



**Center for Agriculture Forestry
Research & Development**

**IMOLA project
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Final Report

SUMMARY OF PROJECT ACTIVITIES ON

**“ASSESSMENT OF THE IMPACT OF THE
YEARLY FLOOD AND DEVELOP STRATEGIES
AND TOOLS IN TAM GIANG AND CAUHAI
LAGOON”**

Fund by: Food and Agriculture Organisation of the United Nations

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I. INTRODUCTION

Tam Giang - Cau Hai lagoon is a famous landscape not only of Thua Thien Hue in particular, but of the whole Vietnam country in general as well. In addition to the inhabitants living on the agricultural activities, many inhabitants live on exploiting the natural resources which are traditional from the previous years up to now and in more than recent 10 years, some households changed into aquaculture. The inappropriate exploitation and cultivation has caused the negative impacts on the environment and ecology.

Especially, the lagoon is also a place where suffers heavily every year the natural calamities such as floods, storms, droughts, salty infiltration. The annual natural calamity has caused the heavy damages not only in socio-economic aspects, but in ecological environment as well for the inhabitants living along the lagoon.

Finding the solutions with the aim at using properly the natural resources of the lagoon as well as coping with the natural calamities has become a critically immediate and long-term demand.

With the significance as above, from September - October 2006, the research group of the Center for Research and Agricultural Development, under the Hue Agrio-Forestry University carried out the research subject: "*Integrated management of the lagoon activities*" with the financial support from IMOLA project.



Picture 1: General view of the lagoon and survey site

The inhabitants living along two sides of the lagoon of the districts of Phong Dien, Quang Dien, Huong Tra, Phu Vang, Phu Loc have two main careers, namely agricultural production and aqua cultivation and exploitation. The additional livelihoods such as service, trade and traditional handcraft serving two main careers are also developed.

The natural calamity put the impact on the various inhabitants community in the various geographical areas along two sides of the Tam Giang - Cau Hai lagoon and the distance from the community to the river gate.

So as to identify, evaluate the impact level of natural calamity on the study site, we carried out evaluation, survey and analysis of investigation result at 4 specific study sites for the whole area under the communes of Quang Phuoc, Quang Dien district, Hai Duong, Huong Tra district, Phu An, Phu Vang district, and Vinh Hien, Phu Loc district (see picture 1).

1. Objectives:

- **Activity 1:** Studying and accessing to the affect of yearly floods on the livelihood of the inahbitants living along the lagoon and natural environment.
- **Activity 2:** Setting up the map system of the loss caused by the floods.
- **Activity 3:** Studying the forecast for the flood system and and setting up the compatible activity

- **Activity 4:** Developing the strategy of minimizing the loss caused by the floods for the aquaculture activities and the related activities on the lagoon
- **Activity 5:** Setting up the frame and developing the training program so as to improve the capacity of protecting from the floods, especially paying attention to minimizing the loss for the inhabitants living on the lagoon's resources.

2. Content

The project is implemented with the main contents:

- **Content 1:** Accessing to the status of floods every year at the study site
- **Content 2:** Climate changing effect and compatible activities and the application of traditional knowledge of the local for natural calamity.
- **Content 3:** Setting up the map of forecasting the flood's impact on the resident areas at the rate of 1:25,000 and the necessary notes.
- **Content 4:** Setting up the map on the loss in Tam Giang and Cau Hai lagoon at the rate of 1:25,000 and the necessary notes
- **Content 5:** Forecasting the damages and loss by the annual floods.

3. Research methodology

- **Collecting secondary data**
 - o Statistical report on the socio-economic status at the provincial, district and commune level (carrying out the professional survey in 4 specific communes of Phong Binh, Hai Duong, Phu An and Vinh Hien)
 - o Report on the strategy of the 5-year socio-economic development at the provincial, district and commune level
 - o Technical reports and study reports were carried out by other project on the site.
 - o System of base map and related maps.
 - o System of information relating to hydrography climate for about 20 years from 1985 to 2006
 - o Report on the damage and loss caused by the natural calamity of the project communes.
- **Collecting data on the site**
 - o Organizing the survey at 4 specific communes of Phong Binh, Hai Duong, Phu An and Vinh Hien of the districts of Huong Tra, Phu Vang, Phu Loc. The survey contents are included:
 - Overview survey and updated directly the data of the project communes by interviewing the local experts and the meetings with the commune staff.
 - Surveying the households through questionnaires (400 households in total were surveyed in 4 selected communes). The surveyed households were selected with the rate, rich: medium: poor: 30%: 40%: 30%. The households belonging to the same group were selected by random.
 - o Investigating the local expert groups: the local expert groups organized the group meetings in order to contribute their ideas in the way of sharing the common knowledge of the community. The investigation groups were organized as follows:
 - Local leader groups: commune, village (2 groups: 10 people/group)
 - Groups of households with economic potential (3 groups with 10 people from 3 household groups: rich, medium and poor)
 - Inhabitants groups by livelihood (aqua cultivation, aqua exploitation, agricultural cultivation,...)
 - Inhabitants groups by gender (10 people/group with 2 main groups: women and men)
 - Surveying and interviewing the group of elderly farmers with good farming knowledge about the indigenous knowledge of forecasting and protecting from the flood in the Tam Giang and Cau Hai lagoon.
 - o Surveying and collecting the data of flood's impact and flood's limit every year and the pinnacle

- Surveying and interviewing about 1,500 households about the flood's limit and pinnacle in the history scale of natural calamity.
- Investigating the allocation coordinate of the pilot resident areas in Tam Giang and Cau Hai lagoon.
- Processing the data
 - Processing the statistic data on the economic status and the potential to cope with the damages caused by the natural calamity.
 - Processing the data for the design of the forecast map and actual state map of natural calamity (ArcGIS,)
 - Analyzing the impact of climate change on the livelihood of the inhabitants in the lagoon area.

4. Process

The process to carry out the project is divided into 3 main stages with 8 steps which are described in picture 2.

Stage 1:

- General survey of the inhabitant's community along Tam Giang and Cau Hai lagoon to select 4 specific study sites for the whole study area.
- Collect information of the losses and damages caused by natural disasters on the livelihood and natural environment and analyze the impact at 4 study communes.

Stage 2:

- Survey the site, develop the vulnerability map
- Set up the potential impacts of yearly floods

Stage 3

- Develop the frame of training program on capacity building to reduce the natural disaster's impact based on the community
- Develop the training document on capacity building to reduce the natural disaster's impact based on the community

II. SUUMARY OF PROJECT

In each commune, the focus group discussion have been organised with leaders, farmers, women, men and the poor farmers. 100 households were also interviewed by questionaired to undertsand the situation. Team have village work and meeting with many other farmers by informal way. Here are summary of the findings in each commune.

1. QUANG PHUOC COMMUNE

Quang Phuoc commune is one of 11 communes and town of Quang Dien district. The commune is located in the East of Sia town (Quang Dien district), a lowland area at the end of Bo river. It is bounded by Quang Tho commune in the south, Sia town in the north, Quang An commune in the east, Quang Dien district in the west. It is often waterlogged in the rainy season and some dykes bordered by Tam Giang lagoon are salty in the sunny season.

The whole commune has 8 villages: Thu Le 2, Thu Le 3, Khuong Pho, Mai Duong, Phuoc Ly, Phuoc Lam, Ha Do, Phuoc Lap. Among 8 villages, 3 villages of Thu Le 2, Thu Le 3 and Khuong Pho are not bounded by the lagoon. All of 5 remaining villages are bounded by Tam Giang lagoon. As a result, under the impact of the floods, these villages are often suffered the most impact..

Total area of natural land of the commune is 1,048ha in which the agricultural land of the commune occupies the highest rate (48.6%); followed by non-agricultural land (residence, garden...) occupying 35%. The land for aqua cultivation is not much (15.4%).

