Social capital, livelihood diversification and households' resilience to floods in the Vietnamese Mekong River Delta

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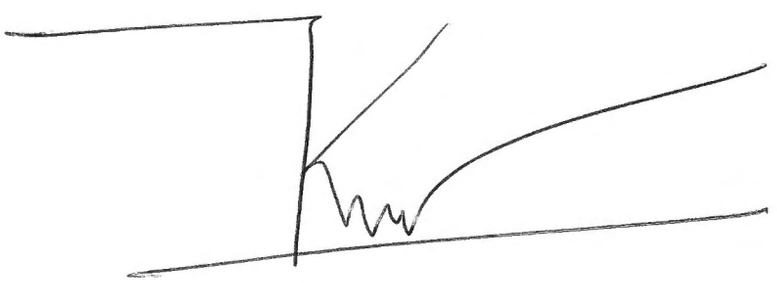
Declaration

Except where stated, this is my own original work undertaken during July 2008 - November 2012 as a PhD candidate at the Australian Demographic and Social Research Institute (ADSRI), the Australian National University (ANU).

Except for some personal information of supporters in the acknowledgments where I quote their real names, the names in the quotations in the thesis are not the real names of the research participants or key informants.

I certify that the Human Ethics protocol number 2009/471 on "Social capital, livelihood diversification and households' resilience to floods in the Vietnamese Mekong River Delta" was approved by the Chair of the Humanities and Social Sciences DERC on 1st December 2009.

The fieldwork undertaken for this research was funded by EEPSEA (the Economy Environment Program for Southeast Asia). The research report[1] and a policy brief[2] were published by EEPSEA. The researcher is the key author of both these publications.



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Abstract

Floods are a familiar and frequent feature of life in the Vietnamese Mekong River Delta (MRD). Although floods bring hardship to people, they also bring environmental benefits for sustaining rural livelihoods. People in the MRD have experienced the impacts of floods for hundreds of years since the sparse population settled in the MRD during the 19th Century. In some years, the flood is 'big' or 'small', but it is 'moderate' in most years. Some people are 'winners' while others are 'losers' due to the impacts of the flood events. The aim of this thesis is to advance understanding about perceptions of the flood events, flood impacts on household livelihoods, and households' capacity to live with floods. The aim of the thesis is characterized into four key objectives: (i) to explore the perception of the flood events in the MRD held by different socio-economic groups, (ii) to examine the impacts of three levels of floods (small, moderate and big) on different households' livelihood activities and assets in the MRD, (iii) to investigate the relationship between livelihood adaptation (diversification or specialization) and households' capacity to live with floods in the MRD and (iv) to examine the relationship between different forms of social capital of households and households' capacity to live with floods in the MRD.

The research employs both qualitative and quantitative approaches to address four research questions. The key methods used in the qualitative approach include focus group discussions (FGDs), in-depth interviews with key informants, field observations and document research. The structured household interview is the key method for collecting quantitative data. The stratified sampling approach was used to choose households in three study sites in the MRD.

The findings indicate that local people use several different terms to describe the flood events. Government staff and local researchers are more likely to use the term 'flood season' *(mùa lũ)* before 1998 whereas local people use the term, 'rising water season' *(mùa nước nổi)*. Similarly, local newspapers mostly use the term 'flood' *(lũ)* in reporting the events. The findings further confirm that there is a shift from the use of term 'flood' to 'rising water season' by government and local newspapers in recent

years. Interestingly, there are significant differences in perceptions of flood depth by gender, socio-economic group and by region.

The study identifies that people use different approaches to cope with different levels of flood events and the approaches vary by socio-economic group and region. The findings further confirm that the flood has both benefits and costs. The negative and positive impacts of the flood events are variable by socio-economic group and region. Interestingly, the moderate flood event is perceived as the most 'beautiful one' in terms of its impacts on household livelihoods because it creates fewer negative impacts, but brings more benefits to most socio-economic groups.

Three properties of households' resilience to floods are obtained from factor analysis which include (i) households' capacity to secure food, income, health, evacuation, and recovery; (ii) households' capacity to secure their homes in future floods as in the threshold flood in 2000; and (iii) households' capacity in learning to adapt using new flood-based livelihoods.

The results further demonstrate that different forms of social capital have different effects on different types of households' resilience to floods. Neighbourhood attachment has a statistically significant effect on a household's ability to secure food, income, health, safe evacuation during the floods, and recovery after floods, and level of interest in learning new flood-based livelihoods, but it does not have a significant effect on the households' capacity to secure their homes in future floods as in the threshold flood in 2000. Similarly, a social supportive network has significant effects on a household's ability to secure homes, but it does not have a significant effect on the households' capacity to secure food, income, health, evacuation, and recovery, and learning to adapt new flood-based livelihoods. Participation in groups and associations does not have a significant effect on improving households' resilience scores in most cases.

Socio-economic characteristics of households (household income) are shown to have a significant effect on the three properties of households' resilience. Better-off households are more likely to confident in securing with food, health, income, and housing. However, rich households are less likely to be interested in learning new flood-based livelihoods because they often own large areas of land which discourage them to take up new flood-based livelihood activities instead of growing rice. Older and aged people and women are less likely to learn and adapt new flood-based livelihood activities

(raising fish, prawns and growing aquatic vegetables). Housing type also has a significant effect on a household's capacity to secure the home (concrete houses are less vulnerable). Regional flood factors also have a significant effect on the three resilience factors; people in the highest flood-prone region are less likely to be resilient in terms of securing their houses, food and income, but are more likely to learn new ways of living with floods.

Surprisingly, the livelihood diversification index has no effect on a household's resilience to floods in most cases. This means that livelihood diversification does not necessarily improve households' resilience to floods. However, in the qualitative data, diversification into off-farm fishing and migration made some people more resilient, but others more vulnerable to floods. Diversification within farming activities such as conducting flood-based farming activities may help some households to improve their income during the flood season. Migration to HCM city or Binh Duong industrial zone may be a useful strategy, but this strategy is problematic due to the high living costs in HCM city. Engaging in new flood-based livelihood activities helps some people to improve their household incomes, but they often face risk from market.

Policies for living with floods should try to (i) enhance the use of flood benefits by changing the current flood risk communication by local newspapers, government reports and other media; (ii) make use of the full benefits of the flood season to improve livelihoods for the poor households who lack capacity to seek non-farm jobs; (iii) maintain and develop the social capital of households, especially neighbourhood attachment and social supportive networks that may help rural households to adapt to future floods.

