Scenarios for the future of the agricultural sector in Bang Phluang area, Prachinburi Province

Preliminary version based on work at Tambon level

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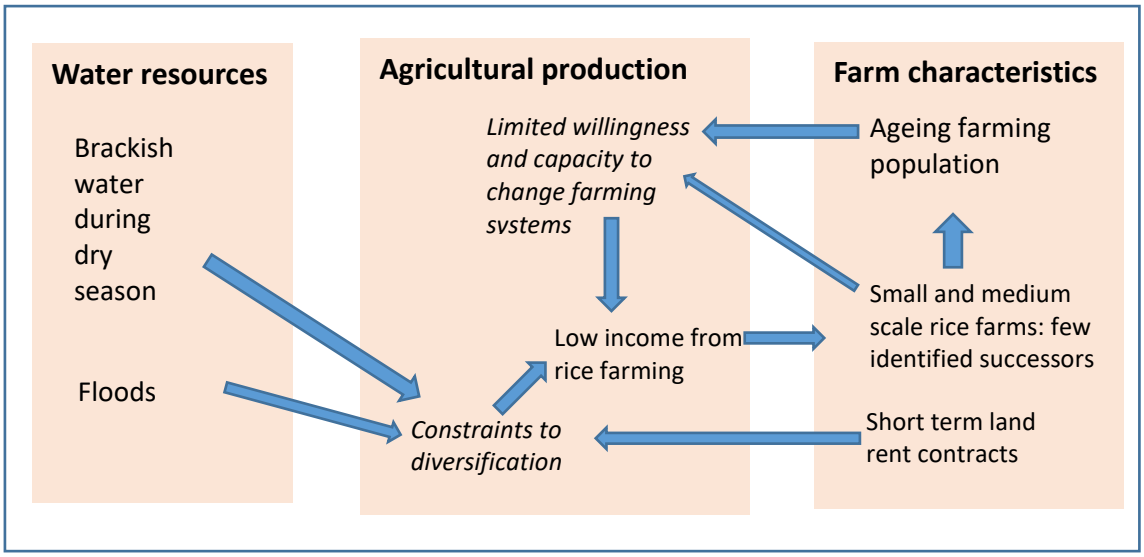
1. Aim of the work

Agriculture is the backbone of the economic and social life in the Bang Phluang area, in Prachinbri Province. There, farms have evolved to adapt to changes taking place in terms of water resources, agricultural value chains and within farming families. These changes often lead to increasing interrelated challenges, among them, the decreasing profitability of rice farming and farmers' aging. Many farmers (especially those involved in rice production at small or medium scale) are increasingly trapped into a vicious circle as described in the following graph.



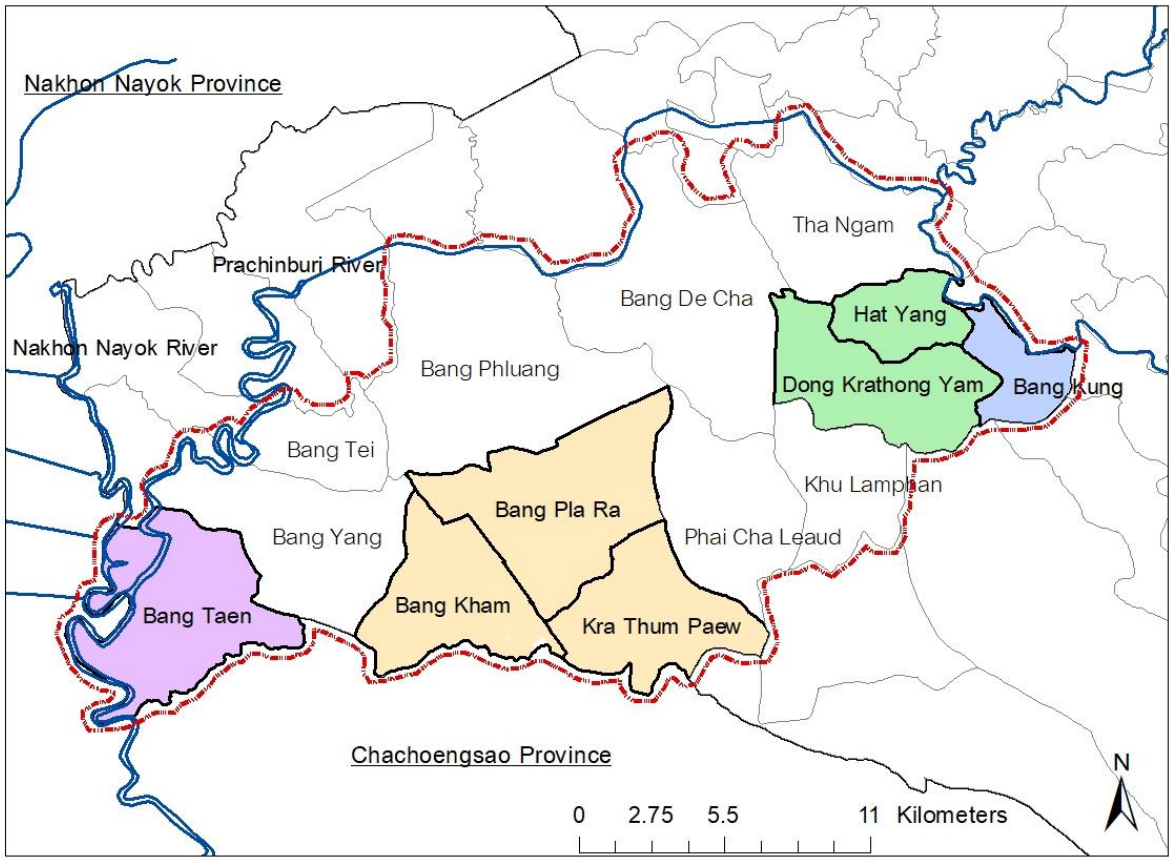
The Doubt research project is implemented by various research organizations (see http://deltasoutheastasia-doubt.com/ for more details). In Thailand, it aims to ***support discussions among actors of the Bang Phluang area to jointly build a vision of the desired future for the agricultural sector in 2029***. Such a vision could define ways to jointly address above-mentioned challenges, in particular in terms of how to:

- get sufficient water for farming activities, in terms of quantity and salinity and in terms of flood management
- ensuring farming activities that are sufficiently profitable (and less impacting on the environment);
- enabling the successful involvement of a new generation in farming.

2. The study area

The Bang Phluang area encompasses the low-lying areas located west of Prachinburi Province, on the left bank of Prachinburi River (see map below). This area includes a variety of farming systems, in particular small-scale and large-scale rice farms, and fish and shrimp farms. Most of the area belongs to the Bang Phluang Irrigation scheme.