The whole commune has 1,733 households with 8,030 people. Of which, 437 households belong to poor households (according to new standard) and 1,991 people, occupying 26.49% in households and 26.47% in people. Number of malnourished children is 145 (accounting for 21.4% of children); number of diarrhoea children is 54 (accounting for 8%). Number of people under labour age is 2,650 (men aged from 18 to 55; and women aged from 18 to 45).

According to the evaluation of the village leaders group, the labour force of the commune is ensured for the production activities and the people here have to do a lot of hard work, especially women. However, due to the fact that only agricultural production and aqua cultivation and exploitation are carried out in the commune, the production season is ended, the inhabitants do not have work to do. Therefore, many people (especially the youth) have to leave the homeland for the far provinces such as Ho Chi Minh, Danang,...to find a job or for labour export in Malaysia and Taiwan.

The livelihood of Quang Phuoc commune's people depends mainly on agricultural and aqua production, accounting for 64.4%. The career division in the villages is rather clear. Among 8 villages of the commune, 6 villages participate in the agricultural production (including: Thu Le 2, Thu Le 3, Khuong Pho, Phuoc Lam, and Phuoc Ly) with the participation of 1,424 households, 6,579 people. And 2 remaining villages focus on aqua exploitation (namely Phuoc Lap and Ha Do) with the participation of 193 households. Number of aqua cultivation households is 321.

The most important crop of Quang Phuoc commune is rice. Besides rice, other crops are hardly focused. Most of agricultural land here are used for 2-crop rice production. However, due to the affect of the weather, rice productivity is not stable. A lot of rice fields bounded by the lagoon are often salted in summer, affecting considerably to the productivity and income in summer-autumn crop of farmers.

Besides rice as a key crop, the locals produce other crops such as groundnuts, chillies, water melons, sweet potatoes...However, they got not big yield and occupied very small rate in total source of income of the commune.

According to the seasonal calendar, the production time is concentrated from January to August every year. In the months of september, October and November, most of the land are waterlogged, illumination power is low, so it is not suitable for the crops. For that reason, at this time, the inhabitants often do not have work to do, some of them have to work in Hue city or in some southern provinces.

Total number of pigs in the commune was 4,050 heads, of which: sow: 1,900 heads, porker: 2,150 heads. The income value of sows was 5.13 billion VND, the income from orkers was 3.326 billion VND. The development of pig raising increased the inhabitants' income, besides provided some manure for crops. Therefore, most of the households in the commune raised 2-4 pigs/year and many of inhabitants invested in raising from 10 to 12 pigs/year.

Quang Phuoc commune has 5 km bounded by the Tam Giang lagoon, a convenient condition for the development of aqua cultivation and exploitation.

The aqua exploitation concentrated mainly in 2 villages of Ha Do and Phuoc Lap. The aqua exploitation of the inhabitants here are mainly pen culture and bottom job. However, in the recent years, due to the development of shrimp raising, some households changed into raising shrimps.

In addition, because the water surface area belongs to the common ownership, many people in different places came here to exploit. Due to the poor awareness of natural resource protection and weak environment protection method of local authorities, many people used the exterminating exploiting tools (electricity pulse, explosive,...) leading to the serious reduce of natural resource.

According to the idea of exploiting fishmen group, due to the change in aqua exploiting tools and intensity, presently, many kinds of aquaculture are caught at the little quantity

(such as Dia fish *siganus canaliculatus*, *therapon jarpua*, *therapon theraps*, *dorab*, white shrimp,...).

Due to the characteristics of site condition and of the aquaculture, Quang Phuoc commune focused only on raising fish and shrimp in the brackish water while the fish raising in the fresh water was little paid attention by both two sides, the inhabitants and the local authorities.

The shrimp raising career brought about a lot of profit for the the fishmen and created employment for the local community. However, relating to this career, in Quang Phuoc commune, we met many complicated cases in both advantages and difficulties of the inhabitants.

The jumbo tiger shrimp raising career has been developed at the commune since 1993. At the first time, only 40 households and the commune leaders group carried out the jumbo tiger shrimp raising in the area of about 20 ha, the productivity achieved from 250 to 300 kg/ha. The area for shrimp raising was increased promptly, after 5 years, total area for shrimp raising of the commune increased up to 160.4 ha and number of households up to 321. In addition to the increasing of area and scope, the productivity from shrimp raising also had the quick growth (in 2000, the productivity achieved about 700-800kg/ha). Due to the spontaneous development, low people's level, high breeding density,... from 2002-2004, the diseases were broken out, leading to the fact that the productivity and yield of shrimp raising decreased considerably and many family households were seriously unprofitable.

The kinds of brackish fishes were caught naturally, creating the traditional aquaculture resource for the inhabitants community in Quang Phuoc. However, for the recent time, because the natural fish resource was reduced considerably, the inhabitants changed into intensive cultivation. The fishes were previously caught naturally, presently the fingerlings were harvested in the beginning of crop and then raised between 4 and 6 months before harvesting from the developed shrimp and fish raising ponds. The species of Dia fish *siganus canaliculatus*, *dorab*, *therapon* are raised and used for fingerlings production. The first step showed that this fish group contributed remarkably in the inhabitants' income resource. A new livelihood group are being established and developed.

So as to have better analysis of difficulties and find out the solutions, the meeting groups including community of natural catching people, group of aqua cultivation fishmen, representatives from the units relating to aqua cultivation and exploitation were invited to the common meetings and the separate meetings of groups. The members analyzed the advantages and difficulties which the inhabitants and managers are facing with and used the brainstorm method to find out the reasons. The system of policies analyzed together with the analysis of internal force of the local communities was applied so as to give out the solutions for both the fishmen and managers.

Due to the hollow geography, the inhabitants are often concentrated on the upland areas, so the population density is very high while the roads in the villages are very narrow, so it is very difficult for the big transport means to travel. This also causes some difficulties for the inhabitants living in the region.

In addition to the road traffic system, the waterway traffic also plays an important role for the commune inhabitants. With many canals in the fields and regularly upgraded, they helped effectively the inhabitants in the transport of crop and livestock products to the storing and consuming places.

Quang Phuoc commune in particular and Quang Dien district in general is a place experienced in agriculture, mainly focused on rice production, so irrigation system was focused by the authorities at all levels. The irrigation system of the commune was rather completed and able to supply water to most of rice areas (only about 16 ha along the lagoon are salted in the drought). However, in the past years, due to the low efficiency

achieved from the rice production, the cost for maintenance of irrigation system was not sufficient, making a part of canal system degraded.

One of the biggest difficulties of the commune is the water drainage in the dry season. Presently, due to the fact that some dams were built to protect the shrimp raising areas along the lagoon from the salt, the partial waterlogging often happens in the rainy season in some areas. According to the inhabitants, to limit this affect, the solution is to build more culverts in order for the rain water run out the lagoon easier.

Around 74% of total interviewed households belong to medium and fairly rich according to the national classification standards in 2004. The rate of poor households occupied 1/4. The reasons cause the poverty for the poor and specially poor households are:

- Lossing in the first harvest of shrimp, causing the doubtful debts. And this debt makes the households impossible to borrow more loans for their business.
- Lacking capital for business and investment in the production.
- Shorthanded, old and helpless families.
- Illness, chronic diseases
- The natural disasters destroyed assets and agricultural and aquacultural products.

Quang Phuoc commune is one of the poor communes of Quang Dien district. The main income resources of the commune in 2005 are from the following fields:

- Agriculture: 25.3%;
- Livestock: 21.6%;
- Aquaculture: 17.5%;
- Additional careers: 25.6%; and
- Service: 10%

Tap-water was available in most of villages in the commune. Presently, about 80% of inhabitants have water pipes leading to their house. The remaining households (mainly the poor households and the households living far from the resident area) have to go to get water from other villages.

