



INTEGRATED MANAGEMENT OF LAGOON ACTIVITIES IMOLA PROJECT II

FINAL REPORT

STUDY ON RU CHA (MANGROVE FOREST) IN HUONG PHONG COMMUNE, THUA THIEN - HUE PROVINCE

Thua Thien - Hue Sub-Department of Forest Protection

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PEOPLE'S COMMITTEE OF THUA THIEN HUE PROVINCE



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ABBREVIATION

PPC	Provincial People's Committee
DPC	District People's Committee
CPC	Commune People's Committee
FAO	Food and Agriculture Organization of the United Nations
FPD	Forest Protection Department
IMOLA	Integrated Management of Lagoon Activities in Thua Thien Hue province
SIDA	Swedish International Development Agency
TTH	Thua Thien Hue

1. Overview

Rucha mangrove forest provides an unique ecosystem in the Tam Giang - Cau Hai lagoon, which has been functioning as an ecological buffer between land and the lagoon. In addition, it is also an ideal breeding ground for many aquatic species such as fishes and crustaceans. However, these ecological important wetland forests have been decreasing in quality and quantity over time by wetland development, specially the wide opening of shrimp's ponds in lagoon.

In the past, some of The Natural Conservation Organizations carried out many activities in order to restore and uphold of Rucha value. A symbolic organization is a project funded by SIDA. With formula of relying on local people, the project supported them in building nursery garden, establishing patrol team, propagandising to protect Rucha, and improving their capacity. Therefore, it contributed to protect Rucha mangrove forest.

The authorities of Huong Phong commune and Huong Tra district believe Rucha is an area which has high ecological value. This area has been managed by Huong Phong People's Committee and has planed to develop in future.

Although the intention of commune's authorities is an exertion in order to conserve and uphold the value of Rucha wetland forest, but it needs the support from many partners, among them we have to notice to these issues: i) Investigation on current status of Rucha, ii) Investigation on main seedling availability and ecosystem in this area, and iii) The threatening of wide opening of aquatic ponds in surrounding areas.

Under the funding of FAO through IMOLA, the mixed researchers who are from TTH FPD and Hue University researched on ecosystem and feasibility of Rucha regeneration from December, 2009 to April, 2010. Therefore, we got initial results on biodiversity, protection and management of Rucha, and Rucha planning in future.

Under the collected information, the researchers proposed the model of Rucha development up to 19.3 hectares in methodology of connecting Middle Rucha with Upper Rucha and Lower Rucha by green corridor. It will be started by making green corridor from Middle Rucha and Upper Rucha. It will be developed green corridor areas to connect three parts of Rucha after that. At the same time, three parts of Rucha will be expanded in edge areas. Plantation will be carried out and expanded in boundary frontier. The areas are high inundation can not plant at present, however we can focus on test of planting in low inundatory areas.

2. Objective

2.1. General Objective

Aim to identify the solution of Rucha restoration and development in order to serve eco-tourism, prevent sea winds and sea wave in Huong Phong commune, Huong Tra district, TTH province.

2.2. Goals

Goal 1: Identify the status of Rucha ecosystem and other factors affect to exit and develop of Rucha.

Goal 2: Evaluate the potential of ecological and other conditions in order to restore and develop Rucha mangrove forest.

Goal 3: Propose the feasible solutions on seedling production and model of Rucha regeneration that can stable develop Rucha mangrove forest.

3. Member Of Reserachers

- Assistant Prof. Dr. Nguyen Khoa Lan, Deputy head of Biology Division, Teachers' collage.
- Msc. Pham Cuong, Forestry Division, University of Agriculture and Forestry.
- Msc. Nguyen Dai Anh Tuan, Vice Director of TTH FPD.
- Bsc. Ho Van Phuoc, Deputy head of Natural Conservation Division, TTH FPD.
- Bsc. Duong Thi KimDung, member of Natural Conservation Division, TTH FPD.
- Msc. Nguyen Quang Hoa Anh, member of Natural Conservation Division, TTH FPD.
- Msc. Mai Quang Huy, member of Natural Conservation Division, TTH FPD.

4. Contents Of Research

4.1. The Status Of Rucha

- The extent of Rucha
- The importance of Rucha
- The forest structure of Rucha
- Soil characteristics of Rucha
- Tidal regime in Rucha
- The impact of sea level to Rucha
- The growing characteristics of trees in Rucha

4.2. Socio Economic Conditions

- Identification of Rucha resource user groups
- Identification of local management institutions related to Rucha
- Identification of local conflicts related to Rucha
- Identification of relevant government laws related to Rucha

4.3. The Current Land Use Pattern Surrounding Rucha

- The structure of land use pattern around Rucha
- The potential and ongoing threats to Rucha

4.4. The Seedling Availability In TTH Province

- The feasibility of seedling production.
- The feasibility of buying the seedling inside and outside of TTH province

4.5. The Feasibility Of Development Of Rucha Mangrove Forest

- Identification of potential areas to develop Rucha mangrove forest
- Identification of model to develop Rucha mangrove forest.

5. Methodology Of Research

Qualitative and quantitative data will be obtained through both primary sources (such as interview, group discussions, and direct observation) and secondary data (previous reports on Rucha survey, statistical reports of commune authority, ect).

5.1. Secondary Data Collection

Secondary data includes previous reports, surveys, statistical reports, maps and related documents from Huong Phong Commune People's Committee (CPC), University of Agriculture and Forestry, Hue University of Science, and related organizations, ect.

5.2. Primary Data Collection

5.2.1. Meeting with authorities of Huong Phong commune

The researchers had five meetings with representative of Huong Phong commune such as Vice chairman of CPC, land surveyor, standing officer of CPC, member of Women Union and leader of Van Quat Dong and Thuan Hoa villages. Therefore, it was collected information related to content of research.

5.2.2. Interview local people who have activities relevant to Rucha

Following the proposal which was approved, we designed the questionnaire in order to interview to relevant local people. Thence, classifying them in to three groups: i) Group of using Rucha resources, ii) Group of people who have activities surrounding Rucha, and iii) Groups of non-using Rucha resources.

5.2.3. Group discussions

We carried out seven meetings in Van Quat Dong and Thuan Hoa villages because there are only these villages have relevant acts in or surrounding Rucha. We used wide sheet, pencil, and pen to describe Rucha. All member of group discussion debated and repaired the map and then one of them presented in order completing and uniting relevant information in Rucha.

5.2.4. Directly observation in Rucha and surrounding Rucha area

The delegation conducted five field-works in order to survey Rucha and agricultural land areas as well as water-face areas of aquaculture surround Rucha.

5.2.5. Identify soil physical and chemical characteristics

* In order to identify soil physical and chemical characteristics, the researchers dug and determine soil profiles, description, identify characteristics of soil and maturity of soil in Rucha area based on normal soil analysis methods. We dug three soil profiles at three sites surround Rucha as follows:

- Soil profile 1: Location in Middle Rucha area is not affected of tidal regime;
- Soil profile 2: Area of aquaculture (shrimp), Thoc Loc pool allocating between Upper Rucha and Lower Rucha;
- Soil profile 3: Lat pool site in Lower Rucha.

Soil samples were analyzed based on normal methods in the laboratory of Department of Silviculture, Faculty of Forestry, Hue University of Agriculture and Forestry.

* Identify soil maturity in the field as follows:

- Washy mud: When going, mud submerged of the foot over 40 cm;
- Stiff mud: When going, mud submerged of foot about 20 - 30 cm;
- Soft clay: When going, mud submerged of foot about 10 - 20 cm;

- Firm clay: When going, mud submerged of foot less than 10 cm;
- Stiff soil: When going, soil was not submerged and feeling be wet (ooze out under foot).

However, for case study in Rucha, according to Ngo Dinh Que (2003) classification of wetland and mangrove soil in Vietnam, we conducted to classify into three main group of soil maturity such as (1) the maturity level of the distribution of land into three main groups are (1) Dilution soil, (2) Soft soil (3) Firm soil in order to being comfortable in the process selecting plants and planting proposed models for the local people.

5.2.6. Determination of water salinity: In order to identify salinity of water, the research group conducted to collect water sample in three different locations in Rucha such as (1) Out side of dam preventing brine of Rucha, (2) In the middle of Rucha and (3) Area of cultivating paddy rice. One time of each week we conducted to collect water samples. Average of salinity of weeks is average salinity of that month. Water samples were collected under 20 cm depth, containing in small jars about 100 ml and covering. In each site, we collected three water samples (3 replications). Collected water samples were analyzed in the laboratory in order to analyze salinity of water in the day.

