

# **Aquaculture and Forestry Activities in Duyen Hai district, Tra Vinh Province, VIETNAM**

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**MONOGRAPH on**  
**Aquaculture and Forestry Activities**  
**in Duyen Hai district, Tra Vinh Province,**  
**Vietnam**

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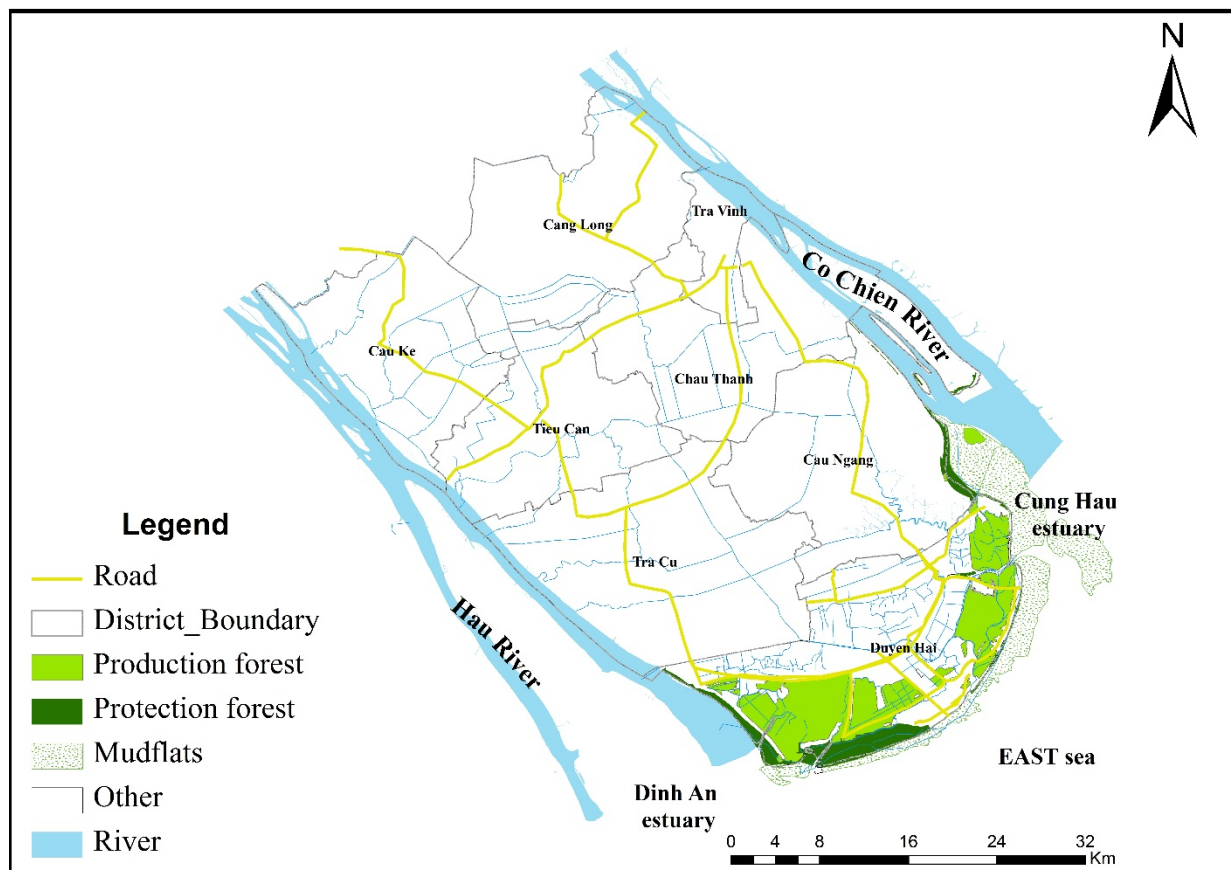
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# 1. Tra Vinh province

## 1.1 Introduction

Tra Vinh province is located in the north-west of the Vietnamese Mekong delta (VMD) which is between the Co Chien river and the Hau river (Figure 1). The province includes Tra Vinh city and 8 districts named Cau Ke, Tieu Can, Cau Ngang, Chau Thanh, Tra Cu and Duyen Hai (General statistical office, 2015). In 2014, Tra Vinh's population, which is slightly more than one million people, was one of the three lowest among the provinces in the VMD, with 83% of it's total population being made up of it's rural population. The province's population density was 440 person/km<sup>2</sup>. Tra Vinh city had the highest density (1,554 person/km<sup>2</sup>) while the lowest density was in Duyen Hai district, which had approximately 246 person/km<sup>2</sup>. According to the General statistical office (2015), Tra Vinh's unemployment rate was 2% while the employed population – aged 15 and above, was 602,000 persons, or approximately 58% of the total population in Tra Vinh province in 2014. In 2012, the average monthly income in the province was about 1.4 million Vietnam Dong (VND); in the rural area this was 1.2 million. The rate of poor households was approximately 10.7% in 2014, the second highest of all the provinces in the VMD (General statistical office, 2015).



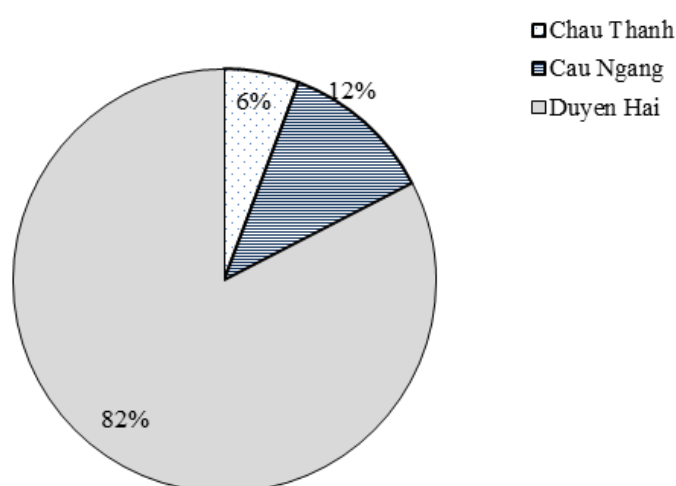
*Figure 1: The administrative map of Tra Vinh province*



## 1.2 Land use and aquaculture

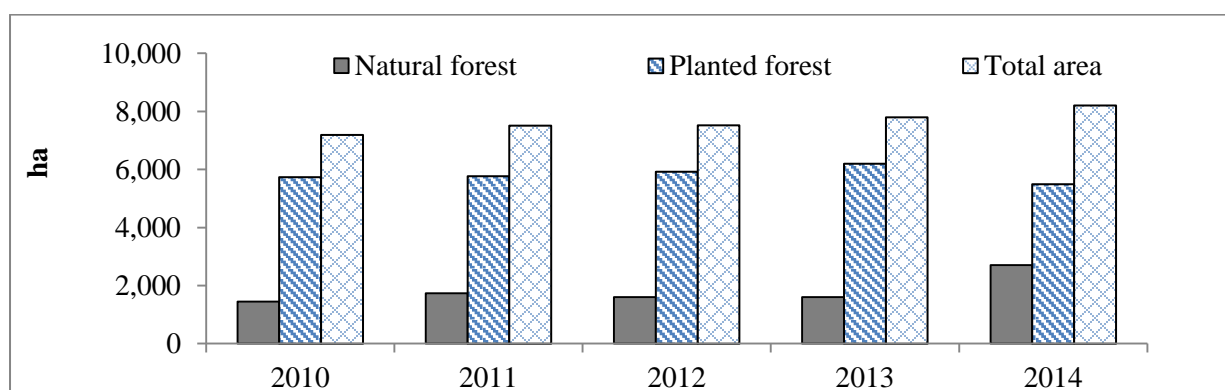
Tra Vinh province covered 234,116 ha in 2013. The average area per capita was 0.23 ha/person. Agricultural production land accounted for 184,024 ha, occupying 63% of the total land.