Bo river is the water supply resource for the production activities, eating and drinking and the living of the inhabitants. Before 2004, the commune inhabitants had to use water from the drilled wells, or from the canals, ponds in the region, so the quality is ensured. From 2005, the government invested in the clean water pipes leading from the factory to the villages, so most of households have clean water at home. However, many poor households did not have investment budget, so they had to buy water from other households with very high price (about 15,000 - 20,000 VND/m³).

With the rather completed canal system originated from the downstream of Bo river, the water resource supplied to the fields is abundant. However, because Quang Phuoc is a hollow commune and has a number of hectares bounded by the lagoon, some areas are often salted in the drought, on contrary, the fields are waterlogged in the rainy season. This caused the not small difficulties for production activities and the travelling of local inhabitants.

Like other communes in the Tam Giang - Cau Hai lagoon, Quang Phuoc commune suffers the impact of monsoon tropical climate. The annual average rainfall in Quang Phuoc commune achieved about 2,500-2,800mm. The rains are concentrated on the months of from September to December. The rainy season is also the flooding season. Every year, there are about 2-5 floods at all of different levels. According to the general evaluation, the flooding causes the most affect in the production activities and the living of the local inhabitants. Although the small floods are not severe, they happen unequally and drop in the rice harvest time and the harvest time of aqua products, hence, they cause the considerable damages for the producers. However, many people stated that the floods make the environment cleaner and fresher, the shrimps and fishes less infected with diseases and the floods can produce fertility for the fields, increasing the nutrition resource for crops.

The survey of actual status and impact of floods on the development process of Quang Phuoc commune showed that, the impacts were different in different times. The inhabitants indicated that from 1953 up to now, the local faced the following history floods:

Some natural disasters happened at local and their impacts

Time landmark	Impact
Flood in 1952	Impact of assets, home, aqua equipment, vegetables,... number of dead people was not available.
Flood in 1953	The water went up very highly and prolonged, 40% of houses were destroyed and lost, vegetables, roads and aqua equipment were damaged. Some people were dead, others had to leave for other places (number of dead people is no idea because the flood happened long time ago).
In 1973	Big flood, roads and aqua equipment were destroyed, some dead people. Many people had to leave for other places (could be alive due to the war time)
In 1976	Big flood, water level went up highly and deeply at about 2m. The crops were lost, the inhabitants meet many difficulties. Hence, after the flood, many households moved to the new economic areas (A Luoi, Central Highland,...)
Flood in 1983	The impact level was similar with the flood in 1976.
Storm in 1985	The storm was very big with strong wind at level 12 and gust above level 12. Due to large geography, little firm houses and many households lived on boats (Thuy Dien village), there were 62 dead people, of which 58 people in Phuoc Lap village (living on boats) and 4 people in Ha Do village. More than 50% of houses which were collapsed and whose roofs were blown up, many parts of roads were isolated. in Mai Duong village, serious landslide was caused by waves.
Flood in 1999	This is the biggest flood in the history which the inhabitants have ever met. In this history flood, the water level was more than 3-4 m deep, the time of waterlogging proplonged near 1 week. In general, compared to previous floods, the flood in 1999 caused the biggest damages for the local inhabitants.

Following up the impact's frequency and level of floods at local gave us some following comments:

- The occuring frequency of natural disasters increasingly went up.
- The intensity of the natural disasters had the tendency of increasing considerably.
- The damaged level in people and assets in the first stage had the increasing tendency, but in recent time, it is limited thanking to the intime warnings and prevention from the government and from the inhabitants.

Above here are some time landmarks and damages which the local people could remember. And in fact, from 1950 on, according to the document of Do Bang (Do Bang: "Floods in 5 past decades in Thua Thien Hue"), there were many big floods and the affects caused by natural disasters were very severe.

To reduce the impact of natural disaster and increase the inhabitants' capability of coping with different kinds of natural disaster, the local people proposed the following solutions:

- Supporting credit so that the local people can invest in the production

- The authorities should have interference with the banks to increase the borrowing time to suit with the production scope and cultivation circle.
- Investing and enhancing capacity of the information warning systems so that the local people can have a lot of information to be active in the control of natural disaster
- Studying the crops and animal development to be suitable with the climate and weather conditions at local.
- To develop aquaculture sustainably, the breeds must be active and strong
- Establishing the proper purchasing system and price policy
- Carrying out seriously the protection of aqua resources
- Investing and upgrading the inter-village, inter-commune traffic system to be active in the relief when the water goes up high
- Limiting the wastes from agricultural production activities to the lagoon
- Supporting the groups of flood control with the necessary equipment (lifebelts, motor boats,...)
- Supporting the poor households with clean water and building toilet

To limit and minimize the risks in the production and in life, farmers have the following demands:

- Training on the techniques of raising shrimps and knitting nets.
- Technical training on first aid for the people in danger
- Training on management of credit for the local people
- Method of treating drinking water and using water
- Introducing the flood control program in schools.
- Increasing the awareness of community in the management and treatment of wastes to prevent from the environment pollution, especially after the flood.

In the flooding season, the travelling of the commune met many difficulties. The travelling not only from the district, city to the commune, but also the between the villages in the commune are separated. Therefore, the general policy of the local leaders informed to the households groups, the households in the commune have to apply seriously the 4 on-the-spot methods. It is detailed that: (i) on-the-spot force; (ii) on-the-spot guidance; (iii) on-the-spot logistics; and (iv) on-the-spot means. On the other hands, it must be active in using the from modern to primitive information system at necessary.

To satisfy the above request, the commune People's Committee set up the concrete solutions:

- There are the concrete control plan for every flood when receiving the warning information.
- The commune Flood Control Board has to check directly each resident group to give out the additional methods.
- Checking and upgrading the broadcasting system in the commune.
- Disseminating and encouraging the local people to avoid the subjectivism.
- Preparing the foods (fast noodle) and medicines as requested by the upper levels.
- Clarifying the evacuation ways and sites for each resident area when a big flood happens

2. PHU AN COMMUNE

Phu An commune is far from Hue City 12km in the Northeast, the north borders Phu Tan commune, the East borders Phu Xuan commune (separated by Tam Gang lagoon), the West borders Phu Duong commune and the south borders Phu My commune

The total land area of Phu An commune is 1.128 ha, this natural land is separated into many usage kinds. We can see that in Phu An commune, 233.54ha of land is used for planting, people plant rice mainly (in the year 2005, the area of Winter- spring rice crop was 210 ha, the area of Summer- autumn rice crop is 60ha), the area for another crop and area of home garden is not remarkable.

Beside the land for agriculture, land is also used for non- agriculture. Among them, land for living is 4924ha, land for production is 6736ha, land for religious is 105ha, land is used for nothing is 807ha, especially, land in the stream, river... is 53900ha

Land for cultivation is based on the job characteristic of each household. With agricultural household, the average land area is 500m²/ person. With aquacultural households, water surface area is divided according to the number of people in the family. Each household has their own land for living. Especially, in Dinh Cu hamlet, there is one household who built the house on the water surface. (appendix- picture 3), but the local authority said that, this household will build the cement house on the land with the average area less than 200m²/ household

The water surface resource of Phu An commune is rich. Beside the water surface area is 160.02ha that people use for aquaculture, a big area in the North and in the East of Tam Gang lagoon not only create an interesting ecological scenery but also contain many important creature resource that serve people's life. In Phu An commune, there is also a canal system and complicated such as: Hoi GAO, Hoi Vine Vê, Hoi Bin, Hoi Co, Hoi a Loch, Hoi Lu Bù... These "Hoi" help the irrigation system of the commune.

Although this commune has advantage about water resource, but the irrigation system is not complete, the salt water prevention dam does not have high quality so the salt water always flow into the field. In the summer, because of the shortage of water, villagers use salt water for watering.

There are 781 household in An Truyen hamlet and there are 3943 people. In Phu An, agricultural household is 1/4 among total households, the left are non agricultural households.