Water salinity analysis was carried out in the laboratory of Faculty of Aquaculture, Hue University of Agriculture and Forestry. Results of water salinity analysis were written into designed form. We conducted to collect water sample one time per week until April 2010. Water salinity was measured in units per thousand (‰).

5.2.7. Survey Ru cha structure:

- Establish surveyed transects: To collect relevant Rucha structure data, we established transects with size of 200m² (20m length and 10m width for one transects). In upper-Rucha and lower-Rucha we established two surveyed transects in the middle of them to collect relevant data.

For middle-Rucha, we established three surveyed transects on the straight line (Northern-Southern direction) in the middle of the hill to collect data. Two surveyed transects were near the edges of the middle-Rucha (at both ends of the straight line) and other one was in the middle of the straight line.

- Collect data: In the transects, we collected relevant data including name of species, number of each specie; measurement of height, canopy cover, canopy diameter; number of branches of trees, etc. All data were fulfilled by designed survey form by researchers.

6. Results

6.1. The Status Of Rucha

6.1.1. The extent of Rucha

In Thuan Hoa village (Huong Phong commune, Huong Tra district), that really existed three Rucha in olden time and still have three Rucha now. The local people said that are i) Upper Rucha, ii) Middle Rucha, and iii) Lower Rucha (see map N.1 as bellow). The total area of three Rucha was around 10ha in the past 30 years by old people of Huong Phong commune. After 1975, the local people and authority of Huong Phong commune reclaimed a part of Rucha in order to organize the irrigation dams.

In addition, some local people cut down trees in Rucha for firewood that caused this area has been decreased. According to statistical reports from Huong Phong commune (2009), Middle Rucha area is the largest one with 3.24ha. The total area of three Rucha is about 5ha. In fact that has not had the correct number of Rucha area. The authorities of Huong Phong commune do not interest in forest land because fishery and agriculture are mainly, and Rucha area is small.

Rucha located in administrative of Thuan Hoa village, Huong Phong commune and its geographical position as following:

- Eastern: bordering with Lat pond, near Thuan An Town
- Western: bordering with Van Quoc Dong village, Huong Phong commune
- Southern: Bordering with Phu Thanh commune, Phu Vang district
- Northern: Bordering with Hai Duong commune, Huong Tra district

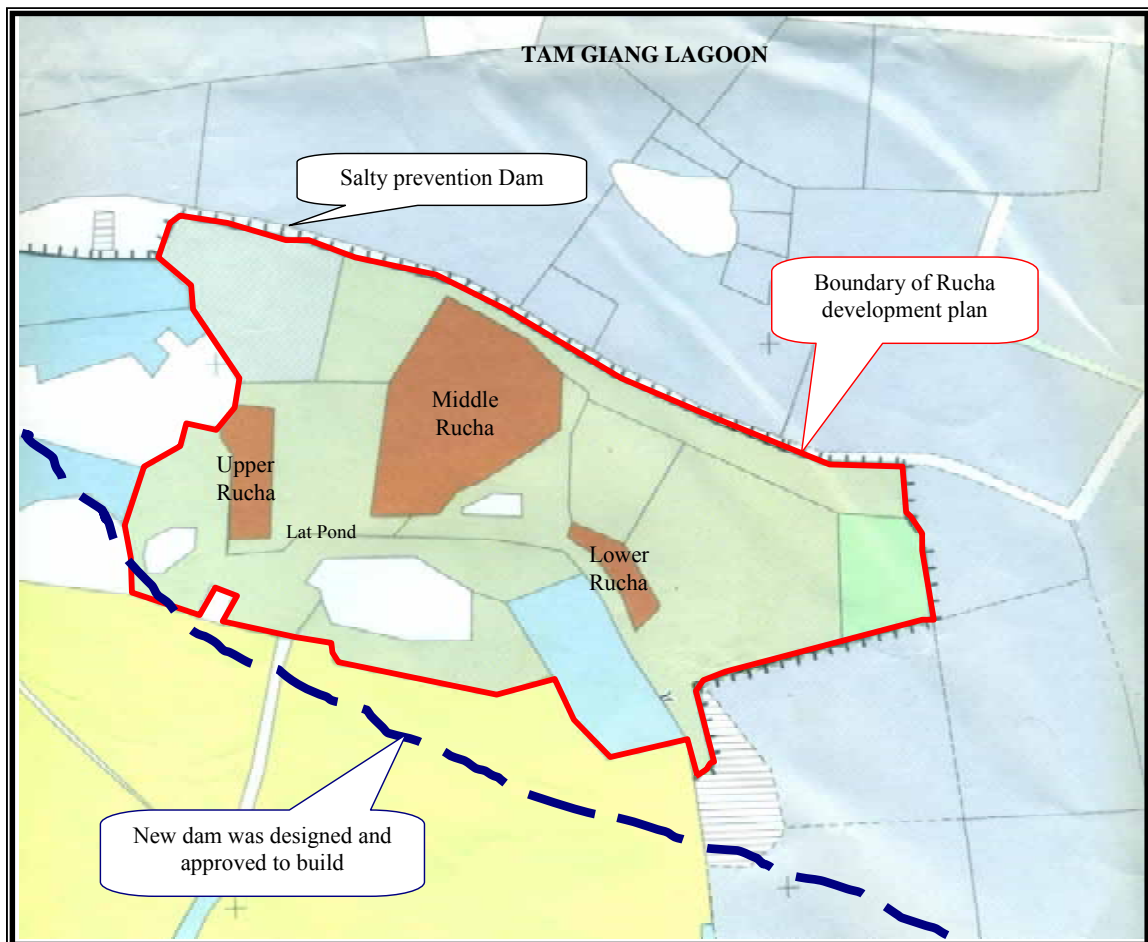


Figure 1: The current status and detail planning in Rucha

6.1.2. The importance of Rucha

In this report, we mentioned in Rucha area in the past. It means that we talk about Rucha mangrove forest nowadays and areas were shifted to agricultural or wetland areas.

Rucha is a screen to defend and protect the life and houses of local people in surrounding Rucha. Their conception is “Rucha finishes that caused the village will be gone”. In historical flood in 1999, Rucha rescued many domestic fowls, livestock, and boats of local. In general, Rucha is a natural shield under the gales or floods for local people. Rucha was also a revolutionary area of the liberation army and helped them overcome the miserably hard time in anti- American period (Nguyen Trac, 2002).

Rucha provides firewood for local people, especially when their life was very difficult from 1975 to 1980. Beside that, Rucha also provides many fishery species, such as crabs, shrimps, fishes, and migratory birds. The people who live there for long time said that fishery species have been decreased because of over harvesting and non-rational plan.

Other value of Rucha is used in grazing livestock of local people. Although Rucha has had prohibition rules in this purpose, but some of them have been willful grazing in this area. The reasons are that Rucha is near village and food of livestock is still profuse.

Rucha is the last wetland forest area in Thua thien Hue and Central Vietnam. Some project's activities funded by SIDA were carried out in Huong Phong commune in order to reserve and develop Rucha through planted salt marsh trees such as *Rhizophora stylosa*, *Bruguiera gymnorrhiza*, enhanced awareness of local people on conservation, or supported them on Rucha management. We can say Rucha is a place used for test modeling of conservation in order to choose the best solution in other similar area.

In addition, Rucha is nearby Tam Giang-Cau Hai lagoon that known as an interested place. The authority of Thua Thien Hue province promulgated the programe on lagoon and marine tourism development dated 27 May, 2008 by TT-Hue PPC, especially in Rucha wetland forest protection and development. It means that Rucha has been interesting enough to become an eco-tourist area in Thua Thien Hue province.

The wetland areas are around 4.8 hectares that used to be a part of Rucha own by Huong Phong CPC. These areas have been rented to 8 households in Thuan Hoa village through annual public sale in aquaculture purposes such as crabs, shrimps, and brackish fishes.

Beside that, the disengaged areas are 2.1 hectares occurred by cutting down Rucha in the past which are used in agriculture purposes, were also rented to 5 local people by Huong Phong CPC through annual public sale in wet rice or other cultivation.