Acronyms

ADB	Asian Development Bank
ANU	Australian National University
AusAID	The Australian Agency for International Development
DFID	United Kingdom Department for International Development
EEPSEA	Economy and Environment Program for Southeast Asia
FGD	Focus Group Discussion
FGD_PD01	Poor male group in Phu Duc commune
FGD_PD02	Better-off male group in Phu Duc commune
FGD_PD03	Better-off female group in Phu Duc commune
FGD_PD04	Poor female group in Phu Duc commune
FGD_TA01	Poor male group in Trung An commune
FGD_TA02	Better-off male group in Trung An commune
FGD_TA03	Poor female group in Trung An commune
FGD_TA04	Better-off female group in Trung An commune
FGD_TMT01	Better-off female group in Thanh My Tay commune
FGD_TMT02	Poor male group in Thanh My Tay commune
FGD_TMT03	Poor female group in Thanh My Tay commune
FGD_TMT04	Better-off female group in Thanh My Tay commune
GSOV	General Statistics Office of Vietnam

HCM	Ho Chi Minh City
IHHD	Inverse Herfindahl – Hirschman
ISDR	International Strategy for Disaster Risk Reduction
KMO	Kaiser-Meyer-Olkin
MARD	Ministry of Agriculture and Rural Development
MONRE	Ministry of Natural Resources and Environment
MRC	Mekong River Commission
MRD	Mekong River Delta
SIWRPM	Southern Institute of Water Resources Planning and Management
SLF	Sustainable livelihood framework
SPSS	Statistical Package for the Social Sciences
UNDP	United Nations Development Program
USD	US Dollars
VCCI	Vietnam Chamber of Commerce and Industry Portal
VND	Viet Nam Dong

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Chapter 1

Introduction

1.1 Research issues

Flooding is a common occurrence in Vietnam, especially in the Red River Delta, the Central coastal region and the Mekong River Delta (MRD). Among disaster events, flood frequency, damage and mortality are ranked as the second most severe after the impacts of typhoons in Vietnam (Imamura and Đặng Văn Tô 1997)[3]. Half of the MRD's area (2 million ha) is flooded annually and the majority of the rural population is vulnerable to the impacts of floods. There is additional evidence that a rise in sea level due to climate change will increase the risk of flooding in the MRD, which will affect the livelihoods of millions of people (Eastham et al. 2008, Wassmann et al. 2004, Dasgupta et al. 2007). Sea level is expected to increase by 75 centimetres (cm) by the end of the 21st century in Vietnam's Mekong Delta (MONRE 2009). Consequently, the livelihoods of people in the MRD will be vulnerable if measures are not undertaken to cope with, and adapt to, future flooding.

Flooding in the MRD has both negative and positive effects. On the negative side, flooding always brings hardship to rural populations via such impacts as crop losses, submerged and destroyed houses, and loss of human life. According to a government report (Ministry of Agriculture and Rural Development (MARD) 2004: 15) the annual flood event in the MRD is known to be "disadvantageous" to rural livelihoods and the socio-economic development of the region. On the positive side, flooding brings beneficial resources such as an abundance of fish, fertile sediment, and a huge amount of water that supports productive agriculture (Đào Công Tiến 2001b, MRC 2005). In addition, the annual flood event also provides opportunities for developing off-farm collecting[4] activities and engaging in flood-based farming[5] practices to improve household incomes during the flood season[6] (Nguyen Van Kien 2008, Nguyen Van

[3] In this thesis, Vietnamese personal names are presented in the order: family name, middle name, first name in text and in the reference list.
[4] Fishing and vegetable harvesting etc
[5] Raising fish, prawns, and growing aquatic vegetables
[6] It is called the 'flood season' because it occurs during four-six months of a 'cropping season'. In the South of Vietnam, people usually call it the 'dry season' *(mùa nắng)* and the 'rainy season' *(mùa mưa)*. However, in the flood-prone area of the Mekong River Delta, the 'rainy' season occurs at the same time as the 'flood', so people often call it the 'flood season'.

Trong and Le Thanh Binh 2004). However, not all of the population experiences similar benefits or losses in any given flood event in different flood regions[7].

Although most people have lived in the MRD for years, little is known about the local perceptions of the annual flood event of household livelihoods. The existing knowledge about flood events and the socio-economic variation of flood impacts on the livelihoods of rural households in the MRD appears simplistic. It is argued that different flood events create costs and benefits that vary across rural households and in different regions. An evaluation of who is worse off or better off from different flood events (small, moderate and big floods) is still neglected in the existing literature. In other words, who is vulnerable or resilient to the big, moderate and small floods is still open to question by scientists and decision makers. In particular, many households worry that their homes may be negatively affected by extreme floods. Others are concerned that they may lose their agricultural wage jobs and their income sources will be disrupted because of the occurrence of floods. Many people are also concerned that their winter-spring rice crop may be affected by rats and pests. If the flood is small, it would not kill the pests and rats. At the same time, some people can turn the 'flood' which is often perceived as 'disadvantageous' into 'beneficial resources'. These people can use the valuable resources from the floodwaters to develop livelihood strategies to adapt to the flood season for living with floods. When income is secure, rural households invest in their homes by upgrading their house foundations as well as securing food and health for their family members to avoid the possible impacts from the floods. This is termed 'households' resilience to floods' in this thesis. Therefore, understanding the variations of flood impacts on rural household livelihoods and their capacity to cope with floods is important to build 'livelihood resilience' for rural households and communities in the flood-prone area of the MRD.

So far, no study has demonstrated an in-depth understanding about the impacts of floods on household livelihoods, non of their capacity to cope with, and adapt to, floods in the MRD. To uncover the complexity of flood impacts and households' resilience to floods, this thesis explores local perceptions of flood risks from the perspectives of the local people, to identify impacts of different flood levels[8] on the livelihoods of different

[7] The areas are often classified into three major zones: high-flood prone, moderate flood-prone and low flood-prone areas.