Each hamlet has their own job characteristics

- There are 100% of agricultural household in Dinh Cu hamlet
- There are 136 household in An Truyen hamlet, among them, there are 13 agricultural households, the left are based on construction, business, handicraft...
- There are 781 household in An Truyen hamlets, among them there are 643 household based on non agriculture such as aquaculture, business, service.

With the particular of the commune, the economy of Phu An commune is based on agricultural production, aquaculture, handicraft and some traditional jobs in the local, service

The agricultural production in Phu An commune includes 2 main activities: planting and animal husbandry. Rice is the main tree in Phu An commune. The total area of the field in Phu An in the year 2005 was 270 ha, among them, the area for Winter- spring rice crop was 210 ha, for Autumn-summer rice crop was 60ha. The average rice productivity is 45,34 quintal/ha and the rice productivity in 2005 was 1229 ton

Animal husbandry in Phu An commune focus on the households mainly. The animal in this commune develop very well based on the technique progress and good ways to prevent insect. In the year 2005, the total number of buffalo is 160, the number of cow is 20, the number of pig is 1800 and livestock is 16000

Phu An commune has one advantage: there are area of water surface for exploitation and aquaculture (aquaculture area is 16002ha, the area of river, stream is 539ha). In the year

2005, the area for aquaculture is 2248ha. The aquacultural productivity in this commune in 2005 was 105,2 tons.

Aquaculture as well as the exploitation of natural products connect with the weather conditions. The aquaculture in the lagoon often be started from January to July, the harvest starts at the end of July. The exploitation of natural products is implemented all the year. However, from January to May, the productivity is low, from June to December, the products is higher.

According to the statistic from People committee of Phu An commune, there are 118 poor households. In Trieu Thuy hamlet, there are 35 households, there are 45 households in An Truyen hamlet, there are 17 households in Truyen Nam hamlet and 21 households in Dinh Cu hamlet. The poor households are distributed "Poor household card", so parent and children will have the benefit from the policy of Government and local about studying, examine...

- Beside the poor group, there are some special poor group. In Trieu Thuy hamlet, there are 34 households, in An Truyen hamlet, there are 35 households, in Truyen Nam, there are 18 households, in Dinh Cu, there are 12 households. These households not only have benefit from Government and local policy but each month, they receive 60.000VND-70.000VND

- Lack of experiences in production
- Lack of capital for business and invest for technique
- Too many children in one family (there is one family in Dinh Cu hamlet that has 16 children). This story is known by the Government through newspaper. Or Ms. Huynh This Bong, at the age 31, she has 6 children -(card 1)
- Short of manpower in family, old people have no one to rely on
- Disease in many years
- Disaster damaged the property, agricultural and aquacultural products

Water for living in Phu An commune is originated from : rain, underground water and tap water

The underground resource is used for serving the living condition and production of villagers. Before, many households used underground water to serve the living condition but many areas in this commune are influenced by salt water so nowadays many households use tap water.

Villagers use rain water to drink mainly. Most of the households have the water container in their houses. The rain every year (3300mm/ year). Villagers take water from another system such as underground or tap water for another purposes.

In recent 6 years, the water for living is improved based on the tap water supplied by the commune. However, based on each villagers areas, some households do not establish the water system yet so they have to buy water from another households. Because they buy water so they save water and only use for cooking. Some households in Dinh Cu hamlet use water in low field to bath.

Phu An commune is up to Phu Vang district, it has some particular characteristics.

- This area have the highest temperature in the province, the averager temperature is about 24- 25,2°C
- The total temperature is from 8500- 9000 °C
- The total sunny hours: more than 2000 hours
 - o In the winter, the lowest temperature can reach to less than 10 °C. But in the summer, the temperature is high, sometimes 40°C or even more than that.
- This area have the lowest amount of rain among the province
 - o The amount of rain every years: 2600- 2800mm
 - o The amount of rain is not distributed regularly each months in a year.

- The total rain amount from January to August is less than 800mm. In June, this area does not have enough water
- This area is influenced seriously from the windstorm, flood and the dry South West wind.

According to the figure of Hydrometeorology Centre in Central Vietnam, the rainy season every year in Thua Thien Hue in general and Phu An commune- Phu Vang district in particular often happens from May, June (Western calendar) and causes the small flood. From September to November (70% amount of rain appears)

From 1978- 2005: there are 98 floods in the Huong river valley. There are average 3.5 floods above 2nd alert. La Nina happens in some years (1996, 1998, 2000) and in these years, floods happen too many times. The time for each flood lasts from 3-5 days, or even 6-7 days. The amplitude of flood is from 3-5m.

According to villagers' experiences, the flood often happens in September, October, November- Western calendar (especially in October). Besides flood, storms often occur in September, October, November

Flood and storms often cause damages to property, life, production and also influence the development of economy and society of the local, and cause serious damages to environment and ecology

Based on the group discussion (FGD), villagers remember clearly some period of time that connected closely with the disaster and the damage of disaster

Some disaster happened in this local and their influences

Timing	Influence
Flood in 1953	Damage to life and property
Flood in 1975	Failure of 250ha of agricultural productivity
Drought in 1977	Great damage, especially in agriculture. Crop failure, some villagers are hungry. Some have to leave the commune to other places to earn a living
Flood and storm in 1983	Houses are knocked down, fishing cages are drifted
Flood and storm in 1985	Damage to people and property. There are 40 households in Dinh Cu hamlet that are knocked down. The property damage is about 100 million VND. There are 36 people died in this commune (there are 13 in Dinh Cu hamlet). After the storm and flood, in the year 1985, Dinh Cu hamlet was established.
Drought in 1989	Influence seriously to the productivity and rice. Salty land.
Flood and storm in 1998	Damage to property reaches more than 300 million VND. The wind is at level 6, level 7 but some villagers come to the sea and 4 people died
Historical flood in 1999	Damage seriously to property, houses, roads... and the amount of money is approximately 10.4 billion VND. There are 4 people died
Flood in 2004	Some aquacultural households are damaged about aquacultural tools, shrimp, fish... The damage is about 10 million VND
Flood in 2005	Some aquacultural households are damaged about aquacultural tools, shrimp, fish... The damage is about 20 million VND

Above is some period of time and some damages that villagers can remember. In fact, from the year 1950, according to PhD Do Bang (Do Bang: "Flood and storm in 5 centuries in Thua Thien Hue province), there are many serious floods and storms and their damages are serious

Droughts in recent years damaged agricultural production and aquaculture. Drought often occurs in May, June, July (Western calendar). Because of the lack of water, the area

for Summer- Autumn crop can reach only 60ha. Drought brings the salty, influence the planting productivity and living. With the drought, high temperature in summer increase the salty in lagoon area and fishes, shrimps died.

Storm not only damaged the crops, property, life but also the trees.

During and in flood period, the garbage, animal died... polluted the water resource.

The water environment in lagoon is polluted day after day because of the agricultural chemical substance (fertilizer, drugs to protect plants...), garbage of villagers who live along the lagoon area, the usage of chemical substance in aquaculture reduce the fishery productivities, and even the death of fish, shrimps....

Villagers do not know how to apply new techniques in aquaculture, this not only prevent the circulation of water, pollute water but also prevent the move of creature from the sea to lagoon. Before villagers only use tools made from bamboo, net so the influence to water circulation and the creature is just a little. So, the project of net enclosure on lagoon area is really necessary for villagers.

Villagers nowadays use a lot of electrical equipments in aquaculture, this made many creatures died... There were a lot of kinds of fish such as: Tom back, tom run, cá on hương, các đối cóc, cá đuối, cá thồn bơn, cá ong bầu in the past but nowadays are rarely.

Before in this area, there is one kind of plant that that can live in salty water named “đước” but after 1990, people destroyed

From the fact of life, villagers have some experiences to help them predict some climate change, so that they can reduce damages

Villagers get experiences from observing the change of animal complexion, the change of the moving of some animal or the change in the nature (cloud, wind, star, moon, etc...)