Forestry trees coverage was 6,676 ha and water surface used for fish farming – including the mixed mangrove-shrimp farms, was close to 13% (29,734 ha) in 2015 (General statistical office, 2015). The production forest in the province had about 4,300 ha and occupied 65% of the total forest area. In production forests, shrimp may also be farmed. Forest area is mainly located in Duyen Hai, Cau Ngang and the Chau Thanh districts, occupying 6,777 ha (82%), 959 ha (12%) and 471 ha (6%) respectively (Figure 2)



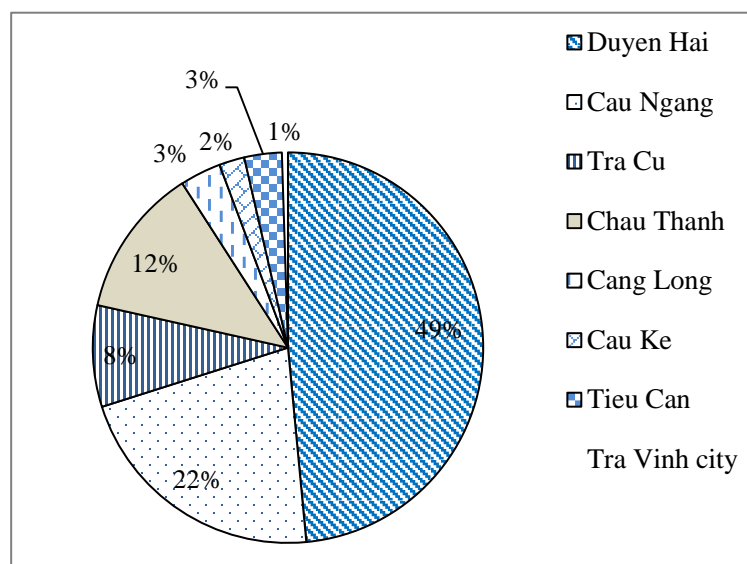
**Figure 2: Distribution of the forest area in Tra Vinh in 2014**

From 2010 to 2014 the forest areas (which includes current forest, mudflats, shrubs, planning areas) in Tra Vinh province, increased slightly from 7,198 to 8,207 ha (Figure 3). The increase occurred mainly in natural forest areas, while the areas of planted forest fluctuated during the 4 years. The planted area was approximately 67% of the total area in 2014 (Figure 3).



**Figure 3: Forest area in period 2010 – 2014**

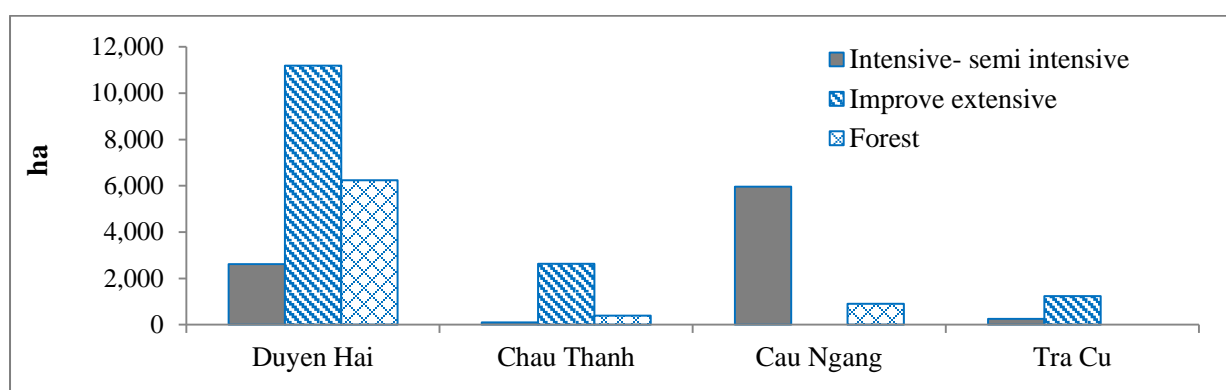




**Figure 4: Structure of aquaculture area in Tra Vinh Province in 2012**

Aquaculture in Tra Vinh province is divided into two types: fresh water and brackish water. The brackish water area occupied 25,648 ha, approximately 83% of the total aquaculture area in 2015 (General statistical office, 2015). In 2014, the area of aquaculture had increased to 30,835 ha in which Duyen Hai has the largest area. Cau Ngang district area was ranked second in the province, while the smallest aquaculture area is in Tra Vinh city (Figure 4, Figure 6). Fresh water aquaculture area was 0.5-3.4% of the total province aquaculture area.

Shrimp farming in brackish water in the province includes intensive, semi-intensive, improved extensive and mixed shrimp-mangrove systems. The largest area of intensive and semi-intensive shrimp farming is in the Cau Ngang district while the extensive area that improved the most is in the Duyen Hai district. The mixed mangrove-shrimp farms are included in production and protected forest areas (Figure 5).



**Figure 5: Brackish water shrimp aquaculture and forestry area in Tra Vinh province**

Total fishery production in Tra Vinh province is approximately 177,000 tons, in which catching accounted for 45% of the total production, approximately 80,000 tons. The main products from aquaculture were molluscs, shrimp and various crab species. The brackish water aquaculture area is found in Duyen Hai, Cau Ngang, Chau Thanh and Tra Cu district. Shrimp productivity is different between species and farming systems (Table 1). From 2005 to 2012 the productivity of *Penaeus Monodon* (Tiger shrimp) fluctuated between 410 kg/ha and 810 kg/ha. The farming of *Litopenaeus Vannamei* (White leg shrimp) started in 2008; at the time *L. Vannamei*' productivity was higher than that of *P. Monodon*. However, recently *L. Vannamei* productivity has declined due to disease, particularly in 2012. The intensive and semi-intensive *P. Monodon* farming systems had an average productivity of 1.35 ton/ha (Table 1). The yield of the improved extensive *P. Monodon* farms was 360 kg/ha. *P. Monodon* is farmed in Duyen Hai, Cau Ngang, Chau Thanh and Tra Cu district, while *L. Vannamei* is cultured in intensive systems in Chau Thanh Duyen Hai and Cau Ngang districts.

**Table 1: Aquaculture productivity in Tra Vinh from 2005 to 2015.**

Category		Productivity (Unit: ton/ha)								
Species	System	2005	2006	2007	2008	2009	2010	2011	2012	Average
<i>Penaeus Monodon</i>	Improved extensive	0.4	0.52	0.41	0.35	0.38	0.42	0.3	0.12	0.36
	Intensive – Semi intensive	1.04	1.13	1.08	1.25	1.08	1.67	2.65	0.91	1.35
<i>Litopen. Vannamei</i>	Intensive – Semi intensive	-	-	-	4.21	9.83	3.12	5	1.51	4.73
Crabs		0.27	0.25	0.35	0.25	0.39	0.47	0.41	0.39	0.35
Molluscs		3.08	1.59	1.39	1.83	1.03	0.78	1.63	0.58	1.49

### 1.3 Appropriate districts for combining forestry and aquaculture

The forest areas in the districts of Chau Thanh and Cau Ngang are limited, although the island in Chau Thanh and the riverside in Cau Ngang are important mangrove locations. Duyen Hai is the district of Tra Vinh Province with the largest areas of both forest and aquaculture.