6.1.3. The forest structure in Rucha

a. The species component and form of life in Rucha

The researchers used standard sampling in order to investigate the list of species, scientific name of fauna in the standard sampling, and ordering them in to classification units. Standard sampling followed method of identification of silvicultural standard plots. The result decided in Table 1 as followed:

Table 1: The list of salt marsh trees in Rucha

No.	Species	Local name	Family
1	<i>Excoecaria agallocha</i> L.	Chá	Euphorbiaceae
2	<i>Dolichandrone grathacea</i> Somun	Quao	Bignoniaceae
3	<i>Acanthus ilicifolius</i> L.	Ồ rô	Acanthaceae
4	<i>Acrostichum aureum</i> L.	Mốp	Pteridaceae
5	<i>Rhizophora stylosa</i> Griff.	Đước	Rhizophoraceae
6	<i>Bruguiera gymnorrhiza</i> Lam.	Vẹt	Rhizophoraceae
7	<i>Aegiceras corniculatum</i> (L.) Blanco	Sú	Myrsinaceae
8	<i>Hibicus tiliaceus</i> L.	Tra	Malvaceae
9	<i>Deris trifoliata</i> L.	Cóc kèn	Fabaceae
10	<i>Pandanus odoratissimus</i> L.	Dứa dại	Pandanaceae
11	<i>Canavalia maritima</i> (Aubl) Piper	Đậu biển	Fabaceae
12	<i>Suaeda maritima</i> (L.) Dum.	Muối biển	Henopodraceae
13	<i>Clerodendrum inerme</i> Gaertn.	Vạng hôi	Verbenaceae
14	<i>Cyperus stoloniferus</i> Vahl	Củ gấu biển	Cyperaceae
15	<i>Ipomoea pes-capre</i> (L.) Sweet.	Muồng biển	Convolvulaceae

Notes:

- Species from 01 to 04: The main species in Rucha
- Species from 05 to 07: The species planted from 2002.
- Species from 08 to 15: The joiner species in Rucha

Table 2: The distribution and form of life of species in Rucha

No.	Species	Form of life	Distribution
1	<i>Excoecaria agallocha</i> L.	Small tree	High, rarely overflow
2	<i>Dolichandrone grathacea</i> Somun	Small tree	Edge of ponds, salty, alum
3	<i>Acanthus ilicifolius</i> L.	Small shrub	Edge of ponds, clay, humus
4	<i>Acrostichum aureum</i> L.	Small shrub	Edge of ponds, solid
5	<i>Hizophora stylosa</i> Griff.	Small tree	Overflow
6	<i>Bruguiera gymnorrhiza</i> Lam.	Small tree	Overflow
7	<i>Egiceras corniculatum</i> (L.) Blanco	Clumwood	Overflow
8	<i>Hibicus tiliaceus</i> L.	Small tree	Edge of ponds
9	<i>Deris trifoliata</i> L.	Piana	Solid, humus, clay
10	<i>Pandanus odoratissimus</i> L.	Small shrub	Edge of ponds
11	<i>Canavalia maritima</i> (Aubl) Piper	Piana	Solid and near the ponds
12	<i>Suaeda maritima</i> (L.) Dum.	Seasonal Herbaceous	Solid and near the ponds
13	<i>Clerodendrum inerme</i> Gaertn.	Small shrub	Edge of ponds
14	<i>Cyperus stoloniferus</i> Vahl	Herbaceous	Edge of ponds
15	<i>Ipomoea pes-capre</i> (L.) Sweet.	Shatter	Edge of ponds

Based on the assessment's criteria and observation in Rucha mangrove forest (the diversity is low when there are 1-3 species, and is high when there are over 10 species), it can be said that the biodiversity is not high in Rucha. Rucha has only four mainly species in four families, in which two species are small trees (50% of total species), and two species are small shrub species (50% of total species). In addition, the project funded by SIDA plated three new species (*Rhizophora stylosa*, *Bruguiera sexangula*, and *Aegyceras corniculatum*) in 2002. These species were picked and chosen in Phu Tan commune, Phu Vang district. However,

these new species are only few trees. The fauna distributes in high land and rarely overflow areas in Rucha. They are mainly *Excoecaria agallocha* in high land areas in Rucha.

b. The growing of trees in Rucha

* Observation some criteria of trees' growing: The researchers observed three small trees that were mainly seen in Rucha ($C \geq 50\%$): *Excoecaria agallocha*, *Dolichandrone grathacea*, *Hibicus tiliaceus* and showed us the result as bellow:

Table 3: The Result of observation some criteria of trees' growing in Rucha.

Number of species	Ave. High of Tree (m)	Ave. Density (trees/ha)	Ave. Number of Branches/ Tree	Ave. Diameter of canopy (m)	Cover (percentage of 3 species) (%)
3	4.97	1,850	3.25	2.96	84.82

Table 4: The dominant species in Rucha

Dominant species	
Species	Frequency (%)
<i>Excoecaria agallocha</i>	76.24

Following the collected information, we have some suggestions as bellow:

- *Excoecaria agallocha* is mainly in Rucha with high frequency (76.24%).
- The trees are average of 4.97m in height, forming a green band along with Rucha with density around 1,850 trees per hectare.
- *Excoecaria agallocha* population is rather regular coming and growing up well in areas that are in high land and rarely overflow.
- At present, all of trees (100%) are regenerated by shoot with average number of branch are about 3.25 branches per tree.
- The component of trees are less diversity in Rucha with three species in three families, in which *Excoecaria agallocha* is the dominant species that caused Rucha is homogeneous forest which is generated by shoot.

* Observation some criteria of trees' production in Rucha

Table 5: The result of observation some criteria of trees' production in Rucha

<i>Species</i>	<i>Blossom season</i>	<i>Ripe fruit season</i>
<i>Excoecaria agallocha</i>	August - October	November to January of next year
<i>Dolichandrone grathacea</i>	July - August	October - December
<i>Hibicus tiliaceus</i>	November - March	May - June

The comments on trees' production in Rucha:

- The flower of *Excoecaria agallocha* annually blooms from September to October when flood comes that caused local people said this is a signally flooding species. *Excoecaria agallocha* species blooms in early summer and its fruit ripe later when compare with this species in Can Gio district and other areas.
- The capacity of seeding regeneration of *Excoecaria agallocha species* is weak in Rucha because the fruit ripe season concur with the flood season that caused seeding was swept by flood. In addition, the forest cover is quite high affect to process of naturally regeneration by seeding in Rucha.

- The bloomy season and ripe fruit season of *Dolichandrone grathacea* and *Hibicus tiliaceus* in Rucha are the same as other areas in Vietnam

6.1.4. Soil characteristics in Rucha

Table 6: Soil characteristics in Rucha

No.	Soil profile	Depth (cm)	Rate of component of soil size (%)			Name of soil
			2-0.02mm	0.02-0.002mm	<0.002mm	
1.	Soil profile 1	<20	18.2	53.5	28.3	Heavy earth and clay
		20-40	24.1	51.3	24.6	Clay and sandy
		40-60	44.5	39.8	15.7	Clay
	Average		28.9	48.2	22.9	Clay and sandy
2.	Soil profile 2	<20	28.1	52.2	19.7	Heavy earth and clay
3.	Soil profile 3	<20	29.7	46.7	23.6	Heavy earth and clay

(Source: Surveyed and Analysis, 2010)

The surveyed results showed that soil in area around Rucha is types of clay and sandy in non-submerged areas and heavy earth and clay in submerged areas year-round. In the non-impact of tidal, soil layer lower 20 cm is main heavy earth and clay types. Rate of clay and limonene particles are quite high. Fluctuation of clay particle in soil layer lower 20 cm is about from 19.7 (soil profile 2) to 23.6% (soil profile 3). Rate of fluctuation of limonene particle is from 46.7 (soil profile 3) to 52.2% (soil profile 2). Following depth of the soil profile, sandy component increases while clay and limonene components decrease (soil profile 1). For soil profile 2 and soil profile 3, we collect soil samples in submerged area therefore we did not describe its soil profile as the soil profile 1.

Soil samples were collected and analyzed in the soil laboratory of Department of Silviculture (Faculty of Forestry, Hue University of Agriculture and Forestry). Based on conditions and supports of project, there are some criteria that were analyzed such as pH, humus content, and nutrient of soil. The results of soil analysis showed that soil in around Rucha is alum earth existing, average pH (about 5.31). Soil is poor of organic substance, and the humic content from 3.27 (soil profile 1) to 3.92% (soil profile 3). Content of total nutrient is at poor level to medium (Seeing table 7). Rucha allocated in isolative area, simple forest structure and lacking of providing with alluvium for rivers therefore low of depositing alluvia. The pH level is comfortable for planting many mangrove species. However, poor soil is an important point that we need to consider in order to establish as well as tending trees after planting for growing and developing fast.