The experience was taken from the previous generations, from the oral, or from folk song...

- Native knowledge about predicting flood
 - o When the ant build the nest on high places, there will be big flood that year
 - o Look at the tie on lá cỏ ống to guess how many times of flood and the damages
 - o When the tree named “bông lứt” blossom, there will be flood
 - o Look at the bone at the back of leg of frogs, if we see the black spot at high position, there will be big flood that year
 - o If we look at the Milky Way, we see some faint line, there will be a flood
 - o The gull fly from the sea to the land
 - o Honey build nest on high place: big flood
- Native knowledge about predicting storm
 - o Bamboo grow and face into the bush → big storm
 - o Northeast wind appear before 6 hours → big storm
 - o Hornet build nest on the land → big storm
 - o Goby eat grit → big storm
 - o Stork move from island to land → big storm
- Native knowledges about predicting drought
 - o “Trăng quầng thì hạn, trăng tán thì mưa”.
 - o There are a lot of “day to” in the sky → big drought

Nowadays, with the development of science and technology, villagers base on the modern knowledge such as weather broadcast to prevent. From the survey result, we can consider that there are 56% of villagers often follow the weather broadcast everyday, on TV or newspaper. Radio.

However, the villagers knowledges are precious in some cases. For example, according to villagers, when we see white clouds move from the sea → whirlwind appear later. In this case, meteorological can not inform immediately. The main problem here is analyze the villagers knowledge and we can base on that to combine the native knowledge with modern knowledge.

Tam Giang lagoon is one of the unique scenery not only in Thua Thien Hue province in particular but also in Viet Nam in general. There are a lot of creature resources in lagoon area. In recent 10 years, with the pressure of developing population, the aquaculture is not suitable and with some other reasons, people have negative impact to environment, ecology in this large area

- The long period strategy of Tam Giang, Cau Hai in general and the water area of Phu An commune in particular is the usage natural resources suitable, solve the conflict between developing economy and protecting environment
- The first strategy is project/ rearrange the net enclosure in Tam Giang lagoon and Cau Hai lagoon, make sure that people can exploit natural resources available.

With the strategy, there are some specific solutions:

- Re project the waterway not only for the travelling of boats, for aquaculture but also for safety in recueing in flood, storm season
- Each households should not use net with high density because it is too difficult for water to circulate and the movement of creature from the sea
- Should have a strict rule for those who catch fish with destroyed equipments on the lagoon

The authorities have intended to rearrange the net enclosure on Tam Giang lagoon and Cau Hai lagoon. However, if they want to have effective result, it is necessary to have the contribution and agreement of villagers. And authorities should let villagers know the advantage of this activities.

+ It is important to educate knowledge about environment for villagers those who live in lagoon.

+ Research offices should connect with the local to find the solutions to solve the water pollution in Lagoon area.

+ Have jobs for villagers, create some jobs, services, enhance the life for villagers to reduce the pressure to lagoon → important task

3. VINH HIEN COMMUNE

Vinh Hien is a commune belonging to a coastal plain, being a final commune in the south of the coastal cultivative land of the Tam Giang – Cau Hai lagoon.

According to the administrative border, Vinh hien commune is bounded by Vinh Hai commune in the West-North, Vinh Giang commune in the West, Loc Binh in the East-South, the Tam Giang – Cau Hai lagoon in the south and East sea in the north.

Vinh Hien commune has the geography lower and lower from West-North to West – South and its 3 directions is bounded by water surfaces, namely East seas, Tu Hien gate and Cau Hai dam connected with Tam Giang lagoon. Its geography is rather diversified, including hills, mountains (available but inconsiderable), sea, dam and lagoon, plain. This is a potential region in developing the tourism, services, aquaculture and exploitation.

Total area of natural land of Vinh Hien commune is 2,272 ha, but the area of agricultural land is little. The area of rivers, springs and lagoon occupies 2/3 of total area of land and water surface. However, the land for aquaculture is only about 60 ha. Area of forestry land in Vinh Hien commune is inconsiderable.

The whole commune has 1,898 households, of which 157 households do not have resident land, living floatingly on boats and guardhouse. The households living on boats and guardhouse rely on aquaculture and exploitation over many generations. Therefore, they

become the fisherman's associations, career villages specializing in cultivate a fixed kind of product. For that reason, population structure and labour are allocated by villages. The commune established the project of settle cultivation and residence. This project was approved by the provincial People's Committee and will be started in 2007.

Previously, the commune leaders had the plan to evacuate the people to the off-shore places for settle residence, but the local people did not want to move to a new place. After the history flood in 1999, many households living on the boats asked for the permission to live on shore because of being afraid of the flood. Total number of persons are 9,010. The commune is divided into 7 villages (Dong Duong, Hien van 1, Hien Van 2, Hien Hoa 1, Hien Hoa 2, Hien An 1 and Hien An 2). The village with the biggest population is Hien Hoa 1 (445 households) and the smallest is Dong Duong (88 households) (table 2). The village with the highest rate of agricultural production households is Hien Hoa 1, and the village with the highest rate of aquaculture households is Hien An 2 and Hien Hoa 2. Total number of poor households in 2005 in the whole commune is 457 households. The rate of yearly population increment is about 1.62%.

The livelihood of Vinh Hien commune is diversified, including agriculture, aqua exploitation, industry, construction, commerce, transportation and other services. Analyzing the data in table 6.2 showed that the rate of agricultural production households occupied about 10%, no household depends on forestry production, number of aquaculture and exploitation occupies about 1/3 total number of households of the whole commune. The structure of income resource of the local people can be divided into 4 main groups, including the main income resource from agriculture and aquaculture, the main income resource from industry and construction, the main income resource from services and others (table 6.3), of which the number of households with the income resource from agriculture and aquaculture occupied nearly 50% total number of households. Due to the geographical position, Vinh Hien is one of the tourist sites, and is a place with many aqua and sea foods, so the service and business activity are under good development. The number of households with the income resource from service is rather big, accounting for up to 21.34% total number of households.

In the recent years, thanking to the change in rice planting technique such as changing from transplanting into direct sowing, using the high yield rice varieties, namely IR38, X21, X23, ... it saved the labour force and contributed in improving the rice productivity. However, in general, crop production met many difficulties and was unstable. The irrigation water resource depending on the nature, dry in summer and waterlogged in rainy season, infected with diseases and insects, degraded cultivation soil are the main difficulties in crop production.

Due to the limited conditions of natural food source and agricultural by-products and wastes, the career of cattle production is under poor development. According to the report of commune's People's Committee, in 2006, the whole commune has only 154 buffaloes and cows. However, thanking to the abundant fishery resource, the pig and poultry (chickens, ducks) production is under rather good development. Total number of pigs in 2005 is 694 heads. Although the avian flu put affect on the chicken and duck production, making total number of poultry decreased considerably compared to the previous years, total number of poultry of Vinh hien commune in 2005 remained 3,385 heads.

Due to the specific natural condition, aquaculture and exploitation are strength of the local. According to the division of household groups in the commune, the number of fishery households occupies near 35% total number of households in the whole commune. The raised types are very various, including shrimp, sweet snail, dorab, groupers, red snappers, Dia fish *siganus canaliculatus*, crabs, small crabs. Previous, the white shrimps was the type which many local people select to raise. Many households invested the labour and budget in raising shrimps. However, in recent years, the water environment was polluted and the breed resource was not active, hence, the shrimp diseases spread on the large scope (the

shrimp disease in 2005). Some popular diseases on shrimps are consist of white spot, yellow head, black gill, zoothanium and white faeces. The diseases caused low productivity of shrimp production, and many households suffered the loss regularly.

Sweet snail is one of the raised new types in the commune. However, to raise sweet snail, it requires a big amount of both time and budget and the construction of Tu Hien bridge is under progress, affecting to the quality of water resource, and with the high risk of diseases, the local people do not dare to do investment. Some diseases on sweet snails include dropped-down bowel and slow growth (reason is not found). The number of sweet snail cages in 2006 is reduced compared to the year of 2005 (5 cages but the target of 30 cages).