Figure 1. Study area and the four focus areas



The research activities were implemented in particular in ***four focus areas***:

- Bang Kung Tambon, which is characterized by small-scale rice farms;
- Dong Krathong and Hat Yang Tambons, which are characterized by large-scale rice farms;
- Bang Taen Tambon, which is characterized by average scale rice farms and where there is an organic rice group;
- Bang Pla Ra, Bang Kham and Kra Thum Paew Tambons, which are characterized by fish and shrimp breeding.

3. Methodology

The *first phase of the work* took place in 4 steps.

1) **Preliminary analysis at Tambon level**. Data was collected on past land use, land use change, farm structure, water management and age structure at Tambon level (see reports on http://deltasoutheastasia-doubt.com). This enabled to identify current and future drivers of change at Tambon level. Other studies were done to identify possible drivers of change at national and provincial level, and at the level of the Bang Pakong River catchment.
2) A total of 17 **individual interviews** were made with representatives of TAOs, head of villages and farmers about how they see the future of their Tambon. All interviewees expressed possible futures for their Tambon in terms of a "business as usual" scenario and a "hoped for" scenario. Based on these interviews, two preliminary scenarios for the future of the agricultural sector in each focus area were redacted.

3) We organized **scenario workshops** in each of the four focus areas. Participants were in total 82: 31 members of TAO office, 25 village leaders, 12 members of farmers' organizations and water user groups, and 14 lay inhabitants of the Tambons. During the workshops, participants discussed change drivers at local, catchment/province, and national levels, based on 1) an assessment of the main changes that took place over the past 15 years, and a 2) presentation of current drivers of change now and in the next 10 years. Then, the two preliminary scenarios for each focus area were presented. Participants discussed and revised the contents of the scenarios for their focus area. They also assessed their plausibility and to what extent they would like these scenarios to take place.
4) Based on this work, we frame **two scenarios for the whole study area**. 15 interviews were done in the other tambons of the study area: Tha Ngam, Bang Decha, Bang Phluang, Bang Tei, Bang Yang; Ku Lamphan, Phai Cha Leaud. Interviewees were presidents of TAO, heads of villages or heads of water user groups. We also collected general data on agricultural structures in these tambons. We discussed with interviewees their assessment of current and future drivers of change and possible scenarios for the future. We then presented the preliminary scenarios prepared in the previous phase and discussed to what extent these scenarios were relevant in their tambons.

The *second phase* will involve interacting with staff from MoAC and of Provincial Government, in order to prepare for a joint workshop with representatives of Tambons.

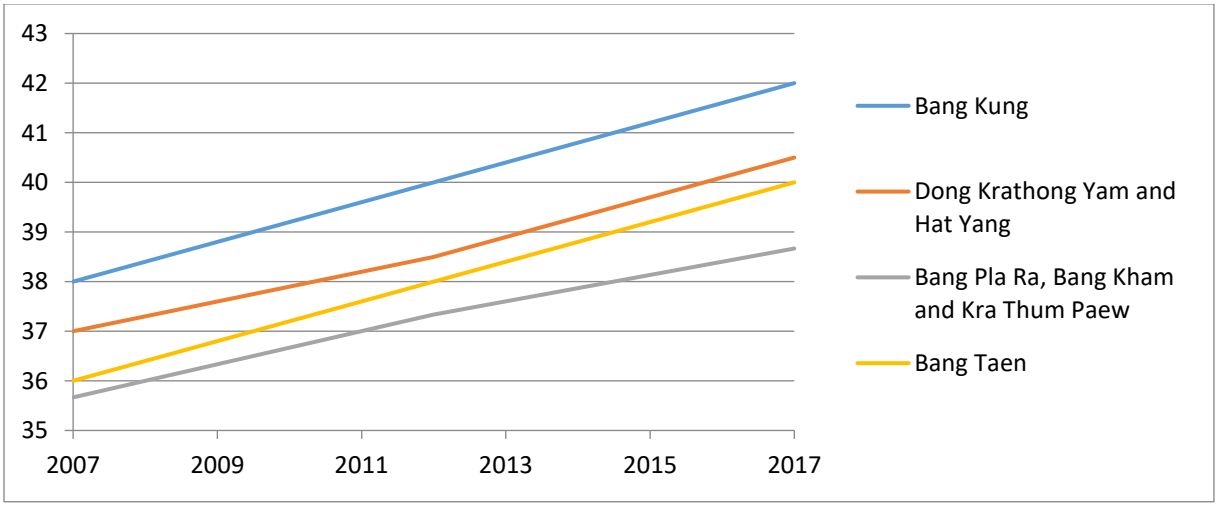
4. Results

4.1. Past changes in focus areas

4.1.1. Ageing of rural population

The average age of population (not only farmers) in focus areas has increased over the past 10 years (Figure 2). In the tambons where farming is more profitable (fish and shrimp and, to a lesser extent, large-scale rice farming) the average age remains lower than in Bang Kung, where small-scale rice farming has limited profitability.

Figure 2. Evolution of average age in the 4 focus areas



4.1.2. Land use changes

Table 1 presents the land use changes in each focus area.

Bang Kung

In 2002, farmers of Bang Kung used to produce rice and they had some trees (mango, coconut, and banana) in upland zones located close to their houses and to the river. However, these trees were removed because of huge floodings in 2011 and 2013, and because of decreasing fruit prices. Since 2002, the paddy field areas in Bang Kung have decreased because farmers uplifted land for building houses, and some farmers adopted diversification. They planted fruit trees on the land they own. They mainly keep fruit production for their home consumption and sell the extra production.

Dong Krathong Yam and Hat Yang

In Hat Yang and Dong Krathong Yam Tambons, before, people grew some fruit trees in upland areas around villages, especially mango and coconut trees. Trees were irrigated using shallow wells and a natural swamp. From 2002 to 2017, the villages grew and thus farmers cut fruit trees to build more houses. Rice remains nowadays the main production. There has been a recent and still limited process of diversification, as farmers are growing fruit trees along the dykes separating paddy fields, and in fields where land has been uplifted.

Bang Pla Ra, Bang Kham, and Kra Thum Paew

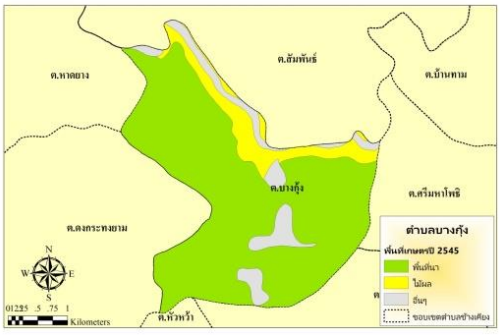
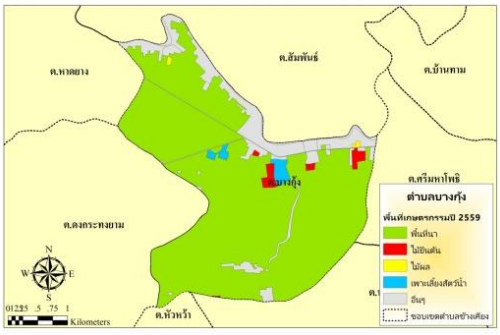
Since 2002, aquaculture has developed a lot in the area, except in the eastern part of Kra Thum Paew where some land owners keep on doing rice. Orchards (i.e., mango and coconut trees) have decreased because of flooding, acid soil (especially in Bang Kham tambon), and low price. Most farmers who planted these orchards were migrant people from Chacheongsao province as they had farm experiences on fruit trees.