Table 7: Soil physical and chemical characteristics in Rucha

No.	Soil profile	Depth from ground (cm)	Analyzed criteria			
			<i>pH_{KCl}</i> (wet)	<i>pH_{KCl}</i> (dried)	Humus (%)	Nutrient (%)
1.	Soil profile 1	0 - 20	5.63	5.47	3.27	0.08
2.	Soil profile 2	0 - 20	5.37	5.26	3.87	0.12
3.	Soil profile 3	0 - 20	5.26	5.19	3.92	0.11
	Average		5.42	5.31	3.69	0.10

(Source: Analyzed, 2010)

Soil maturity affects identification of some species to plant as well as techniques of different work the soil and afforestation. In Rucha, we identified three main soil maturities such as (1) Dilution soil, (2) Soft soil (3) Firm soil. The surveyed results identified area of dilution soil about 6.4 ha (occupy 33.16%), areas of soft soil and firm soil about 8.3 ha (occupy about 43%) and 4.6 ha (occupy 25% of total area), respectively. Most of dilution areas located in Lat Pool and a part of area which was dug land for building the dam to prevent sea water around Rucha, and agricultural cultivation areas. Firm soil area is mainly area without submerged of water and tidal regime and Cha trees growing and developing. Most of soft soil is area of aquaculture and a part of Lat pool near Lower Rucha. Result of identifying soil area based on soil maturity as following Table 8.

Table 8: Land area divided into soil maturity in Rucha

No.	Soil maturity level	Subsidence when going (cm)	Area (ha)	Rate (%)
1.	Dilution soil	>20	6.4	33.16
2.	Soft soil	5-20	8.3	43.01
3.	Firm soil	<5	4.6	23.83
	Total		19.3	100.00

(Source: Surveyd, 2010)

According to surveyed results of measuring salt-water submerged soil area of Rucha, total of salt-water submerged soil area is 19.3 ha and dividing into as (1) Lower Rucha is about 3.86 ha (occupy 20%), (2) Middle Rucha is about 5.79 ha (occupy 30%) and (3) Upper Rucha is about 9.65% (occupy 50% of total area of Rucha).

The affect of water on Rucha was divided into two seasons (1) Rainy season, from September to January, all areas of Rucha are submerged and depth submerged over 50 cm occupying about 50% of total Rucha area (about 9.65 ha); (2) Dried season (from February to August), Rucha is affected of tidal regime as following Table 9.

Table 9: Submerged land area in Rucha

Hill	Total area (ha)	Rate (%)	Non-Submerged land		Submerged land	
			Area (ha)	Rate (%)	Area (ha)	Rate (%)
Lower Rucha	3.860	20	772	4.00	3,088	16.00
Middle Rucha	5.790	30	4,632	24.00	1,158	6.00
Upper Rucha	9.650	50	4,825	25.00	4,825	25.00
Total	19.300	100	10.229	53.00	9.071	47.00

(Source: Surveyed, 2010)

Rucha has non-submerged land area about 10.229 ha, occupying about 53% of total Rucha area. This is mainly distribution area of Cha trees. Submerged land area is about 9.071 ha, occupying about 47% of total Rucha area and this area was planned to develop mangrove system of Huong Phong commune. Most of submerged land areas are using for aquaculture of households in community and part of it is natural water surface of the lake, shallow and high potential for aquaculture. Area of submerged land area is potential in order to suggest some mangrove species for experiment of some mangrove models in Rucha. Rest of land area does not often affect of tidal regime and can suggest some species plating after development period of mangrove such as *Melaleuca lecadendra* or other native species surround Rucha.

Table 10: Level, time of tidal submerged and areas in Rucha

No.	Tidal submerged level	Highest tidal submerged level (cm)	Number of submerged days/month	Area (ha)	Rate (%)
1.	Lowest tidal submerged land	>50	30	9,071	47.00
2.	Average tidal submerged land	30 - 50	4	1,599	8.28
3.	Submerged land as high tidal	5 - 30	2	2,290	11.87
4.	Non-submerged land by tidal	-	-	6,340	32.85
	Total			19,300	100.00

(Source: Surveyed, 2010)

The above table 10 results showed that non-submerged land area by tidal in Rucha occupies over 32% of total area. Among of them, lowest tidal submerged land area occupying more than 9 ha (about 47% of total area). This is one of necessary ecological characteristics based on selection of experiment species and suitable work the soil method when establishing some experiment mangrove models in Rucha.

6.1.5. Tidal regime and water salinity surround Rucha

In TTH province, tidal regime is half-day tidal, more comfortable for growth and development of mangrove species than other day tidal areas of wet land areas in Vietnam. According to P.N. Hong (1991), "Half-day tidal regime areas, trees grow better than day tidal regime areas because submerged time is shorter, trees can absorb oxygen ground, low and prevent steam of trees and land, especially, in sunny season". However, highest tidal level is low, small tidal vibration amplitude therefore mangrove trees in Rucha are low diversity comparison with larger vibration amplitude areas.

Average temperature between months is quite high; temperature vibration amplitude between seasons is not high. Rainfall from October to December is higher comparison with June, August, 2-3 times.

For natural and ecological characteristics in Rucha, some species can grow and develop well herein such as *Excoecaria agallocha*, *Dolichandrone grathacea*, *Hibicus tiliaceus*, etc. However, changing topography because of building the preventing salt water dam therefore mangrove species plating in Rucha were affected their growth. There is only *Excoecaria agallocha* population adapting non-submerged land therefore developing well.

Table 11: Water salinity in Rucha area from December 2009 to March 2010

No.	Month	Water salinity (‰)		
		Outside Rucha	In Rucha	Paddy rice site
1.	Dec 2009	16.03	5.37	0.19
2.	Jan 2010	19.76	5.89	0.21
3.	Feb 2010	20.31	6.01	0.52
4.	March 2010	19.44	6.83	1.78
	Average	18.89	6.03	0.68

(Source: Surveyed, 2010)

Result of water salinity in Rucha showed that average water salinity of area outside Rucha (Tam Gang Lagoon area) is about 18.89‰, inside Rucha about 6.03‰ and paddy rice area about 0.68‰.

Water salinity will increase in dried seasons in TTH province. The highest salinity will be in June to July. There is no data in dried season period because the research only conducts until April 2010 while dried season will be in June or July annual. However, changes of water salinity in Rucha area showed that appropriate to plant some mangrove species such as *Rhizophora stylosa*, *Rhizophora apiculata*, *Bruguiera sexangula* and *Aegyceras corniculatum*.

In economic strategy of Huong Phong commune, there is a project building a dam between Rucha and agricultural land area to prevent salt water and protect agricultural crops therefore in the future Rucha will be directly affected tidal regime and water salinity from Tam Giang Lagoon. When experiment for some mangrove species models, we need to determine ecological characteristics of Rucha such as tidal regime, salinity, etc.

6.2. Socio-Economic Conditions

6.2.1. Identification of Rucha resource user groups

Base on geography and importance of Rucha was analyzed above, Rucha has been used by user groups as following:

a. Indirect users

This group includes all households that live around Rucha. Their houses and boats are protected in the rainy season, and balance of the sub-climate in Huong Phong commune.

Authorities of Huong Phong commune also get fair good indirect benefit in Rucha through for rent fishery ponds and wet rice areas. This is a prosperous income for budget of Huong Phong commune. As collected information, one hectare of agriculture area or fishery area can be rented from 2 to 8 millions VND per year. The areas used to a part of Rucha that was separated in 8 pieces, and under the use of 8 households in Huong Phong commune who paid higher price. Since then, authorities of Huong Phong commune can get up to 40 millions VND per year.

Rucha also has been advertised in many websites by travel companies as a place of interest. It means that, these companies get indirect benefits from tourists when they come to visit these potential places in Tam Giang Cau Hai lagoon. According to local people, tourists come to visit Rucha increasing day by day. Besides that, local people often see guests from Hue City and pupils come to visit Rucha. However, they do not know exactly number of people visiting Rucha annual. Furthermore, there are not any reports and data from other tour agencies in Thua Thien Hue relating to tourists visit Rucha.

b. Direct users

Rucha has high biodiversity in fauna and flora resources, and is the last one of wetland forest area that caused some organizations, residents, local people have both legally or illegally used Rucha resources. They include inside and outside of Huong Phong commune who harvest aquatic products, cut down trees, trap wild birds, organize some eco-tourism, and research on biodiversity in Rucha.