Due to the failure in raising white shrimps in the years of 2003-2004, the local people were active in changing the raising method and type. Many households cahnged from monoraising shrimps into integrated raising, focusing on raising fish in cages and other types such as crabs, potunus pelagicus. The number of brackish fish cages has the tendency of increasing from 2004 to 2006. However, when changing into raising the new species, many difficulties occurred, for example, the breed source was not active, natural feed was lacked or the water environment was changed, unsuitable (table 8).

For the fish species with high value such as red tilapia, grouper, *Dia siganus canaliculatus*, because the breeds production has not done, the breed resource depended totally on the clooection from the nature. The feed resource was previously available in the lagoon (seaweed), but presently, it has been exhausted due to the over exploitation and salt increament. Whereas, the use of industrial feed for these species met the difficulties because the initial study showed that the fish taste was reduced compared to the fish raised with natural feed and the price of inductrial feed was too high, over the market acceptance. Some new species are easy to raise, require little capital, have cheap breeds and large market also met difficulties due to the salt increament after the history flood in 1999, so the Tu Hien gate is opened. In addition to raising brackish fish, freshwater fish raising occupied about 0.7 ha in the whole commune.

Sea capture products include fish, squid and shrimp. Lagoon capture products include fish, shrimps, crab and crab potunus pelagicus. The capture and exploitation of aquatic products on the lagoon and on the East sea are the key economy of the commune. However, some difficulties in sea exploitation are consist of inconvenient narrow passage, shallow and narrow Tu Hien gate, reduced fish quantity and the local people lacked budget to invest in the synchronous capture equipment. The capture on the lagoon also met the difficulties such as the penculture was not planned, exterminated capture was not prevented, and the fish quantity in the lagoons, rivers was reduced.

In the year of 2005, total number of poor households of the whole commune is 457 households. The poor households belong to the different groups, namely farming group, fishery group, disable and shorthanded group. As reported by communal leaders, up to 2006, 157 households still do not have resident land and have to live on boats or guardhouses and live on aquatic capture. These households live in the commune over many generations. The Resettlement Project for these households has been approved and will be implemented in 2007.

There are many reasons leading to the poverty such as lacking experience in production, lacking capital, a lot of children, lacking man power, elderly, illness, diseases, diseases of aquaculture, aqua equipment was swept away by floods.

To seek for the income resource, the whole commune have more than 800 people working in far places, but their population book remained at local. The people who work in far places could be the secondary schools' pupils. The number of people working in Ho Chi Minh City occupies the highest rate. Most of them go to work all year round and often return home on Tet holiday, however, about 20% of them go to work in far places

seasonally. The poor people's wish is to get the technical training, construction of irrigation system, the borrowing program suitable with the poors (the loans of 10 millions VND in minimum with the period of 3 years in minimum at the maximum interest of 0.5%/year). Presently, there is no tap water system to serve the living demand. The living water is mainly from the wells. The whole commune has 792 wells of which 305 dug wells and 487 drilled wells. The number of people using clean water is 6,900 people. In the dry season, many households which do not have wells or their wells are caught with alum, so they have to go to get or buy water from other places in the commune (table 15). The whole commune has the asphalted in-farm canal system with the length of 2km. Due to the conditions of geographpy and land, because the soil's capability of retaining water is bad, the geography is too narrow, the surrounding is the sea and lagoon, the water source for production depends mainly on rain water and some underground water from the sands. It could be said that in addition to a small area of land could produce 2 crops/year and a big part of agricultural land produce only 1 crop/year. Irrigation system for aquaculture is unavailable, causing the severe pollution in many shrimp raising sites. As a result, the shrimp diseases happened on large scope for many years and most of shrimp raising areas in 2006 were abandoned or changed into extensive culture with some other species because the intensive shrimp raising people suffered the loss prolongly.

Vinh Hien is the commune in a region affected by the monsoon tropical climate, hot sun, a lot of rains and affected by the sea and continent. The annual average temperature 24oC, nthe highest temperature is up to 44oC, the lowest temperature is 9oC. The annual average humidity is 83%. The average evaporation is 1,000mm/year. The highest evaporation is often dropped in June and July. The wind directions in summer are mainly South and West-South winds with the speed of 1.3-1.6m/s. In winter, the main wind directions are North and East-North with the speed of 1.6-1.9m/s. The storm wind often happens in September, October and November.

A year is divided into 2 seasons: dry season lasts from March to August with the average rainfall of 47-63mm, the pinnacle is in May, June, July. The rainy season lasts from September to February next year. The biggest rainfall is in October and November, in average, the number of rain days in the pinnacle months is 20-22 days/month, the aveage rainfall is 680-800mm/month. This is the flooding season in the region.

Previously, the experience in forecasting the natural calamity plays very important role in reducing the damages. This experience is accumulated through many generations. With the geographical characteristics of the commune, this is a place where often copes with natural calamity. The life of majority of the inhabitants depends mainly on the waterways, so the experience in forecasting the natural calamity becomes more and more important. These are the factors making the local people's experience in forecasting the natural calamity very plentiful.

However, in the past years, due to the development of the forecasting and communication means, these experiences sre used less and less. Some native knowledges of forecasting the natural calamity of Vinh Hien commune's people are as follows:

- After the full-moon day of lunar July (15/16/17-21/22/23 of lunar July), it often rains heavily.
- On 29-30 of lunar August –20, 03 of lunar September, it has heavy rains.
- In lunar October, the streets are waterlogged for many days.
- The typhoons often happen in the lunar months of July – August – September.
- If any year when the bamboo shoots spring up closed to the bamboo tree or their direction to the hedges, many big storms will happen.
- Black ants crew to high places, big flood will come. .
- Snails crew to the bamboo stake on the lagoon, there is often big storm.
- On the coast, looking at the clouds and wind direction, when the clouds are orient to the East and connected together, a storm is going to come. There are 4 types of

wind, namely the south wind from April to June, the contrary south wind (from Phuoc Tuong pass), the easterly wind from Bach Ma after the storm, the contrary easterly wind from the sea, there will be a storm. If there is contrary easterly wind, the sea water's level will rise highly for some hours.

- Thunderstorm has lightnings, but without sound, the rain will be very heavy. If the lightnings start from Thuan An to the pass, it is going to rain, but from Thuan An to the sea, it is not going to rain.
- If the bee nests are situated at the high places, there will be big winds, but in the low places, there will be big floods.
- The ant nests are on high places, there will be big flood with light wind.
- Discovering the floods and storms through grass. The number of ties in the middle is equivalent to the number of floods in the year and the clearer the tie is, the bigger the flood is.
- The clouds happen in the East sea, there will be big wind.
- If the wind blows from West-South to East-South, the water will go down.
- In July, looking to the sea' direction, if the clouds are gathered into a mass, there will be big rains. In March, looking to the mountain's direction, if it is much cloudy, there will be strong lightning (looking outside in July, looking inside in March).
- The ants construct their nests at the low places, there will be big storm.
- "It is dry when the halo is near the moon, it is rainy when the halo is far from the moon".