[8] Local people and scientists often classify the annual flood event into three common levels: small flood *(lũ nhỏ)*, moderate flood *(lũ vừa)*, and big flood *(lũ lớn)*. The levels of floods 'small', 'moderate', or 'big' are measured by the flood level at Tan Chau Gauging station in the MRD. Tan Chau is one of nine

socio-economic groups in the three most commonly flooded regions. Resilience is a useful concept through which to explore rural livelihoods in the context of living with floods. The thesis further investigates the factors that determine households' resilience in the ways in which they adapt to living with floods. The resilience concept is discussed in this thesis as the capacities and livelihoods of resource-dependent communities and households to cope with and adapt to stresses or shocks (Adger et al. 2002, Armitage and Johnson 2006, Berkes and Jolly 2001, Adger 2000, Adger et al. 2005, Folke 2006, Folke et al. 2002, Klein et al. 2003, Walker et al. 2002, Marshall and Marshall 2007, Langridge et al. 2006, Adger 1999). 'Shocks' or 'stress' in this context refer to the occurrence of several months of flooding that may affect the livelihoods of many people.

Many researchers have attempted to define the concept of resilience, but very few operationalize the concept of resilience to natural hazards by developing measurable indicators. To fill that gap, this thesis attempts to conceptualize and measure households' resilience to floods in a quantitative way. Paton and Johnston (2006: 93) state that resilience can be analysed at different levels: from individual to household, tribe or clan, locality or neighbourhood, community, social association, organization, and systems such as social-ecological systems. However, most researchers examine resilience at individual and community levels. This thesis analyses resilience to annual flood events at the household level; it also identifies factors that determine households' resilience to floods in order to advance our understanding about households' capacity to live with floods. The findings of this study will provide insights into developing measures for coping with, and adapting to, future flood events in the MRD.

1.2 Research aim and objectives

The main aim of this study is to advance understanding about perceptions of the flood events, flood impacts on household livelihoods, and households' capacity to live with floods. The thesis will explore four objectives to support the key aim:

Gauging Stations which are used for water and flood monitoring in the MRD. When the flood peak in Tan Chau Gauging Station is more than 4.5 m above mean sea level it is called a 'big flood'. In most years, the flood is moderate. The moderate flood occurs when the flood peak is between 4.0 and 4.5 m above mean sea level. A 'small flood' occurs very rarely, when the floodwater is very low or less than 4 m. Lê Anh Tuấn, Chu Thái Hoành, Miller, F. and Bạch Tấn Sinh (2007) 'Floods and Salinity Management in the Mekong Delta, Vietnam ' in Trần Thanh Bé, Bạch Tấn Sinh and Miller, F., eds., *Challenges to sustainable Development in the Mekong Delta: Regional and National Policy Issues and Research Needs* Bangkok: The sustainable Mekong Research Network, 15-68.

1. To explore the perceptions of and coping with the flood events held by different socio-economic groups in the MRD.

2. To examine the impacts of three levels of flooding on different household livelihoods in the MRD.

3. To examine the relationship between different forms of social capital of households and households' resilience to floods in the MRD.

4. To investigate the relationship between livelihood adaptation (diversification or specialization) and households' resilience to floods in the MRD.

1.3 Research questions

The research seeks to answer four key questions in order to advance understanding about households' resilience to floods in the MRD.

Firstly, as stated above flooding in the MRD of Vietnam is a well-known event, and different social groups and stakeholders have different perceptions of the water event. In particular, local people often call the 'flood' the 'rising water season', while the media and government bodies see floods as 'natural hazards'. The use of the term 'rising water season' or the 'flood season' reflects the ways people interact with it. However, no study discusses this issue in relation to the MRD. Therefore, the first question of this thesis is to explore the ways in which people in different socio-economic groups talk about the flood events. The first question is as follows.

1. How does the perceptions of, and coping with the flood events in the MRD, vary by socio-economic group and region, from local to state government?

After the perceptions of the flood event are addressed in question one, the second question will explore in more depth the perceptions of flood impacts on household livelihoods from three common flood events (small, moderate and big) in three particular flood-prone areas (low, medium and high flood-prone areas).

As discussed in the section on research issues, some people may become better-off from a given flood event, but be worse off in other flood regimes. In particular, rice farmers may benefit from a big flood event as it brings rich fertile sediment to their rice fields. As a result, rice farmers apply fewer fertilizers, while gaining good yields. However, rice farmers may be worse off in a small flood year because the small flood does not kill

the pests or weeds and brings no sediment into the rice fields. Consequently, they have to apply more fertilizer, but gain lower yields. Similarly, some people can be better off in a low flood-prone region, but become vulnerable if they live in a heavily-flooded area. To understand this issue, the second research question is developed:

2. How do the impacts of the different flood levels (small, moderate, and big) on household livelihoods vary among different socio-economic groups in geographically different flood-prone regions of the MRD?

Resilience is a useful concept to study the capacity of different social groups to cope with the impacts of floods in the MRD. To be resilient to the impacts of floods, diversification of livelihood activity helps farmers to reduce vulnerability to income losses (Ellis 2000, Ellis and Freeman 2005). Many studies have investigated the effects of livelihood diversification on coping with drought and suggested that diversification toward non-farm activities can help poor rural households to reduce vulnerability to climate change (Smith et al. 2001, Eriksen et al. 2005). However, it is argued that poor households are more likely to diversify livelihood activities for survival, while rich people tend to diversify for development and capital accumulation (Carswell 2000). This study further examines whether diversification or specialization of livelihood activities is more or less beneficial for different types of households in living with the floods in the MRD. The third question is as follows:

3. To what extent is there a relationship between livelihood diversification or specialization and households' resilience to live with floods in the MRD?

Besides diversification of livelihood activities helping households to improve their resilience to natural hazards, households' resilience can also be enhanced by banking on social capital. The basic conception of social capital is that individuals invest, access, and use resources embedded in social networks to gain returns (Lin 2001). The term 'social capital' is generally defined as the aggregate of the actual or potential resources that are linked to possession of a durable network of relationships (Bourdieu 1986). Social capital inherent in a community is considered an important resource in coping with natural hazards and climate change (Mathbor 2007, Eriksen et al. 2005, Hawkins and Maurer 2010, EEPSEA 2009, Phóng Trần et al. 2008, Adger 2003, Airriess et al. 2008). Most studies investigate collective social capital in coping with natural hazards at community level; little is known about the effects of individual social capital on

households' capacity to cope with, and adapt to, natural hazards. This thesis further examines the relationship between households' capacity to live with annual flood events and the different forms of social capital of households (neighbourhood attachment, social supportive networks and participation in groups and organizations) in the MRD. The fourth question is set out below:

4. To what extent is there a relationship between different forms of social capital of households and their resilience to floods in the MRD?