Rucha is management by Huong Phong CPC. Rucha located inside Thuan Hoa village, so the main users affect to Rucha (such as cut down trees, harvest aquatic products, graze buffaloes, ect) is residents in Huong Phong commune. However, the wild birds are mainly hunted and

trapped for food by the one who come from outside of Huong Phong commune, especially come from Hue city.

At present, harvesting Rucha resources have been reduced because diversity of Rucha resources became exhausted. However, Rucha is very important in culture and spirit of local people in Thuan Hoa village, so they are interested in Rucha, especially after clear cutting period. Since 2000, following activities carried out of project funded by SIDA, Thuan Hoa villagers established the Rucha self-management team with 11 members in 2000. This team worked in order to protect and develop Rucha for future, prevented illegal logging and buffaloes in Rucha. However, they worked on a voluntary spirit and got no benefit that is why Rucha self-management team dissolved in 2006. After that, Thuan Hoa villagers voted Mr. Nguyen Ngoc Dap managed and prevented illegal activities in Rucha. Mr. Dang is the one who gained in public sale for rent wetland area surrounding Rucha for aquaculture (shrimp). In general, Thuan Hoa villagers have reduced to exploit Rucha resources in few years ago. Mr. Dang is household producing in long time surround Rucha (28 years). He is very interested in Rucha and tried to contribute to protect it. This aspect made local people believe him, those are reasons for his successful of any auctions in village.

6.2.2. Investigation on stakeholders in Rucha management

a. Venn diagram on Rucha management

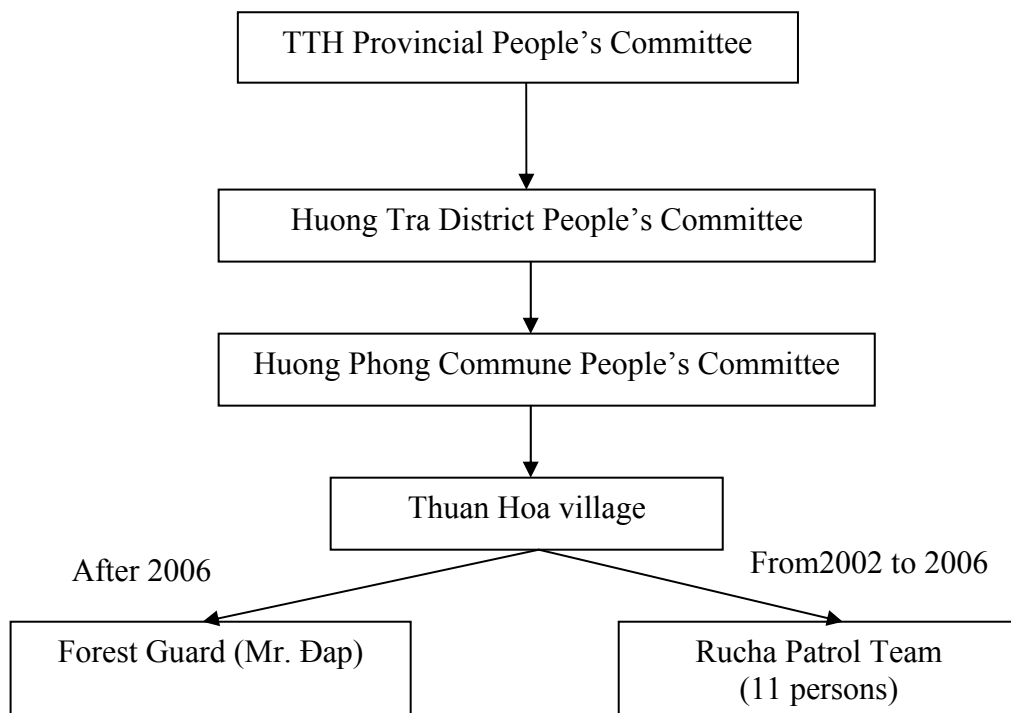


Diagram 1: The structure of Rucha management

b. Stakeholders in Rucha management

- *Thua Thien Hue Provincial People's Committee*: direct sectors, subordinate governments and agencies, organizations to implement the policies and plans on coastal zone management and development (Thua Thien Hue province integrated coastal zone management strategy) including Rucha protection and management. Approve the related documents within its authority. Coordinate the activities, with support the policies implementation. Issuing plan on socio – economic development in Tam Giang – Cau Hai lagoon system from now to 2020.

- *Provincial departments, sectors and agencies:* identify their rights and obligations in implementing Rucha regeneration and management. Check, adjust respective sectoral plans and planning in accordance with the strategy. Participate in developing and implementing the related Rucha management and researches. Seek the opportunities for investment to Rucha restoration and protection. Support and closely cooperate with relevant agencies in the implementation process.

- *Huong Tra District People's Committee:* Check and adjust local planning and development plan in accordance with Rucha management and development. Develop resources and environmental protection programs and plans at their localities. Mobilize resources and community participation in Rucha management and development activities. In 2007 and 2008, the resolution of Huong Tra District People Council focus on Rucha development by ecological conservation.

- *Huong Phong Commune People's Committee:* Participate in the adjustment of planning and development plans of Rucha with Huong Tra district. Mobilize the community to actively participate in the activities associated with Rucha through meeting, workshop, communication and education, ect.

Planning land use until 2010 and setting up land use program from 2008 to 2010 for Huong Phong commune. Including forestry land (Rucha) 3.29ha (0.21%) in 2008, planning until 2010 is 19.2ha (1.22%) as protection forest.

Huong Phong Commune People's Committee assigned Mr. Nguyen Van Dang (head of Thuan Hoa village) to manage and protect Rucha.

- *Thuan Hoa Village:* Manage Rucha through cultural village regulation of Thuan Hoa village, Huong Phong commune in May 2003. In Chapter II of this regulation: Protect landscape, environment and public welfare constructions. Each inhabitant of village need to aware protecting landscape as village and hamlet road, trees, etc. Do not cut the trees in public places as trees in Rucha, trees on two sides of road, etc. for the purpose of protecting green – clean – good looking environment and conserving village cultural heritage. Each year, in festival days and new year holidays, Women Union and Youth Union organize campaigns on planting trees to develop Rucha.

Thuan Hoa village assigned Mr. Dap as forest guard to manage and protect Rucha. If people destroy the Rucha, Mr. Dap plays role in charge to inform to local government for solution. Thuan Hoa management board pay 100,000 – 200,000 VND each year for Mr. Dap and make priority contract for land rental for aquacultural pond with lower prize. (for Mr. Dap only to encourage Mr. Dap to protect Rucha).

- *Other relevant offices:* Base on the collected information, last few years, some relevant offices, Universities, Programmes were carried out many researches in Rucha, such as:

+ The project funded by SIDA namely "Enhancement local people awareness in conservation and management wetland forest in Rucha, Thuan Hoa commune".

+ Research on restoring and development Rucha funded by Department of Science and Technology and Teacher College.

+ Education on environment conservation funded by organization namely Nature Care for Hue in 2007. They organized some tracking route in order to help pupils in Huong Phong secondary school to understand the importance of Rucha, and established the website that posted many information of Rucha.

The research in Rucha management showed us some issues as bellow:

+ The local people in Thuan Hoa village are allways consciousness to conserve Rucha because they understand that Rucha is a screen to prevent the cyclone protect resident areas and boat keeping.

+ The projects invested in Rucha that helped to enhance local people awareness, collecting mainly information in wetland forest, and premise for other researches in future.

+ Rucha has been protected by Mr. Dap is not really a good way because he was not often patrol and got legally right. (Thuan Hoa management board pay only 100,000 - 200,000 VND per year for Mr. Dap. This money is very small and not enough for him when he spent alot of time in Rucha management.

+ The Rucha managent regulation has rules in prohibition of cut trees, soil dig, harvesting fishery, ect. However, it did not assign cleary.

+ It needs to set up the landmark and establishes Rucha management Board in order to manage well. In addition, we have to establish the income from tourist for re-invented to management and development tourist in Rucha.