Being a place coping with many floods and storms every year, Vinh Hien commune's people have a lot of experiences to adapt to the natural conditions. This adaptation was expressed through many different aspects such as the activities before the flood, during the flood and after the flood, the adjustment of livelihood strategies, the bilingual assistance,... The adaptation was also showed in the different levels such as household, village and commune. Some native knowledges about the flood control of Vinh Hien commune's people are as follows:

- Improving the net, upgrading the ponds from August to prevent from the flooding season.
- Buying the dry foods such as noodles, dried shrimp, dried fish, oil, lamp, woods, bags,... before the flooding season or after the weather forecast.
- Excavating the canals.
- Binding and upgrading the house before the floods.
- For the villages, communes: establishing the resident groups, upgrading the dykes, the Board of Flood Control makes the plan in accordance to the "4 on-the-plot" policy, establishing the rescue teams, preparing the rescue facilities (life jackets, bouys...), preparing medicines.
- Selling animal before the flooding season (solar August).
- Preparing the sites for boat parking.
- Updating the information from radio, newspaper, the communal, village board of flood control.
- When the storm is going to come, arranging rice to high places, moving the domestic facilities to safe places, taking capture facilities on the lagoon to keep at home, harvesting beans and rice.
- The women prepare the dry foods for 3-5 days in minimum. It is important to move people to safe places and prevent facilities to continue the production after the flood.
- Pitching bamboo or putting sand bags in front of house to prevent from strong waves.
- Preventing from traffic landslide in the villages by sand bags.

- When the water rises fast and up to 1-1.5m, moving people and some facilities. The domestic facilities which are too heavy to move are arranged in the high places or bound or tied to be not swept away, moving the children before moving or arranging the facilities.
- Running to other houses or public house (People's Committee) when the water rises fast.
- Mobilizing all of forces to help the heavily affected households, treating and doing hygien for environment, collecting garbages, treating water according to the health's guidance, upgrading the gardens and fields for next crop. If they do not have condition, they can buy in debt and then pay debt after the harvest.
- Borrowing money to overcome the flood's consequence, to make new corral if it is swept away, ...
- Suggesting to set up more parking places because many boats remained on the lagoon when the big flood came.
- Having good production plan and intime to reduce damages caused by the natural calamity such as using the short-term rice varieties to harvest before the flooding season, raising shrimp and fish in right crop, fish in cages should be harvested early or moved to safe places or surrounded by net if the floods come early.
- Reducing the risk and damages by diversifying the income resource ("there are some careers to change from this to another when risk happened").

4. HAI DUONG COMMUNE

Hai Duong commune is isolated with other communes and located inside the Tam Giang-Cau Hai lagoon which belongs to the administrative boundary of Huong Tra district, Thua Thien Hue province.

Hai Duong has special position nearly separated outside the Tam Giang lagoon. The commune is bounded on the east by Indo-Chinese sea, on the west separated with Huong Phong commune by Tam Giang Lagoon, on the north by the Quang Cong commune, on the south separated with Thuan An town by Thuan An beach mouth. One most typical characteristic of Hai Duong commune is that it lasts along a single way from northwest to southeast with inhabitants concentrating along the inter-communal road. Transportation is difficult especially in the flood season.

Total natural land area of the commune is 1.027ha lasting along the inter-communal road, and considered as the inter-village road. Most land of Hai Duong commune are sandy dunes which stretch into the east, the cultivated land parts are dispersed along the Tam Giang lagoon in the west. The result of survey shows that the agricultural land is about 349,43 ha; non-agricultural land occupies 544,39 ha; un-used land including mobile sandy areas and natural dunes in the east, bordering on the sea is 133,18ha. In the total of land using for production (349,43ha), the rice paddy land occupies around 60 ha; cropping land (chili, beans, sweet potato,...) is about 9 ha; land for aquaculture is 91 ha; land for planting protection forest and sand prevention forest is 189 ha. Thus, actual land using for production is around 40%, this reveals difficulties that the local people have to bear.

The commune has a rather large area of water surface which serves for exploiting natural sources (436 ha), and the un-used land area more than 133 ha is not yet fully invested to develop production.

From the geographic location and proportion of land types, we can see that Hai Duong is a commune still has many difficulties in economic development.

Whole commune has 1.458 households (HHs) with 8.199 persons (on an average, it is 5,62 persons/household).

- In which:
 - o Number of households with living sources mainly depending on agriculture – forestry – aquaculture are 756.

- Number of households with living sources mainly depending on industry-construction are 164.
- Number of households with living sources mainly depending on services, trade are 352.
- Other careers are 218 households

The detail of career-based household groups is described in table 2.

In the career distribution table, aquaculture is the work which gives main income (41,13%) for the local people of the commune. Following is services, trade activities and aquatic product processing. Agricultural production only occupies a limited proportion (9,27%).

The specific characteristic of Hai Duong is coastal commune with a large area of forestry land and un-used land, so this area provisionally is planned into protection forest to prevent mobile sand and limit influences of wave and wind. Moreover, forest plantation land is sand dunes/sand knoll, so the area is limited and poor nutrition which leads to direct income from plantation is not remarkable. The main forestry species is planted is casuarina-tree (*Casuarina equisetifolia*). Casuarina is introduced tree, was planted in this area 300 years ago with the aim to protect the coastal area. Spending long time, casuarina has proved its adaptive ability with this environment, and it has become the priority for planting in the coastal areas. Besides protection of coastal area, prevention of sand mobile and land slide, Casuarina plays important role in providing fuelwood for Hai Duong commune. The result of survey proves Casuarina forest again the source of fresh underground water supply for residential areas. Almost main underground water sources for production and living belong to these important maintaining sources of water. Besides casuarina, some local trees also participate in covering land and protecting coastal areas in Hai Duong commune. However, so far it not yet has many detailed researches about these species

The annual change of casuarina area is rather big, the households also dynamically exploit and plant casuarina in this area. However, a land tenure issue has limited the remarkable increase of forest cover. Noticeably, in 2005, with the investment of ODA projects funded by Finland the local people had newly planted 8 ha of casuarina forest.

To protecting the protection forest, the commune has established forest protection groups. Currently, these protection groups are working well.

Rice is the main crop of the local people in Hai Duong. However, due to the poor nutrition of soil, weak irrigation system, lack of fresh water for irrigating, almost rice paddy areas are used in one season so the productivity is not high (4,66 ton per ha).

Besides the rice paddy, the commune still has more than 7 ha of vegetables, crops and short-term industrial plants.

Income source from agricultural production of Hai Duong is rather low, the north villages have larger cultivated land area so they have rather big income from cultivated land, the south villages such as Thai Duong Ha has no cultivated land so their main income belongs so much to fish catching and aquaculture.

Due to isolated with other areas, transportation obstacles, the consumption and exchange goods meet many difficulties. This affects to the development of animal husbandry of the local people.

Total herd of the commune includes 6.200 heads, in which:

- Pig: 1.800 heads
- Cow and buffalo: 2.070 heads.

Most of local people raise cattle by leaving unbridled which affects to the crops of local people.

Veterinary and disease prevention are well implemented so it limits the impact of epidemic disease.

Aquaculture is a strong force and one career giving main income of Hai Duong commune. In 2005, both catching and developing of aquaculture reach 2005,8 ton. In which, sea exploited productivity is 1.589 ton. Fish with high economic value is 227 ton.

Aquaculture productivity is 155,8 ton, increases more 21,8 ton than the year of 2004. In which productivity of Black tiger shrimp (*Peneus monodon*) is 80 ton, of caged fish is 64 ton, and of other crab and fish is 11,8 ton. Recently, basing on the support of Finland program, the local people take full advantage of fresh water area to raise 25.000 fresh fishes. The initial result reveals that these households gain rather high effectiveness.

Although bringing highest income for the local people, in recent time the aquaculture and catching have weakly developed. Many households have met epidemic disease with shrimp so they can not pay a debt for banks and other sources where they borrowed money to invest in aquaculture. Some households invested in making new boat for catching in distant sea, but because of the low technique, lack of experiences so they had to sell their boat with low price that can not compensate the invested expenditure.

Currently, in aquaculture, the local people have some changes in aquaculture pattern. Mixing many species in the same pond in order to improving quality of water environment is implemented. Some new species are introduced to diversify the raised species (caged fish raising in highly salty areas,...)