Mangrove areas include both protection and production forest. Duyen Hai also has plans for the expansion of industrial areas along the coast and estuaries of the Nhu Lac commune.

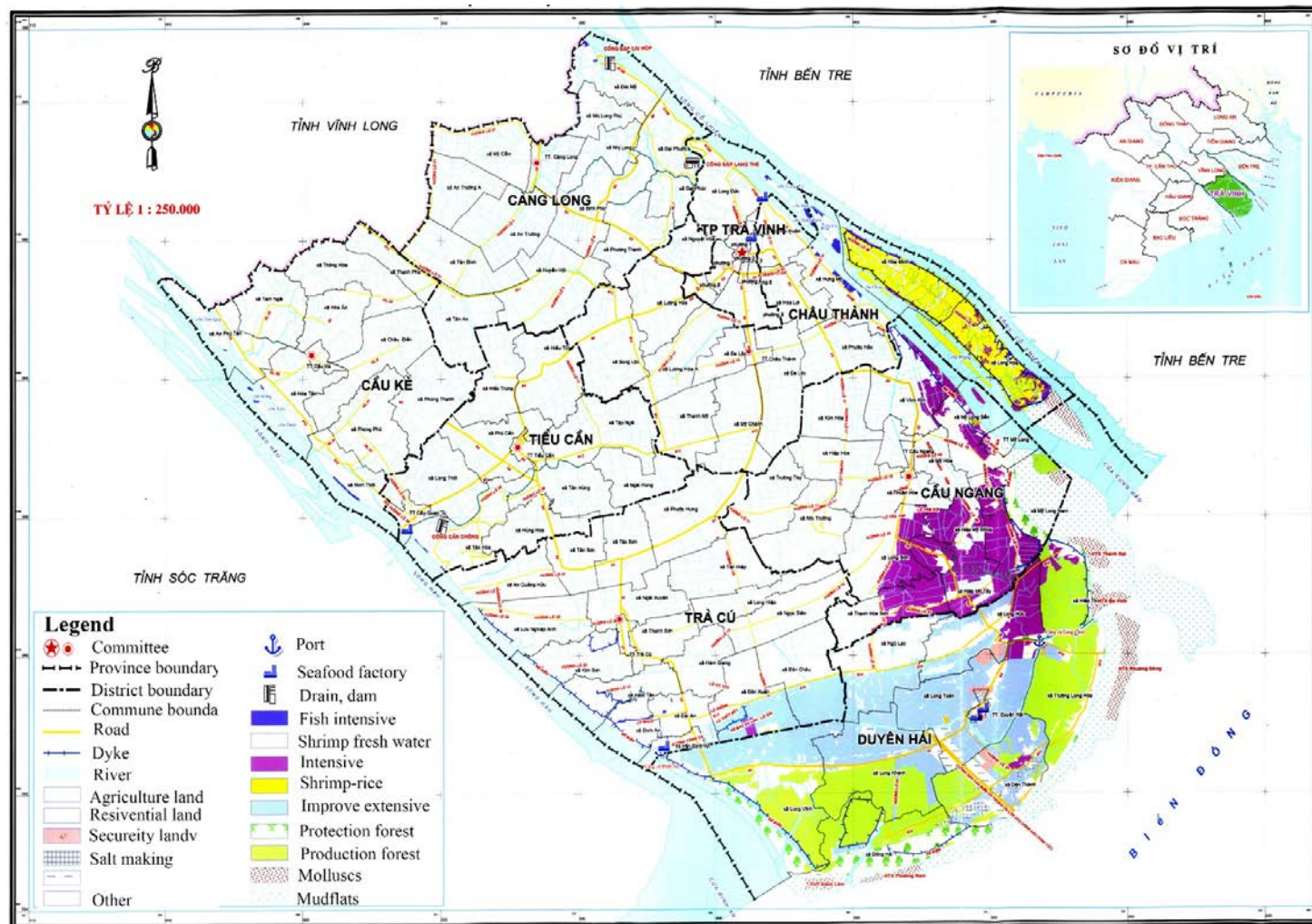
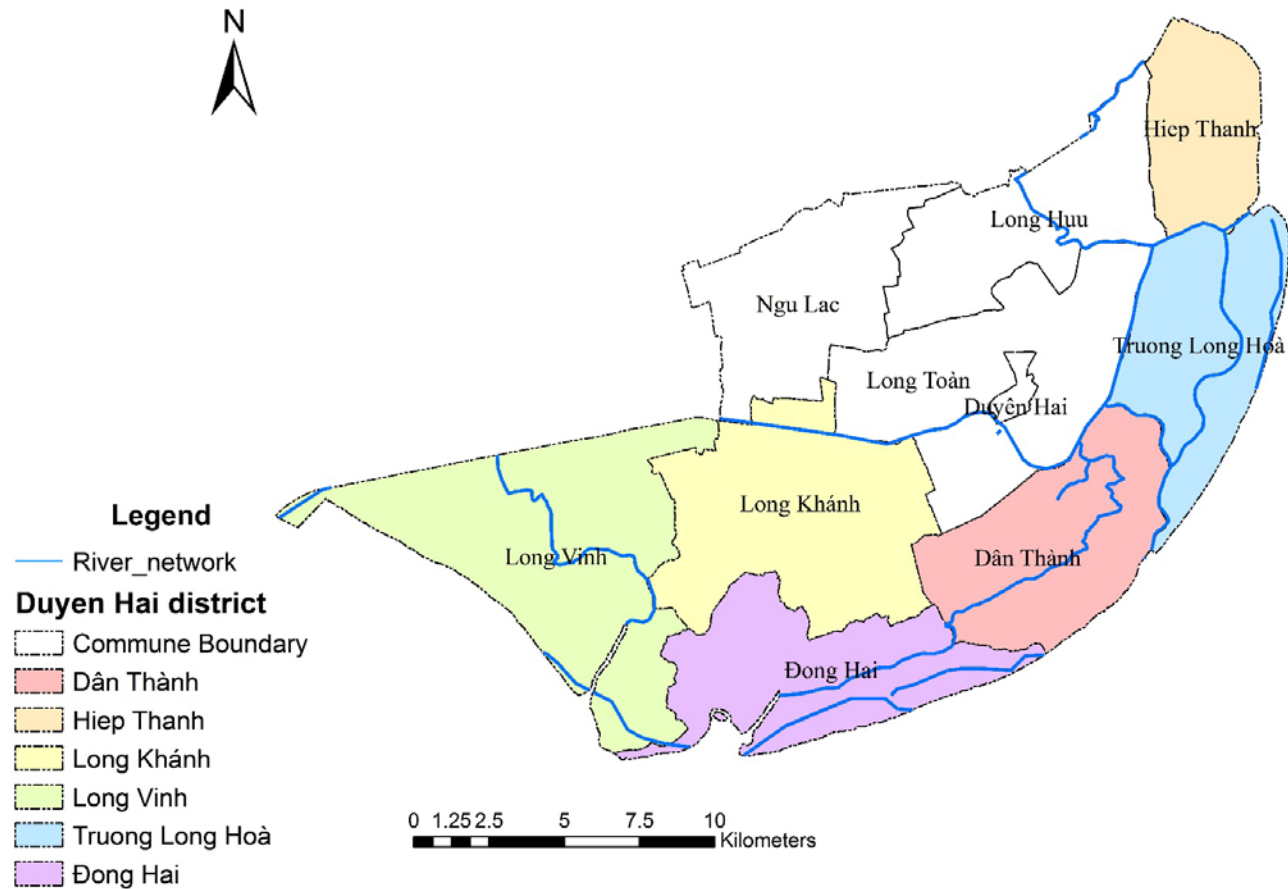