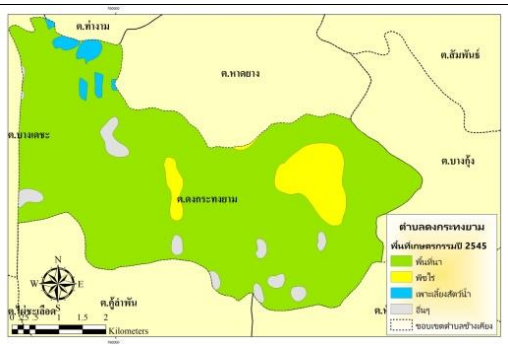
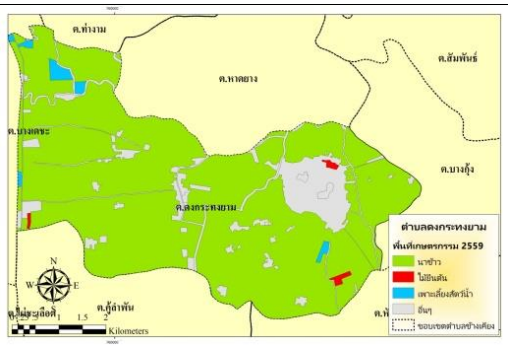
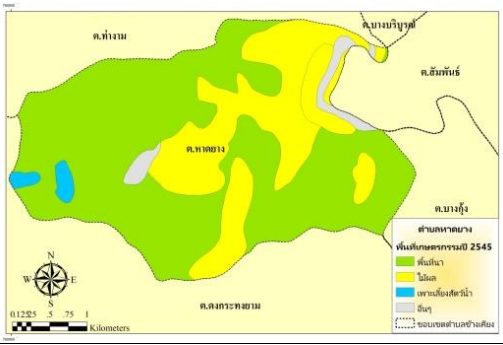
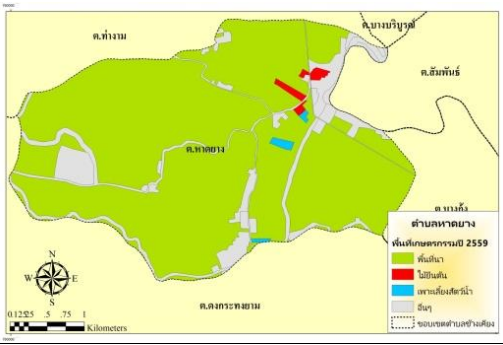
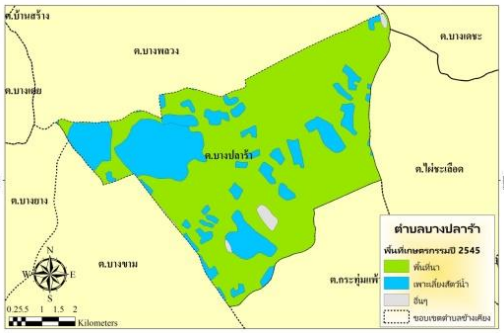
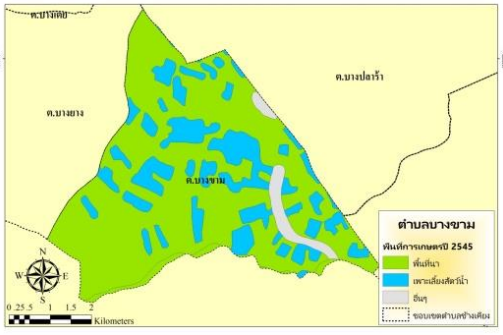
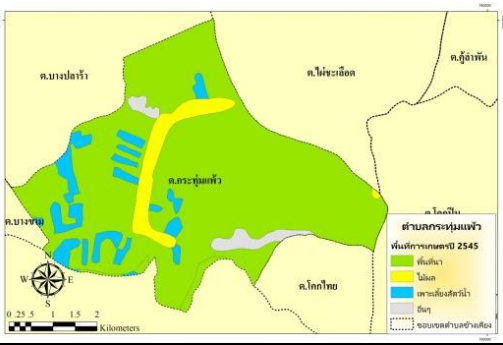
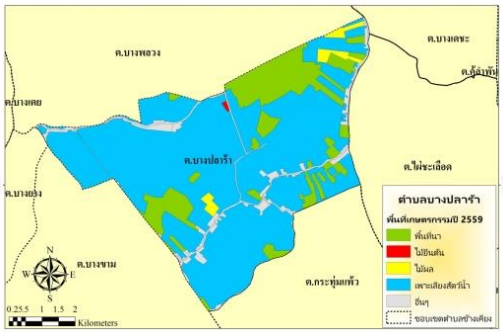
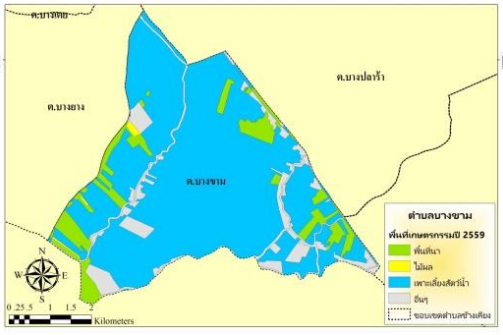
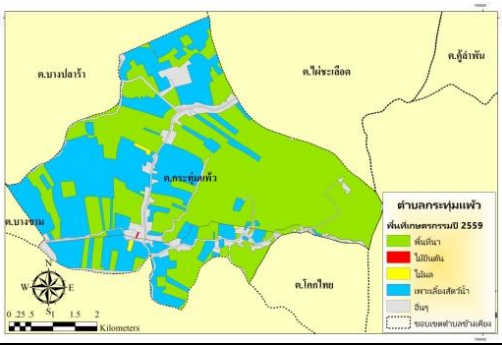
Bang Taen