+ Huong Phong CPC has had Rucha development plan. It is 3.29ha and will become 19.2ha in 2010, and will be a wetland forest nature reserve and developing ecotourism. However, untill now this activities' budget is not available (state budget was not allowcated) so it needs the monetary and consultant supports from conservation organizations in or outside Vietnam.

+ Authorities in three levels have to interest in management and protection in Rucha because Rucha is the biggest wetland frorest area in Tam Giang Cau Hai Lagoon, Thua Thien hue province.

6.2.3. Identification of local conflicts related to Rucha

a. Conflicts in the past

- Conflict between Sai Gon government and local people: Rucha was the secret residence of revolutionists, so in 1960 Ngo Dinh Diem government decided to damage Rucha, destroy the Temples and remove them to outside Rucha. Local people must obey this order but they were very angry.

- Conflict between violators and Rucha guards: The violators are the people who destroy and cut trees illegally in Rucha. Base on village regulation, violators will be punished. The guards will discover, pursuit and capture the violators, so the violators hate guards.

- Conflict between local people and outsiders or boat people from other villages: Some boat people from other villages came to Thuan Hoa village for illegal fishing. Thuan Hoa villagers discovered and confiscated fishing-nets of outsiders. In some cases, the violators were punished by Huong Phong CPC.

b. Conflicts at present and future

- Some local people do not like to plant Cha species: Some local people said that resin of their leaves has toxic, especially their resin uncerates the wound and sore eyelids. Cha's leaves fall into the water and maybe they can be bad impact on aquaculture. Therefore, some people think that should not be planted Cha species and will be replaced into other species such as *Rhizophora stylosa*, *Aegyceras corniculatum*, ect. This is the conflict of some local people on Rucha regeneration and development of Cha species.

- Conflict between regeneration of Rucha and livelihood of some local people: The forest consists of 3 parts: upper, middle and lower. The upper and lower parts are narrow areas with poor forest cover while most of the area of the forest lies in the middle part with the total area of 5 hectares. Forest can be regenerated in some areas between upper and middle part (4 ha in Thoc Loc) and between middle and lower part (2 ha in Bau Lat). However, these areas owned in aquacultural purpose by some local people in Thuan Hoa village. They will be lost aquacultural areas and lost their jobs if we are going to plan into forest sector.

Furthurmore, commune to put work out to tender, local people must pay for land rent. But almost people are in debt to commune. They will not pay if commune revoke these areas for forest regeneration.

Conflicts will arise if forest regeneration is implemented in Mieu islet (1ha) because there are some tombs of fishermen and some shrimp ponds in there.

- Conflict between building dam and Rucha growth: In 1998, the Thao Long Barrage was built to prevent the salt water supporting by Government. Dam is the barrier between Rucha and lagoon. Dam changed tide mechanism, prevented water movement, affecting Rucha and mangrove forest regeneration in this area. However, people can not destroy this dam. This is conflict on building infrastructure with Rucha regeneration, conservation and development.

The new dam system will be built in the future by stone. DARD and MORE established researched team with participation of local government and relevant agencies. Until now, this dam system has not designed yet.

6.2.4. Policies on Rucha utilization, protection and management

- Thua Thien Hue province Integrated Coastal Zone Management Strategy (2004-2020) of Thua Thien Hue Provincial People's Committee.

- Plan on Social, Economic Development in Tam Giang – Cau Hai lagoon system, Thua Thien Hue province until 2020 following Decision 1955/QD-TTg of Prime Minister on 27 November 2009 (Item 3: Environmental Protection and avoiding disasters, b. Mangrove forest development in downstream of O Lau river (Phong Dien), Rucha (Huong Tra) and downstream of Bu lu river (Phu Loc).

- Huong Tra District People's Committee issued Decision 363/QD-UB on land use planning until 2010 and schedule 2008-2010 of Huong Phong commune including forestry land (Rucha) is 3.29 ha (0.21%) in 2008, planning as protection forest 19.2ha (1.22%) in 2010.

- Huong Phong Commune People Committee had detailed aquaculture planning until 2015. Item IV, chapter III: mention to planning Rucha mangrove forest. Rucha will be Mangrove Forest Nature Reserve located in central of aquacultural areas in Thuan Hoa B Village, Huong Phong commune.

This area is still in situation of natural exploitation and shrimp ponds. Total of conservation area is 19.3ha, including core zone 5ha and buffer zone 14.3ha in Thoc Loc and Bau Lat. These areas will be planned and organized for conservation. However, in order to manage Rucha better, Rucha should be assigned to local community of village for protection and aquaculture. Local community can use water area and play important role in core zone protection. This plan is not issued by Huong Tra District People's Committee. Highway 49B is constructed so affecting this plan. Commune People's Committee is suggesting to change this plan adapting current situation.

- Cultural village regulation of Thuan Hoa village was built with community participation and commitment of local government representatives, community based organization, families in this village.

These documents above have legal status and they were issued by provincial, district and commune government. However, conservation and development management is not invested suitably. Communication on cultural village regulation of Thuan Hoa village and Rucha protection and management regulation are not yet expanded. Award and punishment are not specified in regulation so practicability is not high.

6.3. Land Use Pattern Surrounding Rucha

6.3.1. Land use structure in Rucha

Rucha located between Tam Giang-Cau Hai lagoon and agriculture land of Huong Phong commune, so surrounding Rucha areas mainly use for aquaculture and agriculture purposes.

a. The area from Rucha to Tam Giang lagoon

This area is a part of Tam Giang-Cau hai lagoon. It has a system of salinity prevention dam in 100m far away from Rucha to serve agriculture purposes.

The area from Rucha to dam system is 25ha and were assigned and awarded Red Book to 5 households by Huong Tra DPC. These households built the pen system in seasonally breeding shrimp, crab or natural fishing in flooding time.

The area from dam system to Tam Giang lagoon was spontaneous bred fishery by local people. This area was assigned to local people in Huong Phong and Hai Duong commune by Huong Tra DPC.

b. The area from Rucha to residents area

This area was assigned to all households based on numbers of people in one household in order to produce in agriculture purposes. Basically, villagers got Red Book from Huong Tra DPC. However, Huong Phong CPC still owned 15ha of agricultural land and wetland. Local people who have demand can rent under the public sale every year which is organized by Huong Phong CPC.

6.3.2. Identification of ongoing and potential threats to Rucha

The group discussion's result showed us the existing and development of Rucha is quiet potentiality. Beside that, it still has some threats that affected to Rucha such as:

a. Illegal logging

In the past, local inhabitants' awareness was low and they were very poor, so they cut and destroy the wetland forest for firewood and shrimp ponds, etc. These reasons caused Rucha area was reduced, number wetland species were strongly decreased. The number of individuals and number of wetland species were decreased particularly from 1975 to 1980. At the present, there are rarely local people illegally cut trees in Rucha for firewood purpose because they like to use gas for cooking. Their awareness are improved, so number of illegal logging is lower than before.

b. Destructive fishing

Destructive fishing by electricity is prohibited in surrounding areas of Rucha and most of local people agree with, however there are some case of electric fishing but with the far away from Rucha.

c. Hunting birds and wild animal

Long times ago, Rucha and surrounding were wild areas, so there are many species of birds living in Rucha, especially migrated birds came here in winter. However, there are many activities of people such as aquaculture, cattle breeding, bird hunting, ect in Rucha caused birds quantity decreased.

Because of Rucha guard is not enough, some people still hunt birds in Rucha. Particularly children come to rucha for birds hunting and eggs collection. Furthermore, birds are hunted in paddy fields surrounding Rucha.

d. Illegal grazing

Illegally buffaloes grazing is the reason that is why sapling and young trees are damaged. This is also the reason of unsuccessful of Rucha regeneration. Rucha is not protected strictly, so in some cases buffaloes destroy big trees.

e. Pollution

Pollution is from Huong River and many kinds of wastes are increased. Additionally, aquaculture and unsuitable pesticides and fertilizers using in agriculture are the causes of pollution in water environment in the future if lacking of solution in order to prevent. People use many kinds of antibiotics, antiseptics, pesticides, fertilizers, etc. can affect to aquatic animals and sea grass.