Figure 6: The aquaculture map of Tra Vinh Provinces in 2012

## Duyen Hai district, Tra Vinh Province map



*Figure 7: The administrative map of Duyen Hai district, including the main river network*

## 2. Duyen Hai district

### 2.1 Geography, location and soils

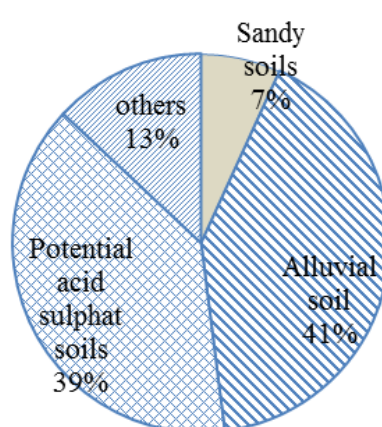
Duyen Hai district is located in the south-east of Tra Vinh province, along its coast line. The district includes Duyen Hai town and 8 communes: Long Toan, Long Huu, Ngu Lac, Long Khanh, Long Vinh, Dan Thanh, Dong Hai, Truong Long Hoa and Hiep Thanh (Figure 7).

Duyen Hai district has a typical coastal topography: relatively flat with an elevation from 0.4 to 1.2 m. Duyen hai has 3 main soil types (Figure 8):

Sandy soils: approximately 2,860 ha, located particularly in Long Huu, Long Toan, Hiep Thanh, Truong Long Hoa and Ngu Lac commune. These sandy soils are located on ridges parallel to the coast.

Alluvial soils, covering approximately 17,300 ha, located in Long Vinh, Long Khanh, Dan Thanh, Dong Hai, Long Toan, Long Huu and Ngu Lac commune.

Potential acid sulphat soils: 16,375 ha, located in particular in Long Vinh, Long Khanh, Dan Thanh, Truong Long Hoa Hiep Thanh and Dong Hai commune.

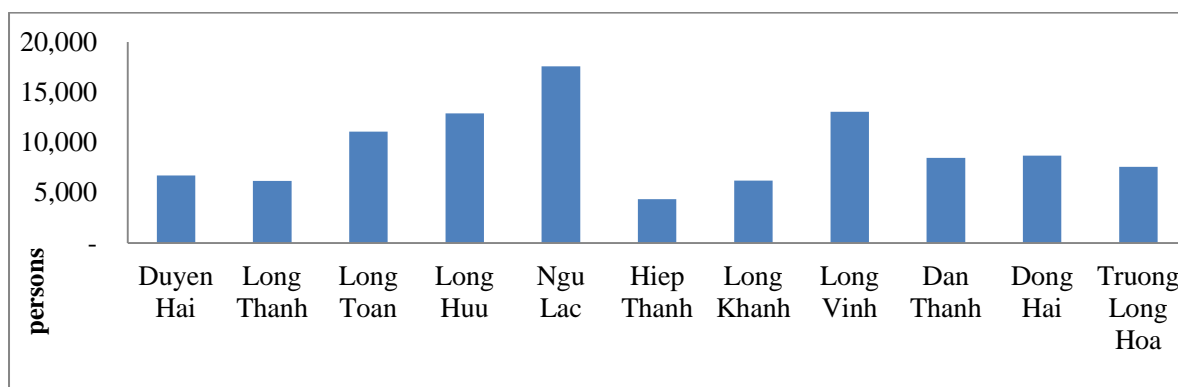


*Figure 8: Soil types and their area (%) in Duyen Hai district*

### 2.2 Demography

The total population of Duyen Hai district increased gradually from roughly 99,000 to 103,000 persons in the period of 2010 – 2014; at the time, the population density was 246 persons/Km<sup>2</sup>, which was the lowest density in Tra Vinh province. Ngu Lac commune has the highest population while Hiep Thanh commune has the smallest population in Duyen Hai district (Figure 9). In 2014, the employment rate of the district was over 60%, while approximately 3% of the population was unemployed. The labour is particularly focussed on agriculture, and the labourers are mostly untrained and low-qualified.

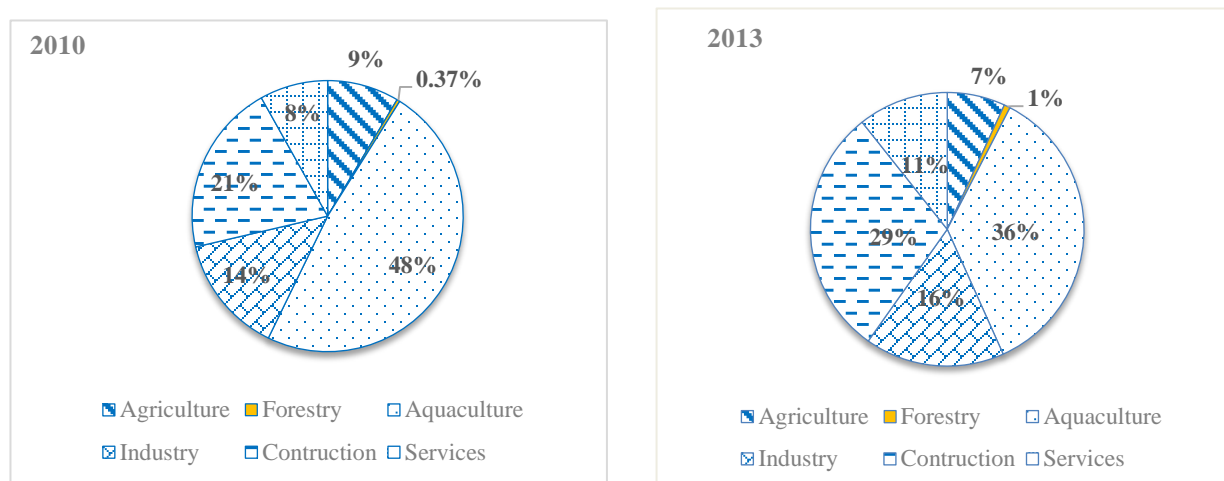
Most communes where forest can be found are sparsely populated, and lack infrastructure for travel and public services and offer no employment outside agriculture. The residential areas have usually been formed spontaneously throughout generations, along the roads, dikes, rivers or canals. The houses were interspersed with agricultural land, but agglomerations formed at crossings of roads and canals.



*Figure 9: Population in Duyen Hai district in 2014*

## 2.3 Economic sectors

The gross economic output of Duyen Hai increased from 5,900 billion VND to over 8,400 billion VND between 2010 and 2013. The contribution of agriculture reduced while the proportion of contributions of industry and services increased (Figure 10). Aquaculture produced a large share: more than 3 thousand billion VND in 2013, approximate 36% of the gross output of Duyen Hai district. The main aquatic product is shrimp from catch and aquaculture.



*Figure 10: Structure of gross output at current price by economic sectors in 2010 and 2013*

Duyen Hai district aims to develop industrial production. Therefore, industries such as frozen seafood-processing, ice-making and salt production increased, while the forestry value was the smallest.



## 2.4 Infrastructure

In general, the district's transportation network is relatively well developed. In particular, the investments in new construction and the upgrading of roads were important in the last 5 years. Provincial highways are spread throughout the whole district.