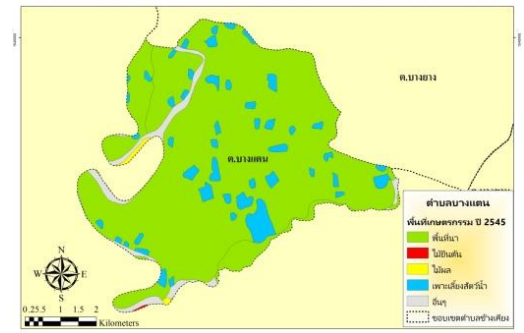
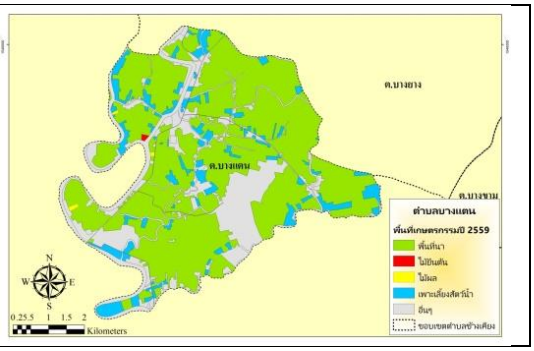
Rice is still the main farm production with some areas dedicated to fish and shrimp farming. A strong urbanization process took place, with expansion of industrial areas, roads, and houses. These urbanizations block the water flow in artificial and natural canals. This leads to less drainage and more flooding problems.

Table 1. Land use changes in focus areas during 2002 and 2016

***Note**: The meaning of colors in land use map: green = paddy fields, red = perennial trees, yellow = orchard, blue = aquaculture, and grey = urbanization (i.e., houses, roads, factories, etc.)*

Focus areas	Land use in 2002	Land use in 2016
1.Bang Kung		
2.Dong Krathong Yam and Hat Yang	Dong Krathong Yam	Dong Krathong Yam

	 Hat Yang	 Hat Yang
		
3.Bang Pla Ra, Bang Kham, and Kra Thum Paew	Bang Pla Ra  Bang Kham  Kra Thum Paew 	Bang Pla Ra  Bang Kham  Kra Thum Paew 

4.Bang Taen		

4.1.3. *Main drivers of change (in past, current and future) and their consequences that are common to all focus areas*

The main drivers of change in all four focus areas can be grouped in 4 types: water management, farm management, urbanization, and farm production price. Table 2 shows the main consequences of each of these drivers of change.

Table 2. Main drivers of change in all focus areas

Scale	**Drivers of change 2002-2018**	**Consequences**	**Drivers of change 2019-2029**	**Consequences**
Local level	Lack of water management	Insufficient water during dry season		
	Shift to rice farming using mechanization and chemical inputs	High production costs, mechanization, increased employment of labour that comes from outside the area	*Same*	*Same*
	Decrease of traditional relations in communities	Less communication and solidarity	*Same*	*Same*
	Urbanization, expansion of roads	Blocking of flood drainage	*Same*	*same*
Regional level	Expansion of industries upstream	- Water pollution - Decrease in fresh water during the dry season - Blocking of flood drainage	*Same*	*Same*
	Huay Samong dam (since 2016)	- Decreased flooding problems - Less saline water during the dry season	New irrigation scheme downstream of Huay Samong	Decrease of available fresh water for irrigation during the dry season
			Wang Chan Weir	Under discussion
National level	Decrease of rice profitability	Lack of interest of young people to work on farm. They move to cities	Unstable price of rice, fish and shrimp	Same

Moreover, ***several future drivers of change specific to each focus area*** were identified. One of them came out as especially important in each focus zone:

- In Bang Kung: implementation of land lease control
- In Dong Krathong Yam and Hat Yang: access to irrigation water
- In Ban Taen: development of organic rice farming and ecotourism
- In Bang Pla Ra, Bang Kham and Kr Thum Paew: collective action to enhance production skills and profitability of fish and shrimp farming

4.2. Scenarios at local level

The scenarios that were modified and validated during the workshop in each focus area are as follows.

4.2.1. Bang Kung

The main past and future change drivers in Bang Kung are presented in the following Table 3.

Table 3. Current and future drivers of change specific to Bang Kung

Scale	Drivers of change 2002-2018	Consequences	Drivers of change 2019-2029	Consequences
Local			Irrigation management	Confidence in starting diversification
National	Lack of actual implementation of land lease act	Insecure access to land Limited investments in non-rice crops	Actual implementation of land act and agreement at local level between tenants and landowners	More secure land - Increase diversification

Business as usual scenario: **a strong decrease of farming**

The drivers of change: farmers ageing, decrease of rice profitability, no change in rental practices and in irrigation management

In 2029, in Bang Kung Tambon, a few farmers have tried shifting to other crops, such as pomelos. These farmers have invested to control floods, by uplifting the land or by making dykes. However, this concerns a small minority of farmers, around 10% of them, who own the land. Moreover, many of them are not close to the river and thus have to deal with insufficient irrigation water during the dry season. Most farmers in Bang Kung keep on renting land on an annual basis. Because of these constraints in land tenure and water access, other farmers have not attempted to diversify. They still produce mainly rice on limited areas and involving high chemical uses that impact them in terms of health problem, high farm production costs, and chemical contamination of water and soil. Profitability of rice farming on small area has become very low. As a consequence, many paddy fields have been sold for urbanization for building houses, especially to migrant people who work in factories located near Bang Kung area. Young people do not work in Bang Kung Tambon: they have

left the area or they commute daily to work in the factories. Only 10% of them have inherited land from their parents and go back to work on farm.

Alternative scenario: **diversification**

The drivers of change: farmers ageing, decrease of rice profitability, improved agreements for land rent, improved irrigation management

In the years 2020s, there have been changes at national level, leading to new laws for land rental and to an actual implementation of these laws. In 2029, in Bang Kung Tambon, owners rent land at least for 10 years, land rent price is controlled and it is difficult for farmers to sell agricutural land for shifting to another land use. Moreover, irrigation in the area is improved so that farmers can access water during the dry season. As a consequence, many small-scale farmers have felt much more secure in investing on land they rent. Diversification has taken place on 40% of land, where people have land or access renting land (the contracts specify that the landowners allow them to modify land).Those are the farmers who have sufficient and can access irrigation. These farmers have invested in the land to protect from floods (e.g., by building dykes or raising field level). Some of them have tried diversification and some start organic farming. Some of these farmers have also initiated rural tourism and they sell their products via community shops, and coffee shops to increase their income. As a result, 30% of young people have come back to do farming as they have seen opportunity to get satisfactory incomes. Some of these young people do diversification farming, others do farming in parallel with other income-generating activities. However, a majority of farms have still not initiated diversification, because these farmers are aged and because of high investment costs. They have become involved in a "large-scale scheme" which was initiated by a public agency. This helped them reduce a bit production costs, but rice profitability remains limited.

4.2.2. Dong Krathong Yam and Hat Yang

The main past and future change drivers in Dong Krathong Yam and Hat Yang Tambons are presented in the following Table 4.