Fertilizers lead to phenomenon of rich nutrients and aquatic vegetation develop very quickly so reducing oxygen in water. Pesticides poison aquatic animals lead to biological accumulation in food chain. Antibiotics are used unsuitably and with over dosage affecting natural bacteria activities, creating condition for anti-medicine vectors development.

f. Building the dam system for Irrigation

The change of ecosystem is a big potential that has been affecting to Rucha now and future. Salty prevention dam systems were built that changed the tide mode of sea level, characteristic of soil and ground water level in Rucha. Mangrove trees will grow up well in Rucha because the water in Rucha became brackish, except to shift fresh water few months per year caused by floods or heavy rain.

6.4. Investigation On Seedling Availability Inside And Outside TTH Province

6.4.1. The feasibility of seedling production in Rucha

Base on observation in Rucha and scientifically basis of salt-marsh trees, we establish the process of salt-marsh trees production in TTH as bellow:

a. Choose salt-marsh species: The criteria of choosing species in Rucha follow Table 12.

Table 12: The criteria of choosing salt marsh species

Criterion	Reasons
Species exist in Thua Thien Hue	These species can adapt to condition of climate and soil in TTH. Furthermore, it can be comfortable in getting and transportation.
Species can plant in usual salt-marsh area in Rucha.	There are not much salt-marsh species in Rucha
Species can plant in area which is rarely overflow in Rucha	Almost of area in Rucha is rarely overflow.
Species can provide food for shrimp and fish	Local people is breeding fishery species in surrounding Rucha.
Species have good figure and non toxic	Make Rucha landscape is better and overcome mistaken toxic of Cha species.

Following these criteria, we suggest that can plant some species as bellow:

- *Rhizophora stylosa* Griff
- *Bruguiera sexangula* (Lour) Poir.in.lamk
- *Aegyceras corniculatum* (L) Blanco.
- *Xylocarpus granatum* Koenig

b. Choose seedling areas: Base on seedling resources in TTH, we can choose some areas such as: Phu Tan commune (Phu Vang district) and Bu Lu river mouth in Loc Vinh commune (Phu Loc district). Rucha and these areas have the same weather and hydrography zone, ect. Some species in Phu Tan and Bu Lu exist and adept with weather and soil which are the same characteristic in Rucha. Furthermore, collected seedling areas are not far from nursery garden, so these areas are very comfortable for collecting, storing, and transportation of seedling.

c. Management mode of nursery garden: In Thuan Hoa village, the nursery garden can establish based on self- management of local people who used to manage a nursery garden that funded by SIDA in 2001. However, after they learn the skill in nursery garden management, they did not receive the fund from SIDA. That caused to stop the model of nursery garden based on self-management of local people in Thuan Hoa village.

6.4.2. The feasibility of buying the seedling inside and outside TTH

Based on the previous researchs and collected information, some areas can provide the seedling inside and outside TTH province in order to develop Rucha mangrove forest such as:

a. The seedling inside TTH

The seedling resource can buy in Canh Duong commune, Huong Tra district and Tan My town, Phu Vang district such as *Rhizophora stylosa*, *Aegyceras corniculatum*, *Bruguiera sexangula*.

b. The seedling outside TTH

The seedling can buy from Ha Tinh, Luang Nam province such as *Sonneratia caseolaris*, *Catharanthus roseus*, *Rhizophora stylosa*. These species have environmental characteristics as the same in Rucha, so they can buy to plant in order to develop Rucha mangrove forest.

6.5. The Feasibility Of Development Of Rucha Mangrove Forest

6.5.1. Identification of potential areas to develop Rucha mangrove forest

Based on discussion results with Huong Phong Commune People's Committee, Rucha area has been planned to restore until 2010 about 19,3 ha (There is detail planning map). Research group conducted observation combining local people (representative of eldest in village and village leader) in order to identify potential and threaten as expanding Rucha area in the future.

Most of discussion and opinions of local people, we considered that most of development potentials for Rucha are suitable with development strategies of local government, completely agreement of local people and community and planned area in order to develop mangrove system of Huong Phong Commune People's Committee.

Rucha has potential to plant, develop and expand more about 14 ha in the future. However, these areas in Rucha is most of submerged land areas that can not plant trees in this period. Experiment models is most of focusing on shallow submerged land area (from 20 - 50 cm depth).

Rucha was divided into three isolated areas, for project we will choose Thoc Loc Pool area (between Upper-Rucha and Middle-Rucha) to establish experiment models combination creating green corridor linking two separate hill areas. Based on ecological and conservation viewpoint, establishing experiment model to restore Rucha expanding its scale and close each other that is very important and signification.

In the first step, we take advantage of lakeshore of aquaculture pool areas to experimentally establish models to plant some species. This experiment will not affect so much aquaculture activities of households in and surround Rucha.

6.5.2. Identification of model to develop Rucha mangrove forest

a. The fundamentals of science

To solve the isolating between three parts of Rucha: Each Rucha has been separated with others by fish ponds or wetlands. The wetland areas are also isolated by dam system for irrigation or dike of fish ponds. These reasons caused prevention, impediment of diversity, and transportation of fauna and flora in each parts of Rucha.

b. The method of Rucha development

Suggested project is linkage the upper-Rucha, middle-Rucha and lower-Rucha by green corridor. The first step will create corridor linking the hills by planting tree corridor; after that developing green corridor to link three hills (planting trees along widthwise and length of the corridor). At the same time, expand and finish the linkage three hills. Planting mangrove trees and expand other directions in Rucha.

Based on restoration objective and development of mangrove in Rucha are protection of current Rucha, combination of developing Rucha link functions of protection, environmental protection, create landscape and serve eco-tourism in the future.

Location and area need to develop to plant Rucha will be based on restoration plan to 2010 about 19.3 ha and planed map of local government; combination of observation results and

discussion with local government (representatives of eldest and village leader) in order to identify potential and threaten when expanding Rucha area.

Part of water submerged area is very difficult to plant mangrove trees. If we want to plant trees in this area, we have to select suitable techniques such as working the soil, choosing mangrove species, etc. The first step, we should focus on planting trees in shallow water submerged area (from 20 - 50 cm depth) in order to establishing experiment models.

Learning of experiences of fail experiment models in the past, if without any management and protection well after planting, animals will destroy the models and unsuccessful. Hence, to reduce risk and badly effects on experiment models, it needs to establish sustainable management and protection mechanism.

In order to mitigate effects on living and livelihood of local people, local government should not withdraw all area to restore mangrove system, it needs to resolve step by step and find other ways for poverty reduction in community instead of withdrawing the areas.

To reduce risk and consequences because of unsuccessful of the past project, it needs to conduct experiment some mixed-species plantation, based on identifying the most potential species, identify models, the most suitable solution in order to expand after that decision sustainable species and mangrove models to develop whole Rucha area in Thuan Hoa village, Huong Phong commune.

c. Suggestion of experimental implementation period

- Period 1:

- + Link upper-Rucha and middle-Rucha (Thoc Loc Pool site). In current, there is a road linking two hills. On the road has existed trees and grow well;
- + Expanding upper-Rucha and middle-Rucha.

- Period 2:

- + Link lower-Rucha and middle-Rucha (Lat Pool site);
- + Expanding lower-Rucha and middle-Rucha.

- Period 3: Huong Phong Commune People's Committee withdraws areas of aquaculture pool and expand whole Rucha area.

- Period 4: Development of planting other areas beside Rucha area such as Mieu hillock, Sao hillock (It needs to survey, study these areas before implementation of experiment models).

d. Afforestation model

- Establishing experiment models in the swell of the ground with low canopy in Rucha will be planted more trees.

- For shallow water submerged land area (from 20 - 50 cm depth) will be priority to plant. Apply to method of swell-hole. The swell-hole will be heaped up equal, lower or higher than water surface about 5 cm.

- Arrange different experiment models: experimental plot (mixed-species or pure plantation), control experimental plots (in order to compare).

e. Planting species

Requirement criteria are environmental protection as well as for eco-tourism services in the future. Hence, Area of existing Cha trees needs to maintain and protect, instead of developing

and planting more Cha species, it needs to plant other species in order to diversify species and biodiversity and create landscape.

Implementation of experimental establishment of exotic mangrove species from other provinces in Vietnam based on sustainable ecological research.

Changes of salinity inside and outside of Rucha strongly affected growth and changing living environment inside of Rucha. With salinity about 6‰ has high significance for introducing half-submerged species, low salinity adaption in order to plant in this area such as *Melaleuca lecadendra*, etc.