1.4 Theoretical background on resilience, social capital and livelihood adaptation

1.4.1 The concept of resilience

Resilience has become a useful concept in the study of environmental hazards. The Oxford English Dictionaries define resilience as (i) the "ability of a substance or object to spring back into shape" and (ii) "elasticity" (Oxford University Press 2012). According to Klein et al. (2003) the term, 'resilience' is derived from a Latin word which means 'to jump back'. The term 'resilience' was first applied in the ecological discipline to study the capacity of an ecological system to 'bounce back' after disturbance. Holling (1973: 17) defines resilience as "the ability of a system to absorb change of state variables, driving variables and parameters and still persist". A 'system' may be a region, a community, a household, an economic sector, a business, a population group, or an ecological system (Brooks and Adger 2001, Brooks 2003). This concept focuses on the capacity of an ecological system to absorb changes, but still maintain its core functions. Natural hazard researchers define resilience as "the ability of the system to recover from floods" (Bruijn 2004: 199). Gaillard (2007: 522) summarises the definition of resilience in the natural hazard field, referring to the "capacity to overcome damage caused by natural hazards". In other words, the resilience concept is only applicable when natural hazards cause damage to households and communities.

Sociologists have a broader definition of resilience in the disaster context. According to Norris et al. (2008: 130) resilience is defined as "a process linking a set of adaptive capacities to a positive trajectory of functioning and adaptation after a disturbance". Disturbance can be either *abiotic* or *biotic* (Colding et al. 2003: 163). *Abiotic* disturbances are those caused by non-biotic agents such as droughts or flooding. In this context, Norris et al. (2008) identify 'capacity' as the process of linking social capital,

economic development, information and communication, and community competence in the face of natural disasters which enhances the adaptive capacities of a community. Although this definition refers to adaptation after natural disasters as other definitions do, there is flexibility in this concept in terms of positive adaptation. Adaptation after disasters can refer to bouncing back or being in a better circumstance.

In a social system, Adger et al. (2002: 358) define social resilience as "the ability of a system to absorb external changes and stress, while maintaining the sustainability of their livelihoods". Chambers and Convey (1991: 6) defined 'livelihood' in terms of:

> the capacities, assets (stores, resources, claims, and access) and activities required for a means of living: a livelihood is sustainable which can cope with and recover from shocks, maintain or enhance its capacities and assets and provide opportunities for the next generation.

The term, 'sustainable livelihood' is discussed in sustainable rural development literature. Scoones (1998: 6) defines a sustainable livelihood as "the ability of a livelihood to be able to cope with, and recover from stresses and shocks". The sustainable livelihood framework (SLF) was developed by the United Kingdom Department for International Development (DFID) to explain factors affecting household livelihood strategies and the ways rural households cope with stresses (Scoones 1998, Ellis 2000). A household is likely to be more resilient to stresses (risk or shock) if their livelihoods are sustained over time (Adger et al. 2002). Those who are not able to cope with, or adapt to, stress or shocks are vulnerable and unlikely to achieve 'livelihood resilience'.

The term 'resilience' is also used in psychology. Resilience can be seen as "positive adaptation in the face of stress" from a psychological point of view (Wang et al. 2010: 499). Resilience also refers to "positive adaptation in the face of stress and trauma" (Wang et al. 2010: 499). This means that if someone adapts positively to stress, she or he is more likely to be resilient.

Although various definitions of resilience are offered by various disciplines, there is a consensus that resilience is the capacity of social groups and communities to cope, recover from, and adapt positively to adversity. This typology is relevant to the Resilience Alliance's definition of resilience. According to Carpenter et al. (2001), there are three properties of resilience in an ecological-social system: (1) the ability of a system to stay in the domain of attraction; (2) the ability of a system to self-organize

(versus a lack of organization, or organization forced by external forces); and (3) the capacity for learning and adaptation (Carpenter et al. 2001: 765, Berkes et al. 2003: 13). If a system does not achieve these properties, it is not likely to be resilient.

In recent years, there has been a paradigm shift to a focus on the third property of resilience in an ecological-social system. In particular, the capacity to learn, innovate from disturbance, and to transform is the main focus in building a resilient community in the face of climate change or other set of crisis circumstances (Folke et al. 2002, Walker et al. 2004). The concept of resilience has recently been seen as linked to both social and ecological systems (Folke et al. 1998, Adger 2000, Folke 2006). In particular, the resilience concept is not only concerned about the ability to respond positively to external changes, but also distinguishes between incremental adjustments and system transformation (Nelson et al. 2007: 412, Walker et al. 2004). Transformation is related to innovation in response to change (Maguire and Hagan 2007). The concept of resilience is embedded in the concept of change, or innovation, and creativity after a disaster (Gaillard 2007: 523). The change may be technical, economic, behavioural, social or cultural, but the change depends on the types of society affected by the disasters (Gaillard 2007: 523).

Flooding in the MRD may not be an external change because most people experience its impacts on their livelihoods every year. It can be seen as part of the ecological-social system since most people benefit from off-farm fishing and the fertile sediment left by the floods. In particular, farmers can develop flood-based livelihoods to maintain household income during the flood season. However annual flooding can also be seen as an 'external shock', if the flood is either too 'big' or too 'small' and so exceeds the coping capacity of households and communities. A 'big' flood often disrupts rural livelihoods so many people are affected in terms of housing, human health, animals, income and food insecurity. Therefore, the resilience concept in the context of 'living with floods' in the MRD can be defined as 'the capacity of households to cope with, adapt to, and benefit from the flood season'. These capacities reflect the confidence of households to secure food, income, health, housing, and learn new ways of living with floods as well as recovery after the flood event.

