al., 1999) as the total area of mangroves in study site increases or decreases during each period of policies implementation.

Thematic maps of four key years 1990, 1997, 2005 and 2016 were constructed based on unsupervised classification method which show the status of mangrove (figure 03).

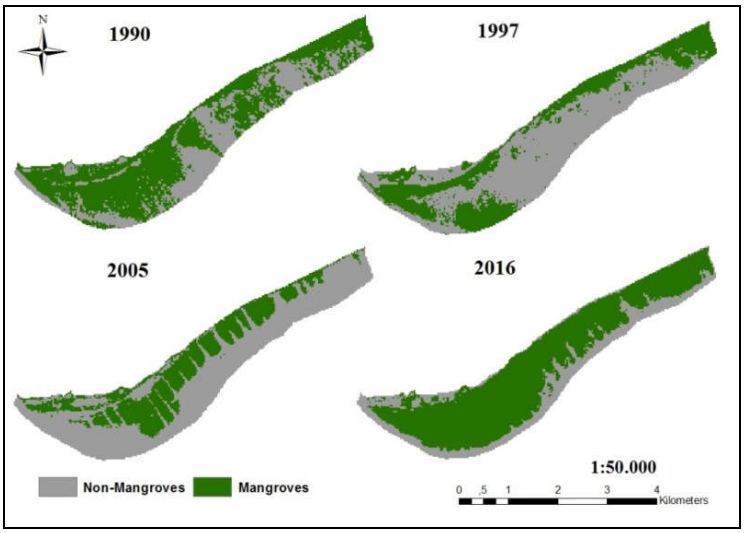

Figure 03. Thematic maps of coastal mangrove extents in Dai Hop and Bang La communes in different years using Landsat images

The total area of mangrove and non-mangrove in study site for each year was calculated using raster calculation tool in ArcGIS. Final results are showed in table 02.

Table 02. Mangroves extent in 1990, 1997, 2005 and 2016 (ha)

Year	Mangroves	Non- Mangroves
1990	509.0	304.5
1997	306.5	506.9
2005	274.8	538.7
2016	587.8	225.6

The dynamics of mangroves area can be drawn from the area of mangrove calculated above. Dynamics and the percentage of changes of mangroves extent are illustrated as the following table:

Table 03. Dynamics of mangrove extent in three different periods

Periods	Mangroves area	Percent
1990 - 1997	-202.4	-39.8
1997 - 2005	-31.8	-10.4
2005 - 2016	313.0	113.9

Accuracy assessment

Landsat Thematic Mapper imagery gives good estimates of the area of mangroves, but, because of the 30 m pixel resolution, it underestimated the linear extent in places where the mangrove fringe was narrow (Manson et al. 2001). The accuracy of image classification and interpretation are 80%, 85.83%, 84.17% and 85.17% performed on classified images in 1990, 1997, 2005 and 2016 respectively.

Dynamics of mangroves

After constructing thematic maps of mangroves in four major years, the dynamic map of mangrove area through three remarkable period was created as in the fig 04.

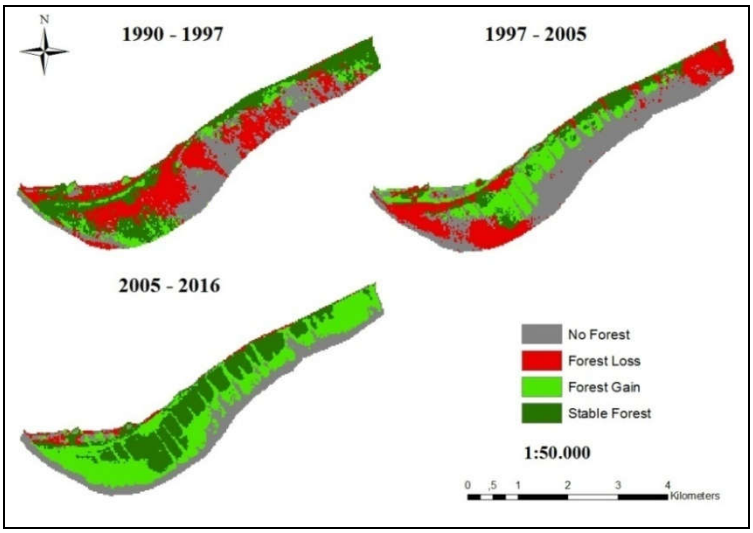

Figure 04. Changes in coastal mangroves in Dai Hop and Bang La communes from 1990 to 2016

Economic indicators: Changes in local livelihood after applying policies

According to the interview with local people in study area, the sources of household income are illustrated in table 04.