Table 4. Current and future drivers of change specific to Dong Krathong Yam and Hat Yang

Scale	**Drivers of change 2002-2018**	**Consequences**	**Drivers of change 2019-2029**	**Consequences**
Local	Limited capacity of the pump	Low rice yields	- Dredging of the upstream part of the Hat Yang canal in Dong Kratong Yam - New pumping machine in Hat Yang	- Access to higher amounts of water at low cost - Improved rice yields - Expansion of diversification - Use of the area for flood expansion
Regional/basin			Wang Chan weir and digging of the Hat Yang canal	

Business as usual scenario: **a rice sector in crisis**

The drivers of change: limited access to sufficient water, decreasing of rice profitability, aging farmers

In 2029, despite several attempts, there has been no improvement of water management in Dong Krathong Yam and Hat Yang Tambons. Rice profitability has decreased, due to an increase in the costs of inputs for rice production, and because farmers still face high pumping costs. Lack of sufficient water also impacts on rice yields. As rice profitability is low, the children of aged farmers are not interested in working on farm and they prefer working in factories. Aged rice farmers hire more farm operators and laborers or rent-out land to farmers from the two tambons and to farmers coming from outside the tambons and who seek areas to grow rice. This also contributes to competition for renting land among farmers that leads to increases of the land rent price. Moreover, low profitability of rice has forced some farmers to sell their land: some have stopped farming to do other jobs, others go on rented land with high renting fee. Land has been sold to investors for building shops or houses, and to a few large-scale farm businesses. Due to lack of well-organized distribution of water during the dry season, few farmers who own land and who have a capacity in terms of farm investment shift to other crops. Moreover, as the rate of rented land increases, there are less and less farmers able to start diversification on their own land.

Alternative scenario: **increased water control and diversification**

The drivers of change: improved water management

In 2029, improved infrastructure and irrigation management enable to secure access for all farmers of Dong Krathong Yam and Hat Yang Tambons to water during the dry season and at low cost. Two alternative scenarios can take place.

> *Alternative Scenario AS1: Wang Chan weir and digging of the Hat Yang canal*
>
> The Wang Chan weir has been built. This weir is located just downstream Hat Yang Tambon, on Prachinburi River. The Hat Yang canal has been deepened and it starts from the lake upstream the weir. Water level in this lake is higher than previously, which entails that there is no need to pump water from the river to the canal and then to the whole area.
>
> *Alternative Scenario AS2: digging of the Hat Yang project and electric pumping machine*
>
> The Wang Chan weir has not been built, because some environmental actors opposed it on the ground that it would damage ecosystems in the river. Some years later, the Hat Yang canal was eventually deepened. During the rainy season, water flows by gravity to this canal, but during the dry season, farmers still need pumping water from the river to the canal. The Royal Irrigation Office installed an electric pumping machine that enables a decrease in pumping costs compared to the previous pump.

In these two alternatives scenarios, there has been a negotiation between the Royal Irrigation Department and the farmers: new water infrastructures were built and, in exchange, farmers have accepted that their areas become a flood inundation area (*monkey cheek*) from mid-August to October. In these two alternative scenarios, farmers that rent land keep on doing rice, but enhanced water management enables a decrease in rice production costs and an increase in rice yields. Thanks to good water management, they plant dry season rice early and they can harvest it before mid-August and before the area starts operating as a monkey cheek. Moreover, many farmers that own land shift to non-rice crops (i.e., livestock, seasonal vegetables, local plants, fruit, perennial trees, fish, etc.). Approximately 30% of farmers in the area have started diversification. Farmers who diversify have built a dyke or have raised land to avoid flooding. Some farmers apply organic farming to get a better price. Besides, several farmers groups have been initiated to support others in terms of farm knowledge, processing and marketing. Some landowners have sold to investors for other uses or rent out land to outside rice farmers who offer high renting fee, because they know that

irrigation is performing. Due to improved profitability at farm level, farmers can improve income to support their family and pay back debts. Some young people take over the farms or work on farm along with their parents because they see the opportunity to get a satisfying income.

4.2.3 Bang Pla Ra, Bang Kham and Kra Thum Paew

The main past and future change drivers in Bang Pla Ra, Bang Kham, and Kra Thum Paew Tambons are presented in the following Table 5.

Table 5. Current and future drivers of change specific to Bang Pla Ra, Bang Kham and Kra Thum Paew

Scale	Drivers of change 2002-2018	Consequences	Drivers of change 2019-2029	Consequences
Local			Development of collective action	Success/failure to improve profitability thanks to better management and marketing

Business as usual scenario: **individual production and marketing**

The drivers of change: Failure of collective action, unstable fish and shrimp price, farm technical advice on agricultural production, underperforming collective water management

In 2029, farmers in Bang Pla Ra and Bang Kham Tambons and in the western part of Kra Thum Paew keep growing mainly fish and shrimp production and young people (not all) still get involved in farming by working with their families. However, all attempts during the 2020s to trigger collective action between farmers have failed. As a consequence, farmers work individually. They look for information on how to breed fish and shrimp individually. Several of them still face problems of animal diseases or unexpected animal death. They keep on having to adapt to unexpected changes in markets, on which they have no control. The majority of farmers adapt to these risks in production and in market prices by focusing on a decrease in farm production costs. However, in doing so, they do not manage to increase the quality of products. They are not able to meet the growing demand on the market for quality certified fish and shrimp. Farmers are compelled to sell at low price so many of them are indebted. Some could not handle these issues so they shift to work other jobs such as farm laborers, or start small plot of diversification along other jobs. Besides, there is no improvement in water management in the area. Because of increased pumping from industries, water salinity issues, which had disappeared in the early 2020s thanks to Huay Samong Dam, have come back. Gates linking Prachinburi River to irrigation canals are closed during the dry season. Farmers are not involved in decision making with regards to the management of the gates and the canals, and farmers do not get sufficient water during the dry season. There is little support from the government agencies due to failure of collective action.

The rice farmers located in the eastern part of Kra-Thum-Paew Tambon prefer to work individually. They do not share knowledge on production techniques and they do not market collectively. They still keep growing rice as they do not dare to shift to grow other crops due to lacking of experience of growing non-rice crops and due to high farm investment. Some of them rent out land to other people from outside the village that come to invest in fish and shrimp farming.