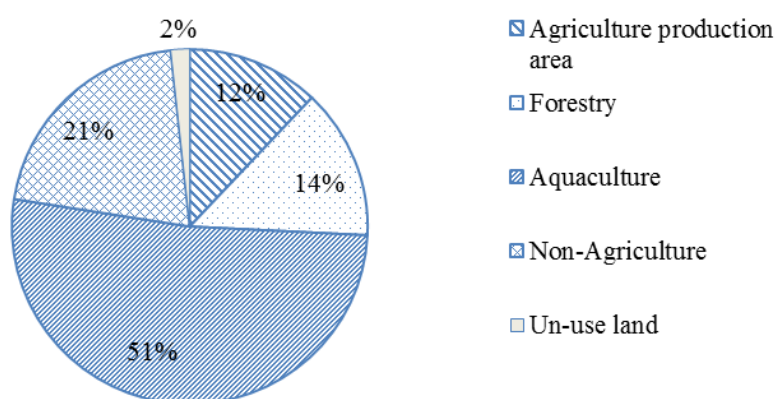
Duyen Hai district has two large estuaries named Cung Hau and Dinh An, which are the exits of the Tien and Hau rivers. The main harbours are located in the Long Toan commune. The inland waterway system is very convenient for local transport.

Duyen Hai has built irrigation systems for agriculture and aquaculture. Long Huu and Ngu Lac commune use irrigation systems for crop production, whereas other communes have mainly rain fed crops. Irrigation systems for aquaculture serve more than 3,000 hectares of shrimp farming area in Hiep Thanh, Truong Long Hoa and Dan Thanh commune.

The electricity network covers the entire district, but reaches mainly the agglomerations. In 2015, the number of households using electricity was approximately 20,500, which means it covers 88% of the total households in 2015. Investments are needed to provide electricity to rural areas for households and production.

## 2.5 Land use and aquaculture area

The total area of Duyen Hai is slightly more than 42,000 ha, which is approximately 17 % of the total area in Tra Vinh province. Aquaculture is the highest ranked land-use in the district, occupying just over half of the land: roughly 21,600 ha in 2014. The forestry area was approximately 5,700 ha, of which the production forestry area occupied 70% (Figure 11).

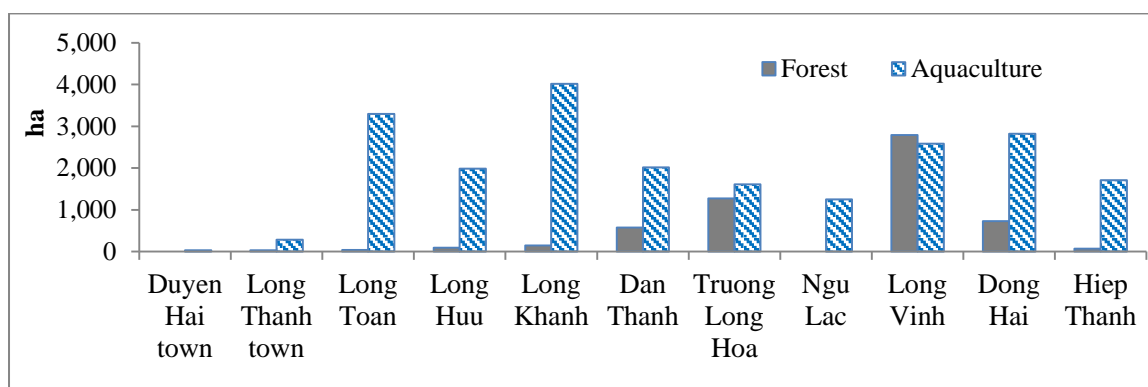


*Figure 11: Land-uses in Duyen Hai district in 2014*

The aquaculture area is spread over all the communes of the Duyen Hai district (Figure 13). The largest area is in the Long Khanh commune, which was roughly 4,020 ha in 2014. Long Toan commune has 3,300 ha. The areas in Long Vinh, Dong Hai, Long Huu, Dan Thanh, Truong Long Hoa and Ngu Lac communes fluctuated between 1,700 and 2,900 ha. Duyen Hai town has the smallest aquaculture area.



The forestry area, where shrimp is also farmers, covers roughly 2,790 ha in the Long Vinh commune, the largest area in Duyen Hai district. Truong Long Hoa commune has 1,275 ha. Other communes have forestry areas smaller than 600 ha, while Duyen Hai and Long Thanh town have no forest (Figure 12).

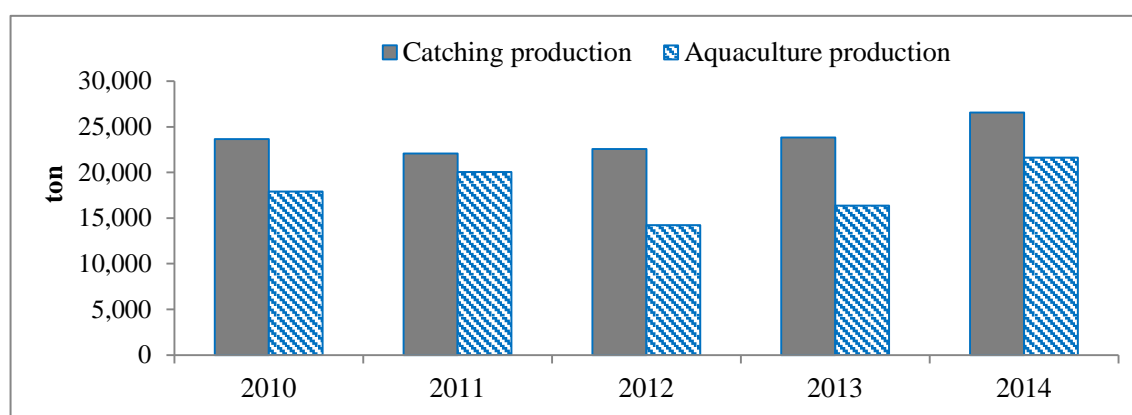


*Figure 12: Aquaculture and forestry area in Duyen Hai district*

## 2.6 Aquaculture and fishing production

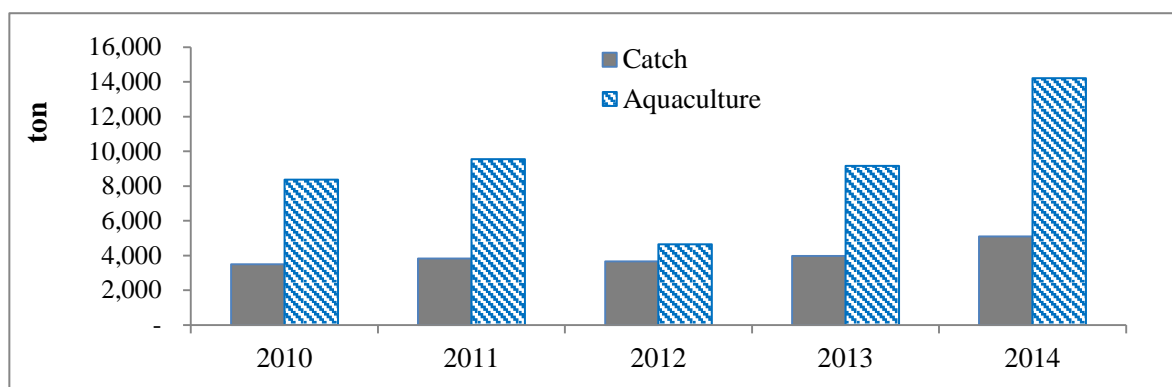
Total fishery production in Duyen Hai is approximately 48,200 tons (Department of Agriculture and rural development Tra Vinh province, 2014). In 2012, the number of fishing boats in Duyen Hai district was 462, which was 36% of the total number of boats in Tra Vinh province.