Table 04. Sources of local incomes in Dai Hop and Bang La

Households	Aquaculture	Agricultural activities	Services	Others
Dai Hop and Bang La	43.3%	21.4%	6.1%	29.2%

Aquaculture is the biggest source of income for local people in study site. Hence, the economic assessment will base on the data of fisheries productivities and the information provided by interviewing local communities.

The results of interviewing 55 local households in Dai Hop and Bang La communes and local administrations shown that there were the significant changes in relation to local livelihood. Main findings are analyzed as below:

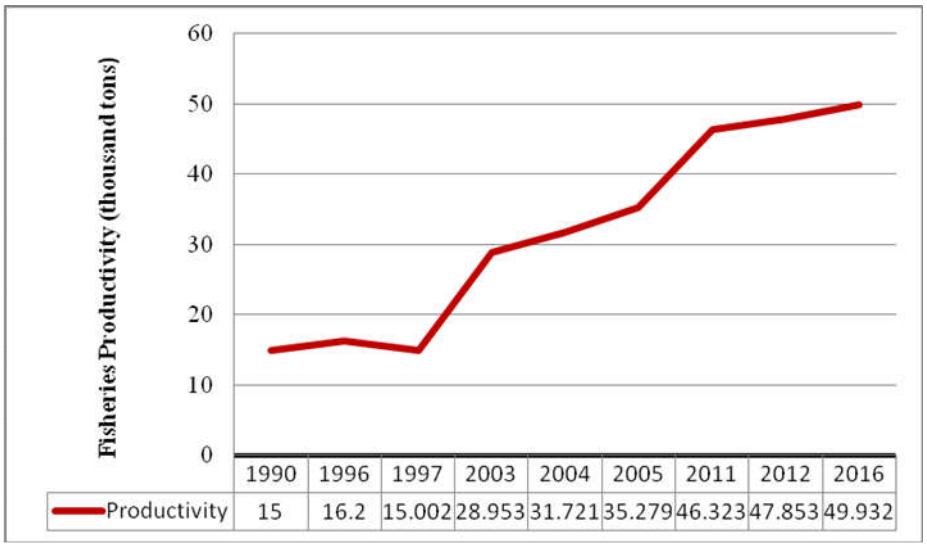

Figure 05. Production of fishery during three periods

(Adapted from the General Statistics Office of Viet Nam, http://www.gso.gov.vn)

Table 05. Average income from seafood products of mangroves

No.	Name of seafood	Productivity	Value
1	Cáy (Fiddler crab)	3 ÷ 4 kg/day	50.000 VND/kg
2	Còng (Small crab)	3 ÷ 4 kg/day	40.000 VND/kg
3	Cá Lác	2 kg/day	80.000 VND/kg
4	Lư	1 kg/day	60.000 VND/kg
5	Hà	1kg/day	100.000 VND/kg

Social indicators: Local satisfaction and local participation

This study focuses on two main social aspects, including local satisfaction and levels of local participation. The results of semi-structured interviews conducted within 55 households in study including chairpersons of the People's committees and local people which were randomly selected. The final results show the remarkable changes corresponding to the typical characteristics of three periods.

a) Social satisfaction

The social satisfaction scale is divided into five levels: Completely dissatisfied, somewhat dissatisfied, neither satisfied nor dissatisfied, somewhat satisfied and completely satisfied. Each household evaluates their satisfaction about policies and projects on mangrove management as well as the effectiveness of management activities in three periods of time in their own point of views.