1.4.2 Relationship between vulnerability and resilience

It is not easy to distinguish between the concepts of resilience and vulnerability. Some people argue that resilience is the opposite of vulnerability. Others argue that

vulnerability is a factor of resilience (Klein et al. 2003). While resilience addresses the capacity and the ways in which people deal with disasters, vulnerability only focuses on the susceptibility of individuals to suffer from damage and thus transform hazard into disaster (Gaillard 2007, Blaikie et al. 1994). The term 'vulnerability' is traditionally defined as the degree of potential losses in the face of natural disaster (Cutter 1996, Wisner et al. 2004, Adger 2000). Buckle (2006: 92) states that resilience and vulnerability do not confront each other, but rather complement each other. For example, something very resilient is not very vulnerable and vice versa (Manyena 2006). However, others argue that resilience and vulnerability are inter dependent (Manyena 2006). Gaillard (2007: 523) states that both resilience and vulnerability are dependent on similar factors such as demographic, social, cultural, economic, and political. However, these factors may vary at different times and scales of analysis.

1.4.3 Who is vulnerable and who is resilient?

Buckle (2006) presents a list of groups of people vulnerable to natural disasters in developed countries (Box 1). However, it is hard to identify some of these indicators in developing countries. For example, it is hard to see people living in caravans in Vietnam and in the MRD. Secondly, these indicators are more likely to apply at an individual level and in the disaster context. Thus the livelihood resilience indicators of households in developing countries may be significantly different from those in developed countries. Female-headed households, children, landless households and pastoralists are found to be more vulnerable to climate change than other social groups, because of their more limited access to resources and livelihood alternatives (Paavola 2008). Furthermore, households who have fewer income sources are more likely to be vulnerable to the impacts of flooding in rural Bangladesh and in the coastal provinces of Vietnam (Brouwer et al. 2007, Adger 1999). Therefore, it is more appropriate if the resilience indicators are examined at the household level in the developing countries, the level where most of the economic activities are undertaken (Alinovi et al. 2010). In the context of examining capacity to live with floods in the MRD, households are the most appropriate to investigate.

Box 1. 1: Vulnerable or resilient people and groups

- Aged (particularly the frail) being less mobile, often poor, often isolated
- Very young, dependent on others, lacking the capacity to care for themselves
- Disabled (mental or physical) requiring assistance from other people or agencies for daily normal support
- Poor/people with limited resources to meet essential needs
- Non-dominant language speakers who may have difficulty accessing information and services
- Indigenous groups who may be socially marginalized and poor
- Socially isolated who may lack support physically and emotionally
- Physically isolated with difficulty accessing services and information
- Seriously ill who require high levels of support just to meet daily needs
- People dependent on technology-based life support systems who also require high levels of daily support
- Large families who have to manage multiple needs within one household
- Single parent families with limited resources and low coping capacity
- People with limited coping capacity who can be made highly vulnerable by the addition of small amounts of additional stress or loss
- People with inadequate accommodation who are already in significant need
- Those on holiday and travelling (particularly those in tent and caravan resorts) who are not familiar with local circumstances and assistance
- Tourists from overseas who are not familiar with local conditions and who are far from their support network

Source: Adapted from Buckle (2006: 91-92)

1.4.4 Determinants of resilience

The Hyogo Framework for Action 2005-2015 (International Strategy for Disaster Reduction (ISDR) 2005: 4) states that building resilience for affected communities and nations is the key strategy for disaster risk reduction. Disaster risk arises from the interaction of hazards and social vulnerability (Blaikie et al. 1994, Vatsa 2004). Resilience of the system is dependent on several factors such as demographic, social, cultural, economic, political, type of the natural hazards, and geographical setting of the place (Gaillard 2007). However, these factors may vary at different scales of analysis. At household level, access to agricultural land, diversity of income sources and good housing quality create essential resources for households to cope with annual flood events in Bangladesh and climate change in the coastal provinces of Vietnam (Brouwer et al. 2007, Adger 1999). Learning to live with change and uncertainty, nurturing learning and adapting, and creating opportunities for self-organization were found to be the important observable factors for enhancing household and community resilience in the Cambodia context (Marschke and Berkes 2006). Similarly, Marshall and Marshall (2007) identified four perceived factors that contribute to conceptualizing resilience at

the individual level in an Australian context (1) perception of risk associated with change; (2) perception of ability to learn, plan and self-organize; (3) perception of the ability to cope; and (4) level of interest in changes. At the community level, Norris et al. (2008) identified four primary sets of capacities that enhance community resilience: economic development, social capital, information and communication, and community competence. Economic development refers to economic growth, stability of livelihoods, and equal distribution of resources within the population (Adger 1999). Social capital refers to networks of social support, bonding within the community, bridging between communities, and networking between communities and Government bodies (Pelling and High 2005, Mathbor 2007, Adger 2003). Information and communication refers to the system and infrastructure for informing the public because people need accurate information about danger and about the behavioural options for them to act quickly. Community competence relates to the capacity of the community to learn, work together flexibly and solve the problems creatively. These contributing factors should be measurable in a practical context.

1.4.5 Relationship between livelihood diversification and resilience

Three main bodies of literature discuss the ways in which rural households adopt livelihood strategies to cope with climate change and other stresses. These include agricultural extensification, agricultural intensification and livelihood diversification (Paavola 2008, Ellis 2000, Ellis and Freeman 2005).

Agricultural extensification refers to taking new units of land for low-input cultivation. Agricultural extensification can also increase productivity and reduce financial risks. However, the opportunity for extensification diminishes when the scarcity of land increases due to pressures of population growth (Boserup 1975: 15). Therefore, agricultural intensification can be a possible strategy for rural agricultural households to cope with stresses in developing countries. Agricultural intensification, as it was originally conceptualized by Boserup (1975: 28), involves the application of more labour to a unit of land in order to achieve greater productivity (because of population growth and a surplus of labour). However, agricultural intensification is placed at risk by market and climate variability. Ellis (2000: 60) states that rural livelihoods in developing countries are highly correlated with risks (market, climate variability, floods, and drought). For example, specialization in the agricultural sector makes it more vulnerable to droughts and floods (Cutter et al. 2003). If there is a flood or drought

in a particular locality, most farm income streams are adversely affected or disrupted. Therefore, specialization in on-farm income is more likely to be vulnerable to climate change.