Alternative scenario: **successful farmers' collective action**

The drivers of change: successful collective action, improved collective water management

In the 2020s, farmers still keep growing mainly fish and shrimp and young people (not all) still get involved in farming are working with their families. One cooperative has established links with several farmers' groups in the area. These farmers' organizations support their members in terms of improving breeding techniques, accessing farm inputs at a lower price, processing and joint marketing and/or running a fish market. They do not just react to external changes; they proactively make plans, especially in the way to produce and market their products. Farmers' groups have also successfully got involved in active networks with cooperatives, other farmers' groups in the region, public administration, etc., in order to enhance farmers' capacities for efficient production of fish and shrimp. Occurrence of diseases has strongly decreased as a consequence. Farmers' organizations have become partners in the decision-making for the management of gates and canals in the area. They manage to have sufficient water during the dry season and to adapt to the increasing salinity rates in the river due to the expansion of industries upstream. Farmers' groups have obtained joint certification and are able to provide certified fish and shrimp both for domestic market and for export, for which demand has increased during the 2020s.

Rice farmers located in the eastern part of Kra-Thum-Paew tambon share information on production techniques. They have managed to reduce production costs by doing so. However, they still market rice individually.

4.2.4 Bang Taen

The main past and future change drivers in Bang Taen are presented in the following Table 6.

Table 6. Current and future drivers of change specific to Bang Taen

Scale	Drivers of change 2002-2018	Consequences	Drivers of change 2019-2029	Consequences
Local	Development of organic farming	- Decrease in production costs - Improved health	Same	Same
			Success/failure of ecotourism project	Provide job opportunities in the area such as home stay, processing, and local products

Business as usual scenario: **a "dormant" agriculture**

The drivers of change: aging farmers, decrease of rice price, expansion of industries, limited adoption of organic farming, failure of ecotourism initiatives

In 2029, rice remains the main production in Bang Taen Tambon. Since 2016, 4,000 rai have been converted to urban or industrial use. Farmers are mainly concerned about reducing farm production costs due to low price of rice. However, many of them still rely on chemical inputs and use external work force. As a consequence, rice profitability remains low and some farmers are in debt. Some farmers try to grow fish cages along the river or other crops such as growing fish and shrimp for

getting more income, but this requires investments and it is a risky activity. In particular, farmers who raise cage fish are impacted by the increase of industries upstream that sometimes pollute the river. Only a few farmers have shifted to organic farming, due to intense farm work and lack of profitability (most of them sell it at the same price as conventional rice). Some of them do organic farming mainly for home consumption because of health concern.

Only few young people take over farming as a fulltime or part-time activity, when their parents who owned land are retired themselves. Young people move out of villages. Public organizations have tried to set up rural tourism in the 2020s, but this was done based on small projects, involving limited activities. These initiatives were eventually not successful. Many people are working now in industries, those recently installed in Bang Taen and also others in the surroundings.

Alternative scenario: **organic production and rural tourism**

The drivers of change: strong farmers' groups, successful organic farming, successful ecotourism initiatives

In 2029, in Bang Taen Tambon, a large number of farmers have engaged in organic production. Farmers have created several groups and organizations (cooperatives, etc.) and developed networks with public agencies and organic agriculture networks to support them in terms of farm production (to reduce production and water problems, increase soil fertility and to improve yields) and processing. They obtained several certifications and jointly sell their products to several marketing channels with a price higher than conventional rice. They sell in particular their products in Bangkok, where there is now an important demand for organic products and they do so with support from public and private organizations. As a result, farmers get a satisfying income so they have increased their confidence for adopting and expanding rice organic farming and also other farm production such as vegetable and livestock, produced in an organic way. Most farmers grow organic farming for getting an income, but some aged farmers also produce organic products mainly for home consumption. Moreover, there has been a successful development of eco-tourism projects, with the support of several public organizations. Inhabitants from Bangkok come over week-ends to stay in the area, learning about organic farming, and they collect organic produce by themselves. Several (not all) young people agree to take over the farms of their parents, since producing organic products plus getting income from rural tourism enables to have overall a satisfying income. These young people adopt many innovations to improve their farm production, processing and marketing.

Table 7 presents a synthesis of the scenarios for the 4 focus areas.

Table 7. Synthesis table of the scenarios for the 4 focus areas

Focus area	**Business as usual scenario**	**Alternative scenario**
Bang Kung	A strong decrease of farming - Limited number of farmers to do diversification due to insecure land access and insufficient water in dry season - Rice farmers earn low profits because of high farm production costs and unstable rice price - Few young people take over farm when they inherit land	Diversification - Diversification has expanded because of improved conditions for land rent and better irrigation management - Decrease in the use of chemical inputs (i.e., safe-pesticide, organic farming) along with rural tourism to improve income - 30% of young people work on farm; some of them have also other jobs
Dong Krathong Yam and Hat Yang	A rice sector in crisis - Few farmers try to diversify due to lack of improvement of water management - Rice yields decreased and pumping costs remain high so rice profitability has decreased - Some farmers stop farming and some rent-out land - Young people are not interested in farming	Increased water control and diversification - Farmers have access to sufficient irrigation water - The area works as a flood inundation area during the rainy season - Rice farmers improve rice yields and decrease pumping costs - 30% of farmers who own land adopt diversification - Some young people come back to take over the farms of their parents
Bang Pla Ra, Bang Kham, and Kra Thum Paew	Individual production and marketing - Failure of collective action and no improvement of collective water management - Diverse individual farm strategies to deal with unstable price of fish and shrimp - Low profitability: some farmers are indebted, some stop farming, some rent-out, etc. - Some young people still get involved farming	Successful farmers' collective action - Success of collective action for improved water management, improving breeding techniques, accessing farm inputs at low costs, joint production planning, processing plus marketing - Improvement of farm profitability - Many young people get involved in farming
Bang Taen	A dormant agriculture - Rice profitability has decreased because of high farm production costs and unstable rice price - Only few farmers try to adopt organic farming due to intensive farm work and limited profitability as farmers sell organic rice at the same price as rice produced with chemical inputs - Lack of success of ecotourism projects - Few young people take over the farms of their parents	Organic production and ecotourism project - Success of organic farming and ecotourism projects, so farmers become more confident in organic production and marketing - Decrease of farm production costs, improved health of farmers and environment - More young people work on farm