Experimental suggested species in the study site as follows:

- *Rhizophora stylosa* Griff.
- *Rhizophora apiculata*
- *Bruguiera sexangula* (Lour) Poir.in.lamk
- *Aegyceras corniculatum* (L) Blanco.
- *Xylocarpus granatum* Koenig
- *Melaleuca leucadendra*

f. *Planting season:* From January to August annual (avoiding rainy season).

g. *Sapling standard:* good saplings, over 50 cm height and 6 to 12 months old of nursery saplings, verdant and none cut off sapling top.

h. *Mangrove management and protection:* Establishment of development models and Rucha ecology management, tending and protecting Rucha after planting based on participation of community and local people. Besides, it needs to build regulation, establishing mangrove management and protection team, etc.

7. Conclusions And Suggestions

7.1. Rucha area decreased area and declined its quality comparison in the past and it has been divided into three small hills intermixing aquaculture pools of households in Thuan Hoa village. Rucha had been planed to develop a mangrove eco-system in coastal zone about 19.3 ha by Huong Phong Commune People's Committee and Huong Tra District People's Committee; among of them, core zone including exist Rucha area and over 14.0 ha of mangrove forest creating and planting in current aquaculture pool areas of households in Thuan Hoa village. However, this is general plan and lacking of budget and consultancy of techniques and other relevant aspects of stakeholders.

7.2. Local people living in Thuan Hoa village actively participated to conserve Rucha through patrolling, protecting, creating saplings, and planting in this area. Involving participation of local people for management and protection Rucha is efficient solution in order to protect and develop Rucha in long-term.

7.3. Soil characteristic in Rucha is clay mixing sandy and heavy earth mixing clay, low humus, salty soil and low nutrient. General, soil in Rucha is poor nutrient and existing alum. Besides, rate of dilution soil area is high occupying over 76% of total Rucha area therefore has potential to plant mangrove species herein. The rest of area occupying about 24% is firm soil area, high potential to plant some species which can not adapt submerged in long time.

7.4. Identify Rucha area can expand about 14.0 ha. Area of Rucha development belongs to development strategy of Huong Phong Commune People's Committee and expectation of local people in village and village leader.

7.5. Identify initial mangrove species have high potential in order to experiment in Rucha area. For area part with effect of tidal regime can plant some mangrove species such as (1) *Rhizophora stylosa* Griff, (2) *Bruguiera sexangula* (Lour) Poir.in.lamk, (3) *Aegyceras corniculatum* (L) Blanco, (4) *Xylocarpus granatum* Koenig and (5) *Rhizophora apiculata*. In the rest of area without effect of tidal regime can plant *Melaleuca leucadendra*. Besides, some natural distribution species surround Rucha need to experiment and expand (These species play role of native species and diversify species in Rucha area).

7.6. Based on experimented model and natural and ecological conditions in Rucha, mixed-species plantation is necessary and suitable technique solution in order to maintain Rucha area combination diversify species in this area serving development of eco-tourism in current trends - climate change and global warming.

7.7. Rucha development strategy based on theory of reduction of isolation of Rucha parts, establishing green corridor link Upper-Rucha, Middle-Rucha and Lower-Rucha following body of lakeshores of aquaculture pools. Besides that, Rucha will be gradually expanded directions by the above selected mangrove species.

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Appendix

Appendix 1: The list of interviewees

Meeting tin Huong Phong CPC

Date: 26, 27, 28, 29/December/2009 and 15,16,17, 18/ March/2010

Name	Potition
1. Nguyen Van Tranh	Vice chairman of Huong Phong commune
2. Nguyen Quang Dung	Standing Officer of Huong Phong commune
3. Tran Thanh Chinh	Land surveyor of Huong Phong commune
4. Nguyen Duy Tiem	Leader of Van Quat Dong village
5. Nguyen Van Đang	Leader of Thuan Hoa village
6. Nguyen Thi Hoa	Member of Woman Union of Huong Phong commune

The list of local people in group discussion and interviewing

Name	Location
1. Nguyen Van Đap	Thuan Hoa village, Huong Phong commune (forest guard)
2. Nguyen Ngoc Coi	Thuan Hoa village, Huong Phong commune (forest guard)
3. Dang Duy Hien	Thuan Hoa village, Huong Phong commune
4. Nguyen Van Cu	Thuan Hoa village, Huong Phong commune (Farmer)
5. Nguyen Xuan Vien	Thuan Hoa village, Huong Phong commune (freedom labor)
6. Dang Thi Chan	Van Quat Dong village, Huong Phong commune (Farmer)
7. Dang Duy Hoang	Van Quat Dong village, Huong Phong commune (fishery)
8. Dang Duy Chien	Thuan Hoa village, Huong Phong commune (Farmer)
9. Nguyen Oanh	Thuan Hoa village, Huong Phong commune (Farmer)
10. Nguyen Tan	Thuan Hoa village, Huong Phong commune (Farmer)
11. Phan Huan	Van Quat Dong village, Huong Phong commune (fishery)
12. Nguyen Van Dinh	Van Quat Dong village, Huong Phong commune (fishery)
13. Tran Sung	Thuan Hoa village, Huong Phong commune (Farmer)

Appendix 2: Pictures on Rucha research



The researchers work with authorities of Huong Phong commune



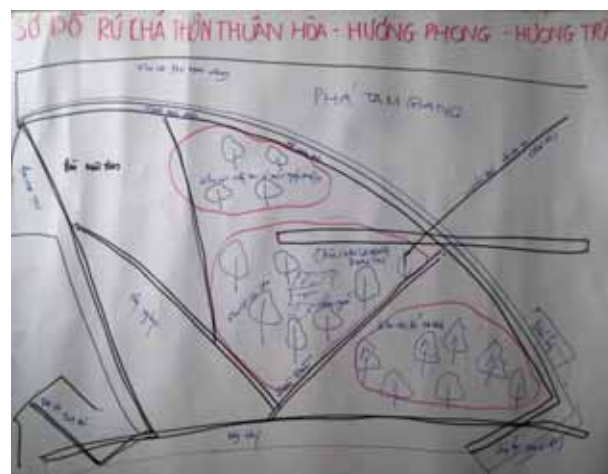
The researchers interview local people in Thuan Hoa village, Huong Phong commune



Group discussion on Rucha restoration



Local people draw Rucha map



Rucha map was drawn by local people



The researchers observed in Middle Rucha



Excoecaria agallocha population in Rucha



Excoecaria agallocha was reproduced by seedling



Hizophora stylosa was plated in Rucha



The system of drain connecting Rucha and Tam Giang lagoon



The system of shrimp's ponds around Rucha



The road constructs nearby Rucha

Appendix 3: Questionnaire

Conflicts on Rucha utilization and management

Interviewer:	Date:.....
Location: Commune	Village:
Interviewee :	Age : Sex : Male/ Female

1. What are the conflicts in Rucha in the past and at present? Conflict description

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2. What are the causes of conflict in Rucha area? Root cause analysis

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3. History of conflicts?

Timeline	Events	Conflicts

4. Who are the stakeholders involving this conflict?

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Biểu đồ Venn Diagram

5. Escalation (increase, decrease, stable)

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6. What are the solutions for conflicts management?

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Threats and their impacts on Rucha

Interviewer:	Date:.....
Location: Commune	Village:
Interviewee :	Age : Sex : Male/ Female

1. What are threats affecting Rucha?

Threats in the past, at the present and potential threats in future

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2. The causes of threats?

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3. Sollutions

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Policies on Rucha utilization, protection and management

Interviewer:	Date:.....
Location: Commune	Village:
Interviewee :	Age : Sex : Male/ Female

1. List all policies on Rucha utilization, protection and management

- Policies of central government

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- Polices of province

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- Policies and stipulation of locality

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2. Analysis and assessment on Rucha utilization, protection and management policies

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3. Suggestion for completing policies and stipulation

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Stakeholders involved Rucha protection, management and utilization

Interviewer:	Date:.....
Location: Commune	Village:
Interviewee :	Age : Sex : Male/ Female

1. List all stakeholders on Rucha utilization, protection and management. Function and duty of each stakeholder

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2. Assessment and comment

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3. Venn diagram on stakeholders' relationship

Appendix 4: SURVEY FORM

Part 1: Transect profiles

Forest category:

Transect:

Name of survey's person:

Date of survey:

Aspect:

Slope:

Canopy cover:

Part 2: Forest structure

No.	Species	H (m)	C (cm)	Diameter of canopy (cm)	# branch	Form of life	Distribution
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
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