

# 論文の内容の要旨

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論文題目 Farmers' strategies for adaptation to changing climate:

Two case studies in coastal Vietnam

(変化する気候への農民の適応戦略：ヴェトナム沿岸域における 2 つの事例研究より)

## Chapter 1: Introduction

Vietnam is one of the five countries in the world that would be most affected by the climate change. It has the coastal line of more than 3,260 kilometers in total length and high-population density with over 23% of the 84 million Vietnamese populations residing in the costal areas. Most of the people in coastal areas are engaged in farming and fisheries, and, hence, will be vulnerable to the immense and direct impacts of climate change and subsequent changes in hydrology.

In this chapter, I review the literature on climate change impacts in Vietnam. The Vietnamese government established the National Target Programs and policies coping with climate change. They assumed some scenarios under climate changes through to the end of the 21<sup>st</sup> century, and derived actions against the changes top-down from the scenarios, while neglecting the local people's reactions to the climatic and societal changes. There is a contrasting approach, however, that starts with the local peoples' perception of changes in climate as well as other natural and societal conditions. It seeks the information on local concerns on climate and other natural and societal conditions, and focuses on the people's reactions to the perceived changes.

I take this 'bottom-up' approach in my thesis hoping that the top-down policies against the climate change impacts can be adjusted or even designed on the basis of the bottom-up understandings of the local peoples' strategies for sustainable livelihood against the changes in climate and other socio-economic determinants in the near future. I explored sustainable farming systems in adaptation to changing climate on the basis of case studies at two locations in the North and South of coastal Vietnam.

## **Chapter 2. Methodologies**

Two coastal districts in Vietnam were chosen for this study. The first case study was done in Nga Son district of Thanh Hoa province, which is located in the North and neighboring the Red River Delta, the second largest delta in Vietnam. The district has been the largest and most famous producer of sedge (*Cyperus* spp.), an industrial crop used to make mats and handicrafts, for more than 500 years. The second case study was conducted in Cai Nuoc district of Ca Mau province located in the Mekong River Delta that is the largest delta of Vietnam. Two surveys were conducted in March 2008 and 2009.

The primary data were collected by participatory methods including key-informants interview, key-informant discussion, focus group discussion, field observation, transect walks, and semi-structured interviews, in which 200 (Case study #1) and 100 (Case study #2) households were visited with questionnaires.

## **Chapter 3. Case study #1: Sedge growers in Nga Son district of Thanh Hoa province**

In this chapter, I investigated the farmers' perception of climate change, their responses to the changes in climate and hydrology as well as the determinants of their adaptive capacity.

With respect to the farmers' perception of climatic changes, 96 out of 200 interviewees (48%) reported higher temperature than 20 years ago, and 83 interviewees (42%) mentioned a delay in the end of rainy season. The sedge harvest had to be delayed in response to the later end of rainy season as reported by 115 (58%) interviewees.

Farmers also reacted to the decrease of sedge productivity and salinity intrusion in recent years. The reaction included changes in cropping calendar and pattern, diversification of income sources by finding non-agriculture jobs, developing animal husbandry and aquaculture as well as setting up private businesses.

The farmers' adaptive capacity depends on the economic and topographic conditions. The study compared one group located inland (the rich group) and the other located closer to the coast (the poor group). The two groups were significantly different in options to develop aquaculture and to start private businesses. These options give them a high cash income, but they require more initial investments than the poor can afford.

## **Chapter 4: Case study #2: Shrimp farmers in Cai Nuoc district of Ca Mau province**

With the same purpose as chapter 3, I investigated farmers' perception of climatic changes, their adaptive responses to the changes, and the determinants of their adaptive capacity in Cai Nuoc district. In this district, the rice paddies had been converted dramatically to shrimp ponds due to the salinity intrusion since 2000.

Among the 100 interviewees, 49 reported that temperature had risen since 20 years ago, 42 mentioned later commencement of the rainy season, and 41 reported a higher frequency of tropical storms than in the past.

The study revealed that the rich farmers increased intensive shrimp and selected better seeds of shrimp, and that the poor opted for other income sources, e.g. growing fruits, vegetables and other crops to reduce their daily expenditure. Increase in rice cropping area was opted for by many

farmers irrespective of the economic conditions. However, the farmers' adoption of this option of increasing rice cropping varied by topography. Switching from direct-seeding to transplanting and selecting more salt-tolerant varieties were common responses for the farmers to the increasing salinity.

### **Chapter 5: General discussion**

The findings in Chapters 3 and 4 were synthesized in this chapter. In the Case study in Cai Nuoc district, government had implemented policies to cope with the increased salinity since 1994. Under the policies, they installed engineering adaptations such as the construction of sluice gates and canals to protect rice paddies from salinity intrusion in some areas, and the conversion of rice paddies to shrimp ponds in the other areas. These two types of adaptations were not really successful, however. The sluice gates have altered local hydrological regimes, and resulted in severe conflict between the people over fresh water supply. Conversion from rice to shrimp also negatively affected the environmental and social aspects. One of the reasons for the problems was the lack of information and experiences at local scales. These experiences from the second case study could be transferred to the first study site in the North, where the policies on land use change are yet to be established to cope with the salinity intrusion due to the sea level rise and damages due to extreme weather events.

The top-down and bottom-up approaches shall complement each other in achieving sustainable farming systems in the coastal areas, where the vulnerability to climate changes should be reduced for the future.

### **Chapter 6: Conclusions and implications**

This chapter summarizes the findings in the preceding chapters. The findings have shown that the farmers have some capabilities to adapt themselves to the changes in climate and hydrology, but that they also need institutional assistances at scales larger than the villages such as policy makers, land planners and agricultural extension officers. Incorporating local knowledge into policy making process would facilitate sustainable agricultural developments in coastal Vietnam in adaptation to the climate changes in the near future.