Table 06. Social satisfaction of local people about mangrove management policies

Social satisfaction	Periods	Completely Dissatisfied		Somewhat Dissatisfied		Neither Satisfied nor Dissatisfied		Somewhat satisfied		Completely Satisfied	
Total households		No.	%	No.	%	No.	%	No.	%	No.	%
55	1990 -1997	9	16.4	17	30.9	7	12.7	15	27.3	8	14.5
	1997 - 2005	0	0	11	20	5	9.1	16	29.1	23	41.8
	2005 - 2016	0	0	2	3.6	4	7.3	17	30.9	32	56.4

As can be seen from the table, the satisfaction of local people has been increased notably over time. Percent of people who are dissatisfied decrease from 16.4% to 0%. The decreasing trends also happen for cases of somewhat dissatisfied (30.9% to 3.6%) and neither satisfied nor dissatisfied (12.7% to 7.3%) levels. Meanwhile, the opposite trends occur in somewhat satisfied (27.3% to 30.9%) and completely satisfied (14.5% to 56.4%) levels.

b) Local participation

Local participation aspect is assessed in term of households' participation in mangrove management policies and mangrove rehabilitation or restoration projects.

Households' participation in mangrove management policies

Households' participation in mangrove management policies was assessed by three different levels:

Level 1: No participation in management.

Level 2: Provide contribution & feedbacks to the policy makers.

Level 3: Take part in community – based management.

Table 07. Households' participation in mangrove management policies

Social participation in management policies	Periods	Level 1		Level 2		Level 3	
Total HHs		No.	%	No.	%	No.	%
55	1990 - 1997	55	100	0	0	0	0
	1997 - 2005	19	34.5	0	0	36	65.5
	2005 - 2016	12	21.8	0	0	43	78.2

Results show three significant trends which are decreasing, remain unchanged and increasing for level 1, 2 and 3, respectively. Percent of local people who take part in management activities increase remarkable in the second period (1997-2005) and continue to raise up to 78.5% in the final period (2005 – 2016) thanks to community-based management policy. However, local people have no right to give feedbacks or contribution to policy makers.

Households' participation in mangrove rehabilitation and restoration projects

Households' participation in mangrove rehabilitation and restoration projects is one of the most important factors to show how did local people involved in management activities. *(e.g. PAM, 327, 661, etc):*

Table 08. Social participation in mangrove management projects

Social participation in rehabilitation/restoration projects	Periods	Involved		Not involved		Do not know	
Total number of households		No.	%	No.	%	No.	%
55	1990 - 1997	25	45.5	27	49.1	3	5.4
	1997 - 2005	41	74.5	14	25.5	0	0
	2005 - 2016	30	54.5	23	41.8	2	3.7

According to the results, the second period 1997 to 2005 is the peak of household's participation in mangrove management projects. In this period, all projects and policies about mangrove management such as project 61 or projects funded by Japanese Red Cross were well known (0% of local people do not know about this) and the percent of people who involved in projects is 74.5%. Besides, awareness of local people has been improved notably along the time. Comparing to the past, the percent of people who do not know about mangrove management projects decrease to 3.7% until now.

The following table shows the multiple aspects in term of all three indicators. In general, policies effectiveness of coastal mangroves management has been improved along the time since 1990. However, it is necessary to create the opportunities for local people to give feedbacks and take part in the process of building up management policies.

Table 09. Policies effectiveness assessment based on three significant indicators

Indicator / Periods	Ecological indicator (Mangroves dynamic; unit: ha)	Economic indicator (Productivity of fisheries; unit: thousand tons)	Social indicator (%)		
			Social satisfaction	Social participation in communities-based management policy(*)	Social participation in major management projects
1990 – 1997	- 202.41	- 0.002	14.5	0	45.5
1997 – 2005	- 31.77	+ 6.326	41.8	65.5	74.5
2005 - 2016	+ 313.02	+ 3.609	56.4	78.2	54.5

(*) the assessment for social participation in giving feedbacks and contribution to build up management policies has not been mentioned in this table but it remains with 0% throughout three periods of time.