In 2014, the aquaculture production in the district was approximately 21,600 tons, in which shrimp represent roughly 66% (General statistical office, 2015). After an initial decrease, fishery production in Duyen Hai has risen slightly from 2010 – 2014 (Figure 13), and was approximately 26,566 tons in 2014, in which local fishing in Duyen Hai accounted for 18%, while aquaculture production fluctuated between 14,000 and 22,000 tons.



*Figure 13: Fishery production in Duyen Hai district*

During this period, shrimp aquaculture production dramatically decreased from 10,000ha to just under six thousand ton (Figure 14) in 2012. Overall, the aquaculture production is smaller than the catch from fishing (Figure 13), but the shrimp catch is much less than the quantity of shrimp from farming (Figure 14).



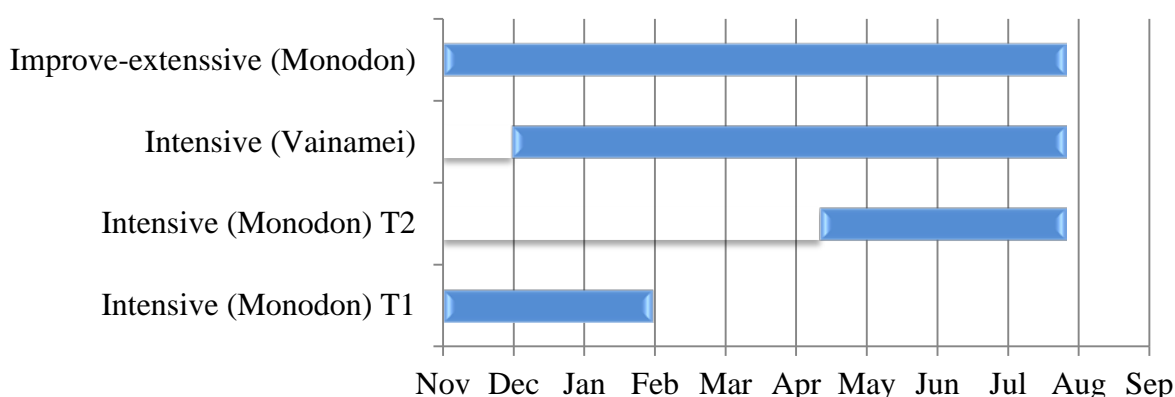
*Figure 14: Shrimp fishery in Duyen Hai district*

## 2.7 Shrimp farming in Duyen Hai district

### a. Shrimp production systems

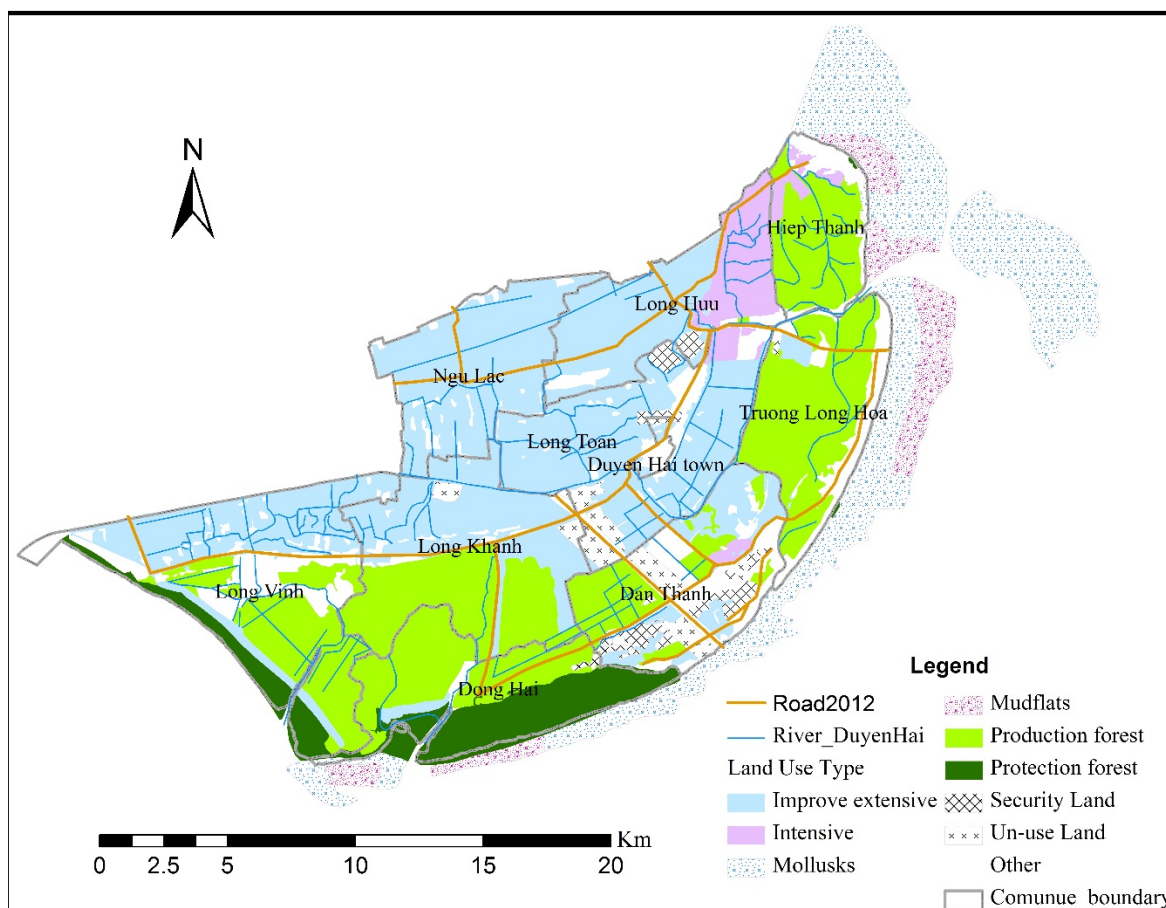
Duyen Hai district produces a variety of aquatic products: various fish species, shrimp, crabs, and molluscs. Shrimp is the most popular aquaculture product in the district.

Shrimp production systems practiced in Duyen Hai are intensive, semi-intensive, improve extensive and integrated mangrove (Figure 15). The farming seasons vary according to the species and systems (Figure 16). The number of crops for each system depends on the stocking period and the growing time. Figure 15 doesn't distinguish between intensive and semi-intensive systems.



*Figure 15: The seasonal shrimp cropping calendar in 2013 – 2014\**

\* Semi-intensive has the same stocking time as intensive.



**Figure 16: Aquaculture in Duyen Hai district in 2012**

### **b. Intensive and semi-intensive**

The intensive and semi- intensive shrimp farms culture either *Penaeus Monodon* or *Litopenaeus Vannamei*. Intensive *P. Monodon* farming has two culture periods: the first is from December to January and the second is usually from April to July (Figure 16). Intensive *L. Vannamei* farms may stock 3 to 4 times between December and August.

The investment cost for *L. Vannamei* farming is about 100 million VND/ha higher than for *P. Monodon* (Table 2). The profit of intensive and semi – intensive shrimp farming depends on disease occurrence, the market, technology, and the cost of farming and capital. *L. Vannamei* has been grown since 2008, and the farming of this species started in the Hiep Thanh commune.