A diversity of livelihood activities provides vital assets for buffering the effects of extreme hazards. Diversification of livelihood activities is one of the risk-spreading strategies of farmers in developing countries (Ellis 2000). Diversification of livelihoods is another factor that affects resilience in terms of response to disaster damage (Gaillard 2007: 534). Livelihood diversification is the creation of a livelihood portfolio comprising on-farm, off-farm and non-farm income which is less reliant on agriculture. Ellis (2000: 15) defines livelihood diversification as "the process by which households construct an increasingly diverse portfolio of livelihood activities and assets in order to survive or improve living standards". Non-farm income such as remittances may provide more advantages than farm income if natural adverse events disrupt farm income streams. Eriksen et al. (2005) found that remittances from rural-urban migration can help to reduce the level of vulnerability in drought affected households in Kenya. Ellis (2000: 11) defines different types of income sources as follows:

> Farm incomes as income generated from own-account farming, whether on owner-occupied land, or on land accessed cash or share tenancy, off-farm income as wage or exchange labour on through [land of] other farmers, and non-farm as 'non-agriculture income sources such as remittance'.

Those which are most vulnerable to natural hazards seem to be those that rely on unique livelihoods. They are most vulnerable in the event of partial or total destruction of these resources. In contrast, communities which rely on several livelihoods are less affected by disruption (Gaillard 2007). Communities with a greater level of livelihood diversity are more likely to be resilient to shocks and stress (Adger 2000). The greater their resilience, the greater is their capacity to absorb shocks and perturbations and adapt to changes (Adger 2000, Adger et al. 2005, Berkes et al. 2003).

Diversity is one of the measurable indicators of resilience of the community as well as households. The greater the diversity of income sources, the greater the resilience of livelihoods to disruption from particular sources (Adger 1999: 245). In Samoa, farmers diversify their farming activities to cope with annual cyclones (Colding et al. 2003). Marschke and Berkes (2006) found that diversity within fishery is a livelihood strategy for rural poor Cambodians to cope with stressors. However, agricultural sectors are

most sensitive to climate variations, so Adger et al. (2002) argue that it is not appropriate to diversify on-farm activities in the face of climate change

Therefore, livelihood diversification from on-farm to off-farm and non-farm activities is an important strategy for achieving livelihood resilience in the context of market variation as well as climate variability (Paavola 2008, Ellis and Freeman 2005). Evidence shows that households with more income towards non-farm sources are less likely to be affected by floods in rural Bangladesh and by climate change in rural coastal provinces of Vietnam (Brouwer et al. 2007, Adger and Kelly 1999). However, it is argued that the poor diversify their livelihoods for survival, while the better-off are more likely to diversify for capital accumulation (Carswell 2000, Marschke and Berkes 2006).

Although livelihood diversification can be a promising strategy to reduce both market and climatic risks and alleviate poverty, the effect of diversification on household income is still debatable. It has been shown that engaging in a large number of activities may not be as economically successful as more intensive types of livelihood activities (Eriksen et al. 2005). Additionally, Anderson and Deshingkar (2005) argue that diversification of income sources does not necessarily increase a household's income due to the cost of diversification (Anderson and Deshingkar 2005). An example is when a household in rural India changed from one to two income sources – their total income reduced by 15.0 per cent because of the increase in the cost of diversification. It can be argued that specialization or intensification of livelihood activities is more important than diversity of income sources (Eriksen et al. 2005, Anderson and Deshingkar 2005). For instance, the average wage of a contract labourer is 25.0 per cent higher than that of a casual farm labourer, while industrial wages are 90.0 per cent higher than that of casual work in rural India. However, Anderson and Deshingkar (2005) did not take the issue of climate change into account. Eriksen et al. (2005) argue that intensity of one income source (brick making) is more important than diversity of livelihood activities in coping with droughts in the rural context in Kenya. However, one of the most critical reasons for livelihood diversification is to achieve a low-risk (market risk as well as climate risk) income portfolio rather than improvement in total income (Ellis 2000).

In the flood-prone area of the MRD rice is the main cash crop for most rural households so annual flooding often disrupts rice farming for several months. In the extreme flood events, many households are at risk of food insecurity, health, human life and income

instability, and housing damage. The question is "how can rural households maintain rural livelihoods during flood months without any farming activities?" More particularly, "how can landless poor households live safely without any income sources during the flood season?" Yamazaki and Dương Ngọc Thành (1998: 144) found that small and medium-sized farmers are more likely to diversify farming activities, while large-scale farmers are more likely to specialize in mono rice farming in the less flood prone provinces of the MRD. Diversification of agricultural activities may allow rural households who have agricultural land to improve their income, but they face risks from the market. Recently, some households have attempted to diversify their rural on-farm income sources using flood-based farming practices such as farming prawns, fish and vegetables in the flood prone regions. Another form of diversification is shifting from wage labour income in the dry season to off-farm fishing income during floods, or migration. However, landless people cannot diversify on farms as they do not have agricultural land. Shifting from off-farm fish collecting or agricultural unstable wage income to non-farm seasonal migration during flood events is the most common livelihood strategy for the rural poor. Therefore, securing income, food, health, life and housing is the most important strategy for 'living with floods'.

1.4.6 Enhancing households' resilience by banking social capital of households

In the relevant literature social capital is seen as playing an important role in economic development, health outcomes, educational achievement, and migration, coping with natural hazards, disasters and climate change. Social capital theory first originated in the field of sociology. Bourdieu (1986: 248-249) defines social capital as:

> the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition – or in other words, to membership in a group – which provides each of its members with the backing of the collectivity-owned capital, a 'credential' which entitles them to credit, in the various senses of the word.

According to Bourdieu (1986) social capital can be actual or potential resources (symbolic or material goods) for group members, meaning that participation in groups may result in gaining access to either symbolic or material resources. Social capital is formed by formal (institutional) or informal (less institutional) relationships, which exist by exchanges of symbolic or material goods to maintain network relationships. According to Bourdieu's theory, maintaining a social relationship is the key to

accessing social capital. Bourdieu (1986: 249) shows that the existence of a network of connections or social capital is:

> the product of investment strategies, individual or collective, consciously or unconsciously aimed at establishing or reproducing social relationships that are directly usable in the short or long term, i.e., at transforming contingent relationships that are at once necessary and elective, implying durable obligations subjectively felt (felling of gratitude, respect, friendship, etc.) or institutionally guaranteed (rights).

Some social networks are naturally created, such as kinship networks, but people have to invest in most other social relationships. Bourdieu further claims that social capital is a collective asset that is a product of group members as well as shared by group members. The amount of social capital available to a person depends on the size of his or her networks or membership of groups, or the amount of capital (economic, cultural or symbolic) possessed by each of those groups to whom he or she is related.