This study also suggests that the first period from 1990 to 1997 is is beginning period of policies and it did not meet three indicators of policies effectiveness. The second period from 1997 to 2005 is the is recovery and transition period of policies and it highly meets three indicators of policies effectiveness. Finally, the period from 2005 to 2016 is development and prescription period of policies and it meets three indicators.

3.3. Solutions for better management of mangroves

Model of sustainable management and development of mangroves

From the research results and literature overview, some possible solutions that improve the effectiveness of coastal mangrove management in study areas were figured out:

General community-based management (CBM): In Dai Hop and Bang La, CBM had been implemented for three years (2005 – 2008) by Vietnam silviculture science Institute piloted. However, small capital and low effect lead to the end point of this model.

Manager teams need to decide how to prioritize their efforts in order to achieve objectives. In order to do this it is necessary to identify not only stakeholders but also 'key' stakeholders – that is, those stakeholders who are most affected by, or have most effect on the organization or project and those who need to be engaged (Powell and Osbeck 2010). Therefore, the list of stakeholders need to be listed out:

- Government;
- Commune forest protection group;
- Local communities;
- Red cross (city, district, commune);
- NGOs & Foreign organizations (Japanese Red Cross, Danish Red Cross, etc.)

Then, we can put it into graph (as below) to determine about who need the concern most.

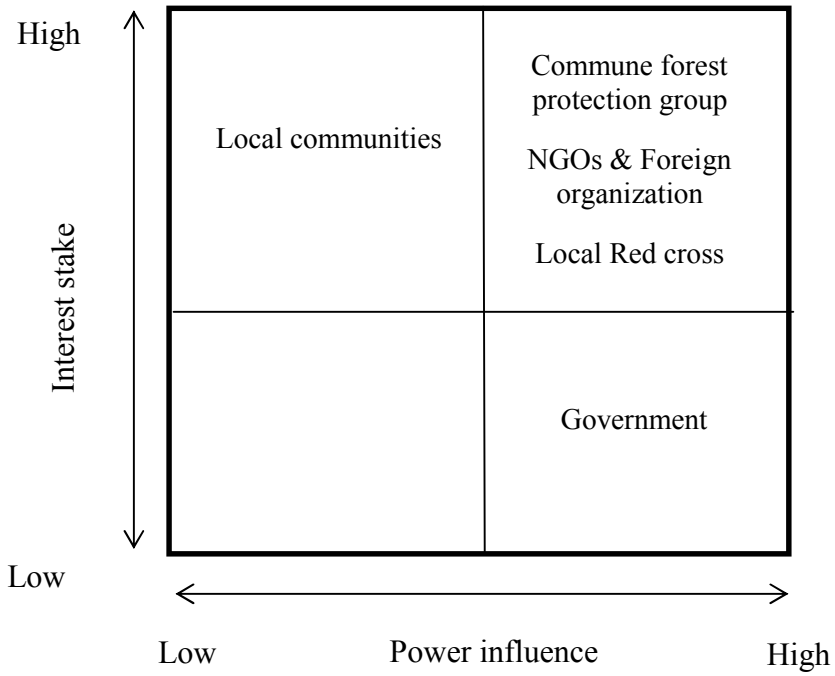

Figure 06. Power versus interest grid
(adapted from Eden & Ackermann, 1998)

Local communities are the stakeholders who need to be taken into consideration as implementing coastal mangrove management policies. They have high interest stake, but have no power influence. So, one of the best solutions is CBM.

Strengthening cooperation between two communes in mangrove management

The cooperation system is one of the best choices for this type of region to manage mangroves effectively. Cooperation in mangrove protection and management should be applied between:

- Local commune mangroves protection station.
- Protection group to assess the effectiveness of CBM regularly.
- Propaganda activities.

Other solutions for sustainable development of mangroves

In addition to changing model of coastal mangroves management, using engineering, capital, public communication and technology solutions harmoniously enhances effectiveness of coastal mangroves management in general.