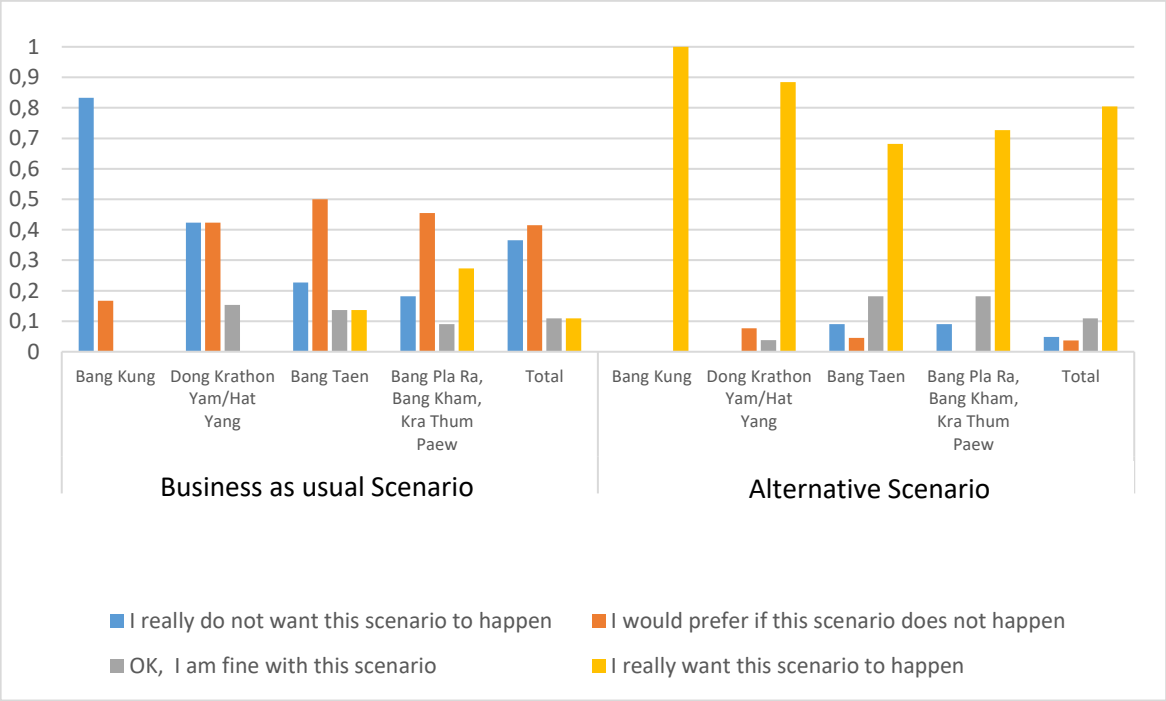
4.3. Assessing scenarios

During the workshop at local level in each focus area, the participants assessed each of the two scenarios in terms of their preferences and the likelihood that the scenarios will occur.

4.3.1. *Preferences of inhabitants*

As Figure 3 shows, participants clearly prefer the alternative scenario as these people could see the opportunity to improve their income from farming in a sustainable way. Moreover, some of participants (i.e., diversification farmers in Bang Kung/Dong Krathong Yang/Hat Yang, and farmers doing organic rice farming in Bang Taen area) already get some benefit from activities described in the alternative scenarios.

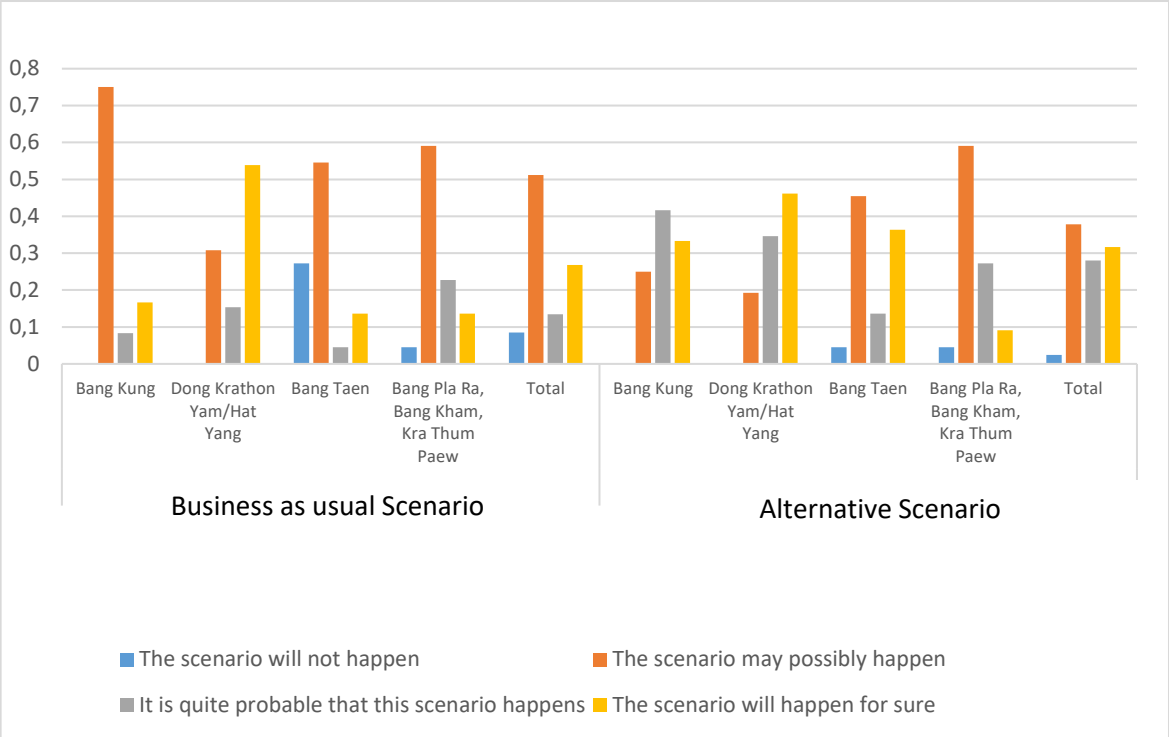
Figure 3. Scenarios preferred by participants in the workshops at Tambon level



4.3.2. *The likelihood that the scenarios will occur*

Participants in the four workshops generally have a similar assessment of the probability that each scenario will occur. In particular, they believe that the alternative scenario can occur (Figure 4). They are confident that the main drivers of change (i.e., improved land lease act, improved water management, success of diversification, organic farming and collective action) may enable such a scenario.

Figure 4. Assessment by inhabitants of the likelihood that each scenario occurs



4.3 Upscaling to the whole study area

The current and future drivers of change in each of these tambons was similar to each of the focus area, either as a whole, or in part: one part of the tambon being related to one focus area, and another one related to another focus area. The following Table 8 summarizes these linkages.