In total of 1.458 households, the number of the poor households (basing on the new criteria of the government) are 210 (occupying nearly 15% of households in whole commune). Average income of the poor households is only around 170.000VND per person per month. In recent time, there are 185 households escaping from the poor, but 103 households are re poor again. The reason of re poor is not mentioned in the commune's report. According to the survey and household interview of the research group, some below reasons can cause the re poor of households:

- Cultivated area is small, poor nutrition and salted,... leading to the low productivity of crop.
- Impacts of natural calamity, flood, drought, land slide,... make production activities and residence of the local people become unstable.
- Households have many children or many people with poor health or illness.
- Impacts of diseases in shrimp and other sea products make many households be indebted in bank and cannot pay.
- They lack capital to invest in production.

The survey result of income sources of poor households reveals:

- Most poor households have only 2 to 5 different sources of income, but all these sources are dispersed and unstable.
- Major income sources of these households are mainly from agricultural production activities and hired labour. Specific income sources are detailed as following:
 - o Capture fisheries
 - o Agricultural cultivation
 - o Construction activities
 - o Livestock – animal husbandry.

As presented in previous parts, careers and livelihood distribution of the local people depends on the geographic distribution of residential areas. The residential area in the North of Hai Duong commune, where have a lot of agricultural land and favourable water source, the main income is from agricultural production activities such as cultivating wet rice, crop plants and other vegetables. On the contrary, the economy of residents in the south of the commune including villages such as Thai Duong Ha, Thai Duong Thuong, heavily depends on activities related to aquatic products such as catching (on the sea or in the lagoon), aquaculture. The services depending on these carriers are also developed in these residential areas.

Most households in this area have few conditions to send their members to the school. The survey result on schooling level of household's head, who makes decision in all activities of the households, is presented in table 6. Only 30% of household's head attended school and graduated secondary school (9th grade) and above. The rest normally finished the primary school (5th grade) and had no condition to attend school.

The survey result of proportion of income and income sources of the households also reveals that many households have income from the help of relatives (oversea Vietnamese, migrants,...). These sources often play an important role in certain periods, especially in the time of mobilizing capital or at the end of year when households need to spend money for the Tet holidays. However, this income source in general is unstable for the Hai Duong commune.

The natural calamities in recent year have many changes. Averagely, numbers of floods and storms occur yearly in the local area from 4-7 floods. However, the effective level of storm and flood are different.

Point of time	Effectiveness
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The 1953 flood (Flood in Dragon year)	In this flood, the water level increased around 3 metre. Due to effectiveness of flood, the previous estuary namely Eo beach mouth (belonging to the Hoa Duan village, Thuan An town presently) was filled up and the Thuan An beach mouth was opened replacing the old one and cutting the Huong Hai commune into 2 parts (the Thuan An town and Hai Duong commune as present). The traffic was heavily broken. Many people died (can not remember the number due to the flood went along time). Graves were swept away; soil dyke system preventing the salinity was broken.
The 1961 storm	The locality was heavily damaged in crop, rice, property, and cattle. Fortunately, human damage was a few.
The 1976 flood	The water level was high and flooded around 1,5metre. The residential area was isolated into 2 sub-parts. Dyke, crops was heavily damaged. This year the country is just unified, the local people's living was still unstable which was damaged by the natural calamity, so damaged level was too great.
The 1983 flood	The damage level was similar with the flood 1976. After the flood, the salted water overflow to the field which makes the production was interrupted around 1-2 years.
The 1985 storm	Big storm with 12 degree of wind level and shocking above 12 degree. In this period, the warning system was not developed; the local people after long time did not meet any big storm so they were subjective and passive. Big wind combined with flood-tide flow the property of the local people to the sea. According to statistic data, nearly 100% of households lost their property, 70% of houses were collapsed or damaged. Houses in the villages Ganh and Cho were leveled ground. In this storm whole province had hundreds died people but Hai Duong commune had no one died. After the storm, 120 households had to move to another area.
The 1999 flood	This is the historical flood. Many parts of the commune were flowed to the sea, place heavily broken was 200metre with 15metre of depth (until April 2002, this estuary just was closed). Two Ganh and don villages were mostly damaged. In this flood, many places were under the water around 3-4 metre depth, the time of flood around one week. Generally, this flood created biggest

damages for local people if comparing with previous floods.

The 2004 flood The 2004 flood was also a big flood for some areas in Thua Thien Hue province. However, the rainfall concentrated mainly in Huong river. In Bo river, the rainfall was a few. The water flowed to low land was not remarkable so it has a few impacts on the production activities of the locality.

Review the impacts of natural calamity to the local people in Hai Duong commune in particular and in the central Vietnam in general, we have some comments as following:

- The frequency of the natural calamity in recent years were more and more increase
- Intensity and degree of natural calamity were more and more big

For the flood, the water from the upper stream run to the low land is more and more fast. Before, after raining 2-3 days, we just saw mud water, but now only one night we already see that mud water running to the lowland. During the flood, the water speed is too fast.

With the quality of houses in the surveyed area, the capacity to prevent and minimize the damage of natural calamity is great. We evaluate capacity in preventing natural calamity through the ability to stay at home of households when flood and storm occur. The result shows that most of households have tendency moving to the higher place to shelter when natural calamity come. It needs to clarify that the natural calamity in Hai Duong commune is flood and storm.

Storm creates heavy damages because the materials for making the house of the local people are not good and the house structures are not solid. Most of interview results reveal that storm is very dangerous because it has great impact to human life and property. When storm occurs, the local people move to shelter in places having better infrastructure such as pagoda, communal house, school, commune people's committee office, house with concrete structure

Flood damages the cultivation activities as well as aquaculture. However, the damages to human life causing by big floods is not remarkable. The local people have habit to move to sand dunes or move to high place before the flood comes, the damages related to human life rarely happen. Only the case of the 1999 flood, above 90% of surveyed households told that flood damages their house and human, the damages of other floods (1975, 1984, 2004, 2006) are recognized of 40% surveyed households.

The communities often help each other in prevention of natural calamity. Important information flows in the community are from the neighbor, relatives and career associations. Around 85% surveyed people answer that the neighbor, relative and career relationships play important role in preventing and overcoming natural calamity. This role is through sharing information before, during and after natural calamity as well as capacity in sharing, safety and overcoming the spiritual consequence.

Before, when the weather and flood and storm forecast system was not developed, the economic living of the local people was not high, in order to preventing impact of natural calamity the local people had to base on the experiences or indigenous knowledge to predict the change ability of the weather to prepare for coping. Through collecting information, we found that the local people still maintains experiences related to predict and prevention as follow:

- Before the raining season, observing the location of the bamboo shoot, if the shoot grows inside of the bamboo cluster, that year will have big storm.
- The sea surface is quiet, the wave lights as glow-worm. It means that after 8-10 hours it will appear storm.
- Observing one grass species (co nang). If it has many big culms, that year will have many floods. If that grass species has small and few culms, it means that very few floods occur.

- Disemboweling of goby, if in its bowel having many shellfishes, it may has big flood. According to local people's experiences, this fish eats a lot of shellfishes to keep its body heavy, so it can stay at bottom of river to avoid the water flow.
- Normally if "Cang" fishes run to the fish corral, it means that the weather has big changes (heavy raining or storm)
- Shellfishes stick together into big cluster, it means that big flood will appear (the cluster will keep shellfish not follow the water flow)
- When informed the storm coming, the local people cover the roof by straw to avoid the turning up the roof (straw absorbing water will be heavy).
- To avoid diseases after flooding, the fishers often eat garlic or ginger to prevent the cold.

III. RECOMMENDATIONS AND CONCLUSION

The results from this study conclude that:

1. Locating in the lagoon area, but the natural, social and economic conditions of the four communes are different.
2. The influences of flood, therefore difference to each commune and each location. Annual floods have both positive and negative affects to production, such as flood bring good condition for soil fertility, cleaning environment,.. but also damage crop and aquacultural farms.
3. Local people have experiences in coping, recover and adopt to the annual flood. However, the big flood is out of their capacity.
4. The training in all aspects of flood management, crop, luivestock, aquacultural production are need to local people.