After interview, this study states that communication activities in Bang La commune are very effective. Students in primary school also get training about importance of mangroves during classes. To raise awareness for the people of the two communes in particular and people living in the coastal areas of Vietnam in general, local authorities should:

- Construct propaganda and education programs in community fit for each object (children, youth, managers...), pay attention to the young audience.
- Train staffs in administrative groups, inhabitants who participate in assigning forest tending how to maintain and promote the growth of mangroves effectively, how to make proper exploitation of natural resources in mangrove ecosystems.

- Strengthen environmental interpretation.
- Promote environmental education trend, move from the information dissemination to education, from awareness to the communities education.

In short, this study propose some main sustainable management solutions: General community-based management; strengthening cooperation between two communes; engineering solution; capital solution; communication and so on. However, because of specific characteristics of study area this study focus on CMB management solution.

IV. CONCLUSION

Dai Hop (Kien Thuy) and Bang La (Do Son) have large areas of mangroves, which stretches along sea dike. Mangroves have significant roles including not only protecting coastal inhabitants from extreme events but also contributing to develop economy and ecosystem diversity. Through the investigating effectiveness of policies on mangroves management using this set of three indicators, main findings suggest that:

In study site, the area of mangroves fluctuates complicatedly due to policies on mangroves plantation, protection and management. With assistance of many organizations or projects such as: Japanese Red Cross, 661 Project, PAM 5235, etc. mangroves have had positive changes. Until now, total area of mangroves in Dai Hop and Bang La communes is more than 500 ha and has increasing trend.

The first period of time from 1990 to 1997 is the beginning period of mangrove management policies which did not achieve and meet policies effectiveness indicators. The second period of time from 1997 to 2005 is the recovery and transition period of mangrove management policies. This period witness the significant changes of policies and projects systems which help to decrease the area of mangroves loss and increase the awareness and participation of local communities. The final period from 2005 to 2016 can be considered as the development and prescription period and this is also an important stage which local administrator remain protection activities. However, policy makers should enable local people to give feedbacks and contribution to enhance the mangrove management policies.

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ĐÁNH GIÁ HIỆU QUẢ CHÍNH SÁCH QUẢN LÝ RỪNG NGẬP MẶN: NGHIÊN CỨU ĐIỂM TẠI KIẾN THỤY VÀ ĐỒ SƠN, THÀNH PHỐ HẢI PHÒNG

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TÓM TẮT

Nghiên cứu thực hiện nhằm mục đích điều tra những chính sách liên quan đến việc quản lý rừng ngập mặn ven biển tại khu vực nghiên cứu từ năm 1990 đến năm 2016 thông qua việc sử dụng dữ liệu ảnh Landsat đa thời gian; đánh giá hiệu quả chính sách sử dụng hệ thống ba chỉ tiêu; đồng thời đề xuất những giải pháp khả thi để cải thiện chính sách tại khu vực nghiên cứu. Ba giai đoạn chính sách quan trọng đã được phân tích và đánh giá sử dụng hệ thống ba chỉ tiêu, bao gồm chỉ tiêu sinh thái, kinh tế và xã hội. Kết quả nghiên cứu cho thấy, từ năm 1990 – 1997, những dự án tái trồng và phục hồi rừng ngập mặn đã được áp dụng, tuy nhiên không mang lại hiệu quả. Giai đoạn 1997 – 2005, việc áp dụng của các dự án và chính sách đã cải thiện số lượng và chất lượng của rừng ngập mặn tại khu vực. Vì vậy, sự cải thiện này đã đóng góp đáng kể vào việc nâng cao thu nhập và thúc đẩy sinh kế của người dân địa phương. Giai đoạn 2005 – 2016 là giai đoạn phát triển và bảo vệ rừng ngập mặn. Nghiên cứu này cũng đưa ra được mô hình quản lý tối ưu địa phương nên áp dụng là mô hình quản lý rừng dựa vào cộng đồng, nhằm tăng diện tích cũng như chất lượng của rừng ngập mặn một cách bền vững.

Từ khóa: Hệ thống thông tin địa lý, hiệu quả chính sách, Landsat, quản lý rừng dựa trên cộng đồng, quản lý rừng ngập mặn, sinh kế cộng đồng.

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