Coleman (1988) addresses the importance of network structures rather than just the size or density of a social network. Coleman defines social capital by its function rather than its quantity (Coleman 1988: 98-100):

> Social capital is not a single entity but a variety of different entities, with two elements in common: they all consist of some aspects of social structures, and they facilitate certain actions of actors–whether actions or corporate actors–within the structure. Social capital exists in relations between and among actors within and outside a social structure, and it is manifested by changes in the relations among persons that facilitate collective action.

Coleman (1988: 107) argues that the closeness of the social structure is important not only for the existence of effective norms, but also for other forms of social capital such as trust. The proliferation of obligation and expectation is created by the trustworthiness of the social structure which depends on the closure of that social structure. Coleman also claims that the effective norms can give both material and non-material benefits, but effective norms are dependent on the closure of the network structure. Using an example from educational achievement in the US, Coleman demonstrates that children have good performance in school, if the relationship between parents of children's friends is close. On the other hand, if the relationship between parents of the children's friends is not close, their children are less likely to perform well in school. Finally, Coleman sees social capital as a public good of the community rather than of individuals.

According to Putnam (1995, 2000) social capital is formed by networks, norms and trust which facilitate collective actions. Similar to Coleman (1988), Putnam sees social capital as collective goods. Putnam (2000: 19) defines social capital as "features of social life-networks, norms, and trust–that enable participants to act together more effectively to pursue shared objectives". Similar to Coleman (2000), Putnam argues that norms and trust are created by social networks that facilitate collective actions for collective benefits. Putnam (1995: 665) uses the term 'civic engagement' to explain that people are connected together through participation in civic organizations, as an indicator of collective social capital. Putnam (2000: 25) claims that social capital in the US has declined dramatically due to a sharp drop in the civic engagement of citizens.

Social capital can be seen as resources that are embedded in social networks. According to Lin (1999: 35) social capital can be defined as "resources embedded in a social structure which are accessed and/or mobilized in purposive actions". Lin (2001) differentiates between access and mobilization of social capital by individuals. Mobilized social capital refers to the actual use of particular social ties and resources, whereas accessed social capital refers to the degree of access to the resources in the network by the actor. Lin (1999: 39) argues that investment in social relations by individuals is the means through which they gain access to embedded resources to enhance expected instrumental and expressive returns. For Lin, benefits from social capital are an investment strategy that individuals have made. This is similar to Bourdieu's notion of the creation of social capital as the product of investment. Lin (1999: 36-41) demonstrates two types of benefit from social capital: (1) returns to instrumental action (economic, social, political returns); and (2) expressive returns (e.g. physical and mental health and life satisfaction).

Social capital can be classified into different forms. Putnam (2000: 22) differentiates between bridging and bonding social capital. Bonding social capital describes the cohesion that exists between small groups of similar people such as family members (kinship), close friends and colleagues, and perhaps the members of religious groups or neighbourhoods. Bridging social capital describes the networks that link acquaintances beyond the immediate family group (Meadowcroft and Pennington 2008: 121). For Coleman (1988) social capital can be seen inside the social structure such as the family (bonding social capital), or outside the family or community (bridging social capital). Social capital can also be interpreted as vertical or horizontal (Grant 2001: 976). Horizontal social capital can be seen as bonding social capital that links members of a

community. Vertical social capital can be understood as bridging or linking social capital that links communities with public institutions or governmental bodies. Social capital can also exist in either structural or cognitive forms (Uphoff and Wijayaratna 2000: 1876). Structural form includes roles, rules, procedures, and precedents as well as social networks that establish on-going patterns of social interaction, while norms, values, attitudes and beliefs are forms of cognitive social capital.

While bonding social capital is good for understanding specific reciprocity and mobilizing solidarity, bridging social capital is important for mobilizing external resources (Putnam 2000: 22, Mathbor 2007, Narayan 1999, Adger 2003). Narayan (1999) argues that if there is strong bonding social capital, groups can help their members; however, there will be a lack of bridging social capital because the strong bonding network may exclude external resources from strangers. Bridging social capital between groups can create economic activities for less powerful or excluded groups, such as the poor (Narayan 1999). Newman and Dale (2004) argue that networks comprising a diversity of bridging, bonding, and linking social capital enhance a community's ability to adapt to change; however, a network which comprises only bonding social capital may reduce resilience. Pelling (1998) argues that bridging social capital allows communities to access external resources from government and financial institutions for coping with floods. Another type of social capital is linking or networking social capital, which is important to link bonding social capital with state or public institutions in order to facilitate collective action to adapt to climate change (Mathbor 2007, Adger 2003).

Whether social capital is classified into bonding, bridging, linking or vertical and horizontal, structural or cognitive, it can be grouped into formal and informal social networks. Li et al. (2005) grouped social capital into formal and informal social networks in each of which social capital can be divided into three realms: neighbourhood attachment, social network and participation in formal organization. The classification of formal and informal networks was also discussed by Stone (2001). According to Li et al. (2005), neighbourhood attachment of individuals is one type of informal social capital that refers to the degree to which people are attached to their neighbourhood. This is an indicator of bonding social capital at the local community level. Neighbourhood attachment can be described as "a household residing in a neighbourhood, its social capital is accumulated through both developing physical neighbourhood bonding and community bonding (Tu and Li 2011: 4). Informal social

network is another form of social capital of individuals. According to Li et al. (2005: 112), informal social network is defined as "the extent of people's intimate interaction with those beyond the immediate family". Formal social capital is defined as participation in civic organizations.

Different forms of social capital are important at different times. Bonding social capital of family members in Kenya who sent remittances back to households during drought years helped to reduce their vulnerability (Siri et al. 2005, Smith et al. 2001). Hawkins and Maurer (2010) found that close ties (bonding) were important for immediate support during disastrous events, but that bridging and linking social capital were vital for long-term survival and wider community revitalization after a disaster. Airriess et al. (2008) found that co-ethnic social capital (bonding) was very effective for evacuation, relocation and recovery both during and after hurricane Katrina. Sanderson (2000) suggests that building social resources by enhancing neighbourhood relationships can help to save lives at risk from floods. Pelling (1999) suggests that social assets play a key role in shaping access to local, national and international resources for coping with floods. Linking social capital is important for preparedness before extreme events (Adger 2003). For example, agricultural cooperatives in Vietnam during the 1980s played an important role in linking state and society to repair sea dikes to cope with storm surges; they are a kind of linking social capital (Adger 2003). Li et al. (2005) found that disadvantaged groups are more likely to benefit from weak informal ties, whereas advantaged groups are more likely to draw from formal social capital. This is due to the fact that poor groups are more likely to benefit from the bonding network of community groups, because they are less likely to have a chance to participate in formal organizations. However, richer social groups have greater opportunity to participate in formal organizations, so they can access resources more easily.