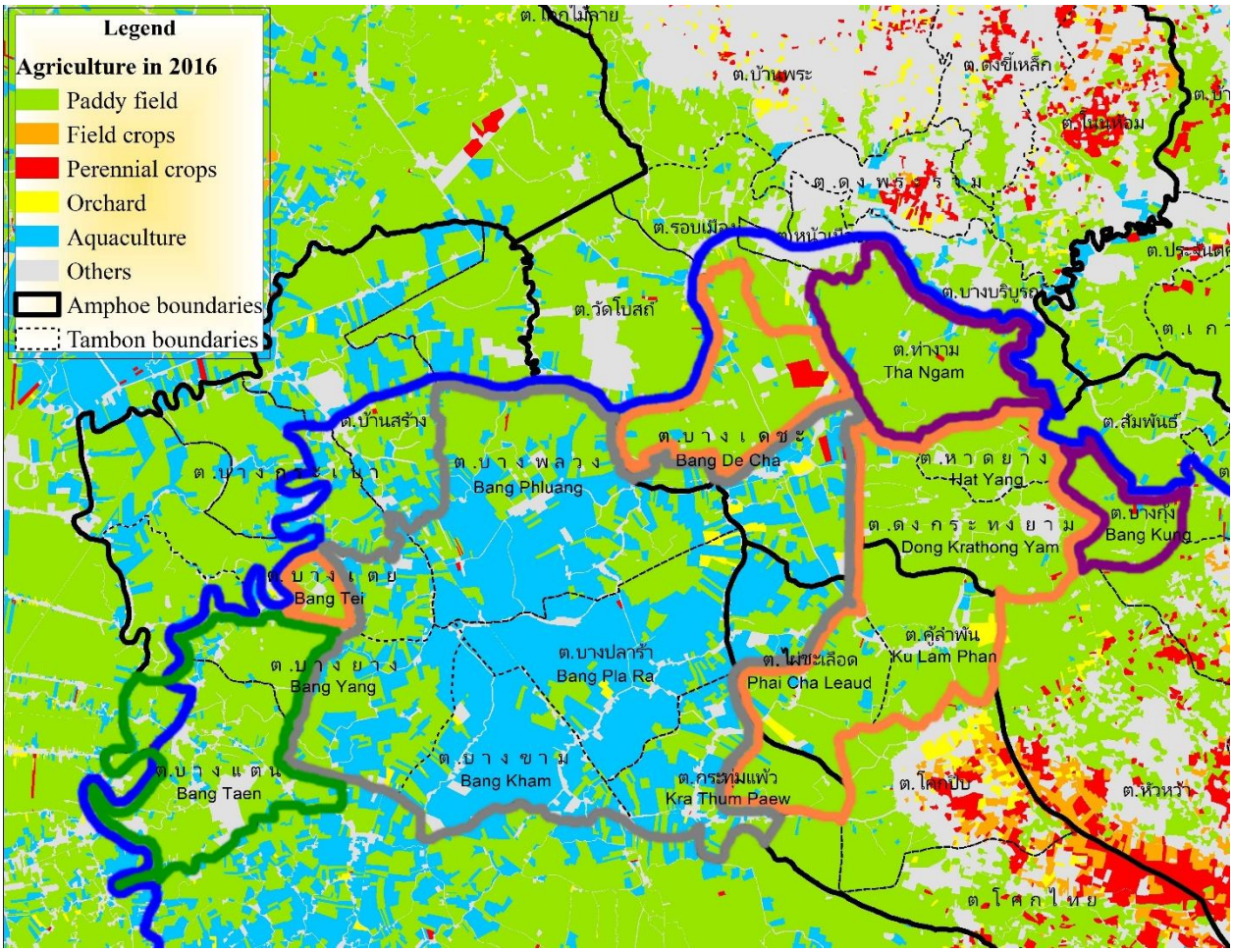
Table 8. Linkage between focus areas and the whole study area

Focus area	**Characteristics/drivers of change**	**Similar tambon in the study area**
Bang Kung	- Small-scale farms - Aging farmers - Mostly rice production, a bit of diversification	Meang district - Tha Ngam tambon
Dong Krathong Yam and Hat Yang	- Large-scale farms - Electric pumping machine - Mostly rice production, a bit of diversification	Ban Sang district - Middle of Bang Tei tambon - Eastern of Kra Thum Paew Meang district - North of Bang De Cha tambon Srimahosot district - Ku Lamphan tambon - South of Phai Cha Leaud tambon
Bang Pla Ra, Bang Kham, and Kra Thum Paew	- Rely water from Bang Phluang Water Gate - Mainly fish and shrimp farming with some rice production	Ban Sang district - East of Bang Tei tambon - Middle of Bang Yang tambon - Bang Phluang tambon Meang district - South of Bang De Cha tambon Srimahosot district

		- North of Phai Cha Leaud
Bang Taen	- Mainly rice with some fish and shrimp breeding - Organic group and ecotourism project	Ban Sang district - The northwest of Bang Yang tambon

One specificity that came out is that, in Bang Yang, Phai Cha Leaud, and Bang De Cha, four large-scale companies have bought land and started plantations on a large scale (from 200 to 5000 rai). According to interviewees, a positive outcome is the provision of employment, but a negative one is that these large-scale farms block expansion of floods. Figure 5 represents the zoning made corresponding to Table 8.

Figure 5. Zoning of the Bang Phluang area in terms of future scenarios



4.4 Two synthesis scenarios for the Bang Phluang area

We draw hereafter some key common elements for two synthesis scenarios for the whole Bang Phluang study area.

4.4.3 Business as usual scenario

In 2029, most rice farms in the area have failed to move away from conventional farming practices. The share of farmers doing diversification and organic rice remains very limited. Some groups

received support, especially from public organizations, to do organic products or non-rice crop. However, they did not manage to on once the support ended.

Many farmers have sold land and some rented out to other farmers from different origins such as other tambons in Bang Phluang area and other provinces (i.e., Samutprakan, Chacheongsao) to invest in fish and shrimp farming. Some farmers sold land to companies that invested in plantations and in factories. These companies provide employment, but they built dykes to protect from floods, thus also contributing to higher floods in their neighborhood. There is high competition to rent land with high rent fees.

Initiatives to improve water management have failed. Rice farmers keep on producing rice, though with a key focus on decreasing production costs, but they still face the issue of increase renting and pumping costs. Some farmers could not deal with these issues so they stop farming and shift to do other jobs. Only some farmers managed to secure a better access to irrigation water thanks the installation of individual pumps and the digging of canals to bring water from Prachinburi River to their farms. Profitability is low and very few young people come to become farmers.

4.4.4 Alternative scenario

In 2029, various initiatives successfully managed to support the evolution of farming systems. Access to irrigation water during the dry season has improved, for two reasons. First, infrastructure was improved, thanks to an agreement with the Royal Irrigation Department, that rice fields in the area are also used as flood expansion areas during the rainy season. Second, water user groups are working better and there is now some coordination of water use in the main canals. Many farms that were previously farming conventional rice now try to produce organic rice or diversification crops under some support from the government agencies, and some farmers initiate by themselves. More generally, beyond these specific changes, the farms have improved their capacities to evolve and to change the crops produced depending on new constraints and opportunities. One reason is that lessees have increased the security of land tenure and thus they can invest with confidence on improving soil characteristics and equipment of the farm. Second, several farmers' organizations have successfully become engaged in joint technical advice and marketing. Some young people have started farming for three reasons: 1) profitability of existing farms is interesting: 2) they see that their farms can evolve positively in the future; 3) some public policies accompany the installation of young farmers.