On the whole, intensive and semi-intensive shrimp production systems are located in Long Toan, Long Huu, Hiep Thanh and Dan Thanh communes. Intensive shrimp farms can be found sporadically in Long Vinh and Long Khanh; this is probably due to various reasons such as the effectiveness of intensive farms in the neighbouring Cau Ngang district, initial investment cost, the environmental conditions and the requirement of infrastructure. For example, electricity is very important for the operation of the paddle wheel aerator in intensive systems, because if it was run on diesel, the operational cost would be higher and farmers would therefore receive significantly lower profits. In fact, in the production

forests, some farmers can't apply the intensive system due to the infrastructural conditions, despite the fact they have the permission of the government.

**Table 2: Some characteristics of the intensive and semi-intensive shrimp farms in Duyen Hai**

Species	Area (ha) of the farm	Investment cost (million Dong/ ha)	Yield (ton/ha)	Stocking density (PL/m <sup>2</sup> )		Profit (million Dong/ ha)
<i>Monodon</i>	0.1 – 0.15	150 – 250	1.5	15 – 20	7 – 10	150
<i>Vannamei</i>		230 – 300	3.8	100	30 – 50	250

PL = post-larvae

### c. Improved extensive and Integrated mangrove.

In the improved extensive and the integrated mangrove shrimp system, farmers may stock shrimp between the beginning of November and July (Figure 14). The quantity stocked depends partly on the quantity recruited through the inflow of water. The productivity of these systems is roughly 450 Kg/ha while the profit is approximately 40 million VND/ha/crop (Table 3).

The improved extensive system is popular in Long Khanh, Long Vinh and Dan Thanh communes. In this system *P. Monodon* is stocked with a density of approximately 5 -7 PL/m<sup>2</sup> (PL = post-larvae). Farming is continuous: after every 2 months, the larger shrimp is harvested and the stock complemented.

Integrated mangrove-shrimp farming is in both production and protection forestry areas. In both types of forest, forest farmers mainly apply the same method as in improved extensive except they harvest more frequently (every full moon). In the production forest farmers may practice intensive shrimp farming via government permission.

**Table 3: Some characteristics of improved extensive and integrated mangrove shrimp farms in Duyen Hai**

Species	Investment cost (million Dong/ ha)	Yield (ton/ha)	Stocking density (PL/m <sup>2</sup> )		Profit (million Dong/ ha/crop)
<i>Monodon</i>	75	0.45	5	-7	40

### d. Shrimp disease impact

The main shrimp diseases in the district are white spot disease, yellow head disease, white scour and the Early Mortality Syndrome (Acute hepatopancreatic necrosis). In 2014, disease outbreaks effected over 3,000 households and approximately 3,500 ha. The diseases in intensive and semi- intensive shrimp farming occupied just under 500 ha, from which 72% was farmed with *L. Vannamei*.

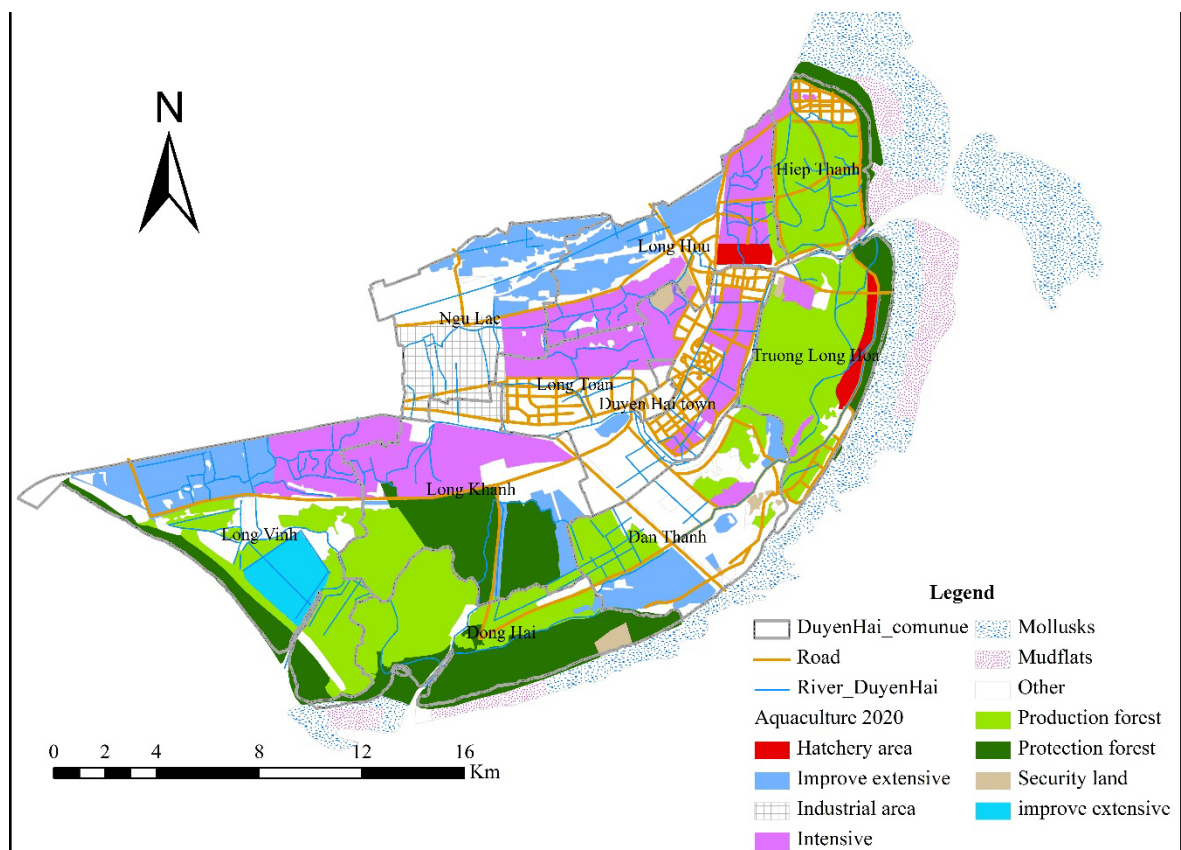
## 2.8 Planning

Industrial development is a priority in Duyen Hai. The Long Khanh and Long Vinh communes plan industrial development to more than 2,300 ha. These areas are mainly located in the communes Ngu Lac and Long Toa, and may result in loss of mangrove area in Long Toan.

The aquaculture planning in Duyen Hai aims to cover more than 15 thousands ha in 2020 and to decrease to nearly 14 thousands ha in 2030. The systems to be developed are mainly intensive and semi intensive systems (Figure 17).

According to the 2020 planning, Long Huu, Truong Long Hoa, Long Toan, Long Khanh, Long Vinh and Hiep Thanh communes should have nearly 4,400 ha of intensive and semi-intensive shrimp farms, an increase of 31% compared to 2012. The area for improved extensive shrimp farming would be close to 9,800 ha, a decline of more than one thousand ha, probably due to the increase of the industrial area. The productivity of shrimp farming should increase from 10,000 tons to 20,000 tons in 2020 (Table 4).

According to the plans, the protection forest area would increase to around 5,300 ha. This increase should occur in Long Khanh, Long Vinh and the Dong Hai communes (Table 5). The total area of production forest would be nearly unchanged, however there are significant changes expected in some communes. In Long Khanh, both production and protection forest areas should increase, while in Long Vinh production forest would be transformed into protection forest but also 300 ha would be lost.



**Figure 17: Planning of aquaculture in Duyen Hai in 2020**

**Table 4: The planning of area and production of aquaculture in 2020 and 2030**

Category	2012		Planning					
	Ha	tons	2015		2020		2030	
			ha	tons	ha	tons	ha	tons
<i>P. Monodon</i>	13,797	4,256	13,950	10,000	12,400	10,000	12,400	9,800
Improved ext.	11,183	1,002	10,250	3,000	9,813	3,000	5,800	2,800
Intensive	2,614	3,254	3,700	7,000	3,900	7,000	3,900	7,000
<i>P. Vannamei</i>	401	980	300	1,500	485	1,500	500	2,500
Fresh water shrimp*	304	15	350	280	350	280	400	320
Fish (after f.w. shrimp)	-	-	1,000	1,200	1,000	1,200	1,500	1,800
Crabs	11,202	5,157	12,721	7,500	12,721	7,500	12,721	7,500
Mollusks	-	181	1,000	1,500	1,000	1,500	1,000	1,500

\* *Macrobrachium rosenbergii* ; f.w. = fresh water shrimp

Important total net increases are expected in Truong Long Hoa, Hiep Thanh, and in particular in the Dong Hai commune. The important increases in production forest with mixed mangrove –shrimp systems are planned in Long Khanh, Dong Hai and Hiep Thanh, while Long Vinh and Truong Long Hoa plan a decrease, in favour of protection forest.

**Table 5: Forestry planning 2020 in Duyen Hai district\***

Name	Protection forest (ha)		Production forest (ha)	
	2010	2020	2010	2020
Duyen Hai district (total)	1,651	5,382	4,083	4,046
Duyen Hai town	-	-	-	-
Long Thanh town	-	-	116	93.6
Ngu Lac	-	-	-	-
Long Huu	23.3	22.2	64.8	64.0
Long Toan	34.9	56.5		
Long Khanh	-	851	62	832
Long Vinh	592	1,683	2,196	701
Dong Hai	693	1,363	31.8	909
Dan Thanh	94	106	481	455
Truong Long Hoa	195	779	1,081	750
Hiep Thanh	18	521	51	241

\* Duyen Hai town and Ngu Lac commune have no forest

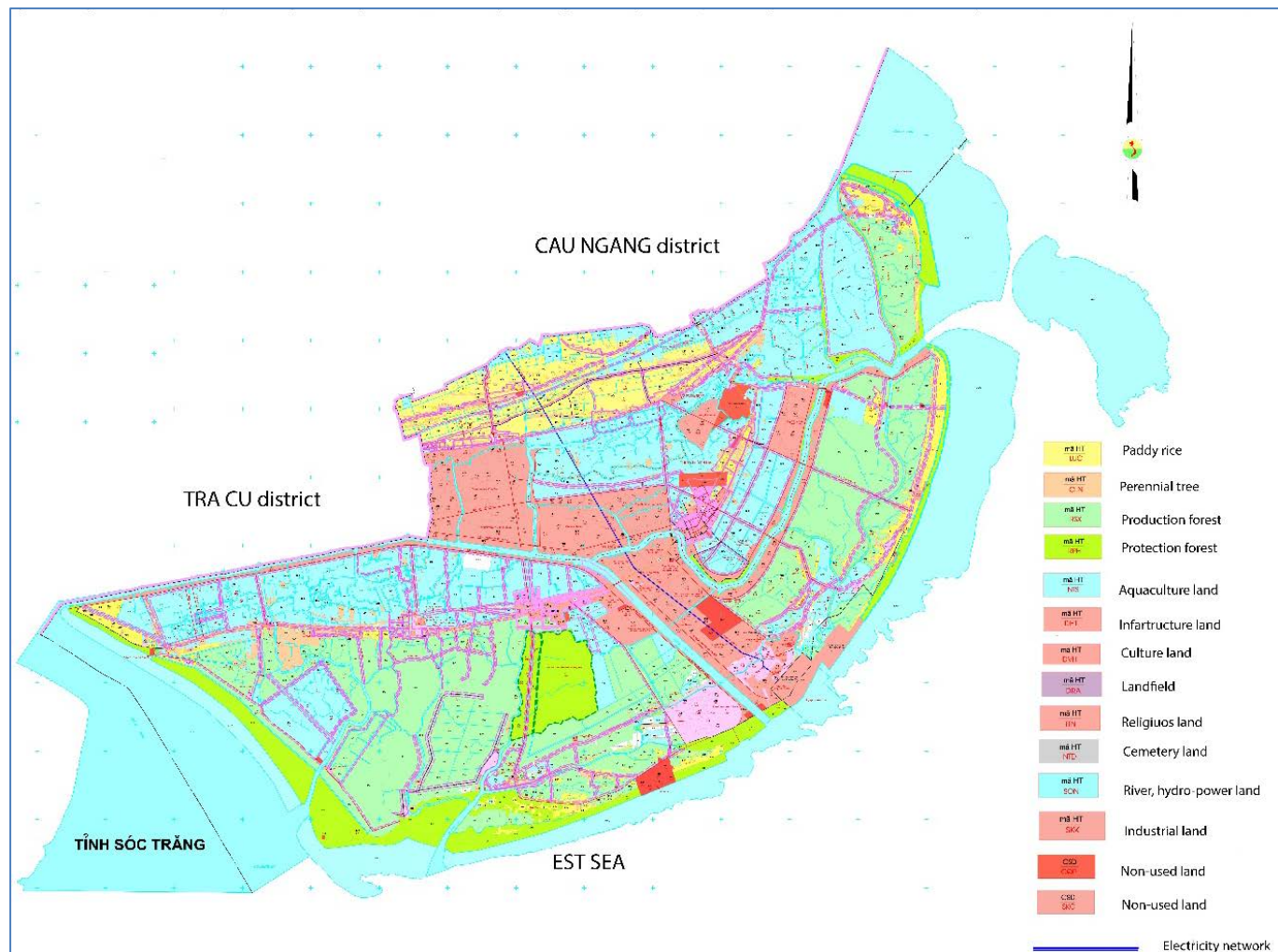
### **3. Conclusions and recommendations**

The districts in Tra Vinh that have both forest and aquaculture are Chau Thanh, Cau Ngang and Duyen Hai, from which Duyen Hai has the largest area in both forest and aquaculture. The coastal and estuarine communes in Duyen Hai that have both forest and aquaculture are Long Vinh, Dan Thanh, Dong Hai, Truong Long Hoa and Hiep Thanh. The area of protection forest should increase in Long Khanh, Long Vinh and Dong Hai commune, which gives opportunities for mixed-shrimp mangrove systems. However, in Long Vinh the total area of forest will be reduced by more than 200 ha.

In Truong Long Hoa, Long Vinh and Hiep Thanh, the area of intensive aquaculture should increase. This may go at the expense of mangroves and cause potential conflicts in the Long Vinh and Hiep Thanh communes.

The communes recommended for the ALEGAMS study are Hiep Thanh, Long Khanh, Long Vinh, Truong Long Hoa, Dan Thanh and the Dong Hai communes. These are the coastal and estuarine communes where mangrove forest should increase. In Hiep Thanh, Truong Long Hoa and Dan Thanh, the tensions between the expansion of intensive aquaculture and mangroves should be assessed through institutional and social analyses by field survey and consultation with stakeholders. The Long Khanh and Dong Hai communes are considering developing forest which could cause tension with shrimp farmers.





**Figure 18: The planning of land use in Duyen Hai in 2020**

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