So far, most researchers have examined the effects of neighbourhood attachment in relation to health outcomes (Ziersch et al. 2005, Veenstra et al. 2005, Carpiano 2006, Caughy et al. 2003) and job attainment (Li et al. 2005) and more recently on residential risk aversion and relocation choice (Tu and Li 2011). In the MRD, good neighbours are vital for coping with and adapting to floods, but little is known about the role of the households' attachment to the neighbourhood and living with the flood in the MRD. Local people say "relatives who live far away from home are not as good as the closer neighbours" *(bà con xa không bằng láng giềng gần)*. Neighbours help each other to evacuate, lend food and money to each other during the flood season, and share local

knowledge to exploit the benefits of the flood season such as collecting snails, fish, and other aquatic resources. Neighbours also help neighbours to repair houses, if someone's house is destroyed by the flood. They also share local knowledge to protect human lives when fishing in the floodplain and growing flood-based farming practices. The relationship among neighbours is cultivated through cultural and religious activities, participating in events (wedding parties, ancestor's memorials), recreational activities (playing sports, chess), having coffee together in the early morning during the flood season, and visiting neighbours when they are sick. If people have good relations with their neighbours, they are more likely to mobilize resources when facing food, income and housing insecurity during or after the flood season. Alternatively, they can access local knowledge to develop flood-based livelihood activities to adapt to the floods.

Besides relationships with neighbours, social support from networks is important in coping with disaster and climate change. Social support is defined as those social interactions that provide individuals with actual assistance or embed them into a web of social relationships perceived to be living, caring, and readily available in times of need (Hobfoll 1988: 121 cited in Ibañez et al. 2003: 2). Social support is classified into received support (actual receipt of help) and perceived support (the belief that help would be available if needed). Sources of social support can also be grouped, into informal (family, neighbours) and formal (government). Types of social support can be grouped into tangible (food, shelter) and intangible (informational and emotional support). Ibañez et al. (2003) found that survivors received more support from informal networks such as family and neighbours than from formal sources (government), and far more tangible sources (food, shelter) than emotional or informational support. Social supportive networks beyond the family such as friendships, religious groups or other supportive networks, play an important role in accessing resources for coping with floods. Flood-affected households are more likely to access relief or mutual assistance if they have wider supportive networks. For example, farmers can access technical knowledge for farming fish, *Neptunia prostrate* (water mimosa), fish and prawns during the flood season using friendship networks.

Finally, participation in local groups and associations may help rural households to access technical information, farming skills, and micro-credit and relief resources for adapting to floods. However, the effect of formal social capital in coping with floods is also neglected in the literature on MRD.

1.5 Relationship between households' resilience to floods, social capital and livelihood diversification

The analytical framework developed to support this thesis shows the complex relationship between households' resilience and social capital, livelihood diversification, and the socio-economic characteristics of the household (Figure 1.1). Households' capacity to live with floods is measured by their capacity to secure food, income, health, sustain human life, access housing and safe evacuation during the floods and recovery after the flood. These capacities are determined by the pre-existing socio-economic conditions of households, the magnitude of the flood event, and the geographical setting and livelihood activities of the households. Gaillard (2007) identified that the resilient capacity of traditional society depends on four factors: the nature of the hazard; the pre-disaster socio-cultural context and capacity for resilience of the community; the geographical setting of hazard areas; and the livelihood conditions of the community. These factors vary by time and space.

It is clear that the economic status of households is related to their capacity to secure their homes, food and income during the flood season. Poor households are less likely to be confident of coping with the flood season because they worry about shortage of income and food during the flood season. They also worry if their homes are affected by the floodwaters because they are more likely to live in simple houses which are more likely to be affected by flooding. However, most households have similar anxieties about child mortality due to drowning.

Livelihood diversification can help rural households reduce risk from natural hazards, but livelihood diversity is often constrained by the economic status of households, social capital, human capital and the location where households are situated and their access to land and financial resources.

Social capital in relationships with neighbours helps them to share local knowledge and technical information about livelihood strategies (Smith et al. 2001, Schwarze and Zeller 2005). Through informal social networks of friends and neighbours, they may gain information about adapting to new ways of living with floods, and receive emergency support such as rice or money to survive during the flood season if they are affected. Social capital may directly affect households' resilience to floods by accessing material or non-material goods from their neighbours or networks to cope with each

flood season. However, different forms of social capital of households are influenced by the socio-economic conditions of the households (Li et al. 2005).

The regional flood factor can be a determinant that affects households' resilience to floods in terms of securing houses and making livelihood choices to adapt to the flood. People living in the heavily flooded region are less likely to be confident that they can secure their homes during the flood season. However, people in the low and moderate levels of flooding, are more likely to secure their homes.

Location of the homes is another important factor contributing to households' level of confidence to cope with floods. In the MRD, most homes are built along the roads or river banks. Some households do not have capacity to buy land to build a house, so they have to construct their homes beside the river or canals. This makes them more vulnerable to the impacts of flooding. Those who have homes located along the river bank are less likely to be confident to cope with floods. However, those people can be confident that their homes will be secure if they remove to residential clusters[9].

[9] Residential cluster is a resettlement program for poor and vulnerable households in the flood-prone areas of the MRD. The cluster is designed for about 250-300 households. It is an artificial area which is built in the rice fields. A detailed description of residential cluster can be found in Đặng Quang Tính and Phạm Thanh Hằng (2003) *Living with flood in the Mekong River Delta of Vietnam*, Hà Nội: Department of Dike Management, Flood and Storm Control, Ministry of Agriculture and Rural Development, Socialist Republic of Vietnam. See also Vo Thanh Danh and Mushtaq, S. (2011) 'Living with Floods: An Evaluation of the Resettlement Program of the Mekong Delta of Vietnam', *Advances in Global Change Research,* 45, 181-204.

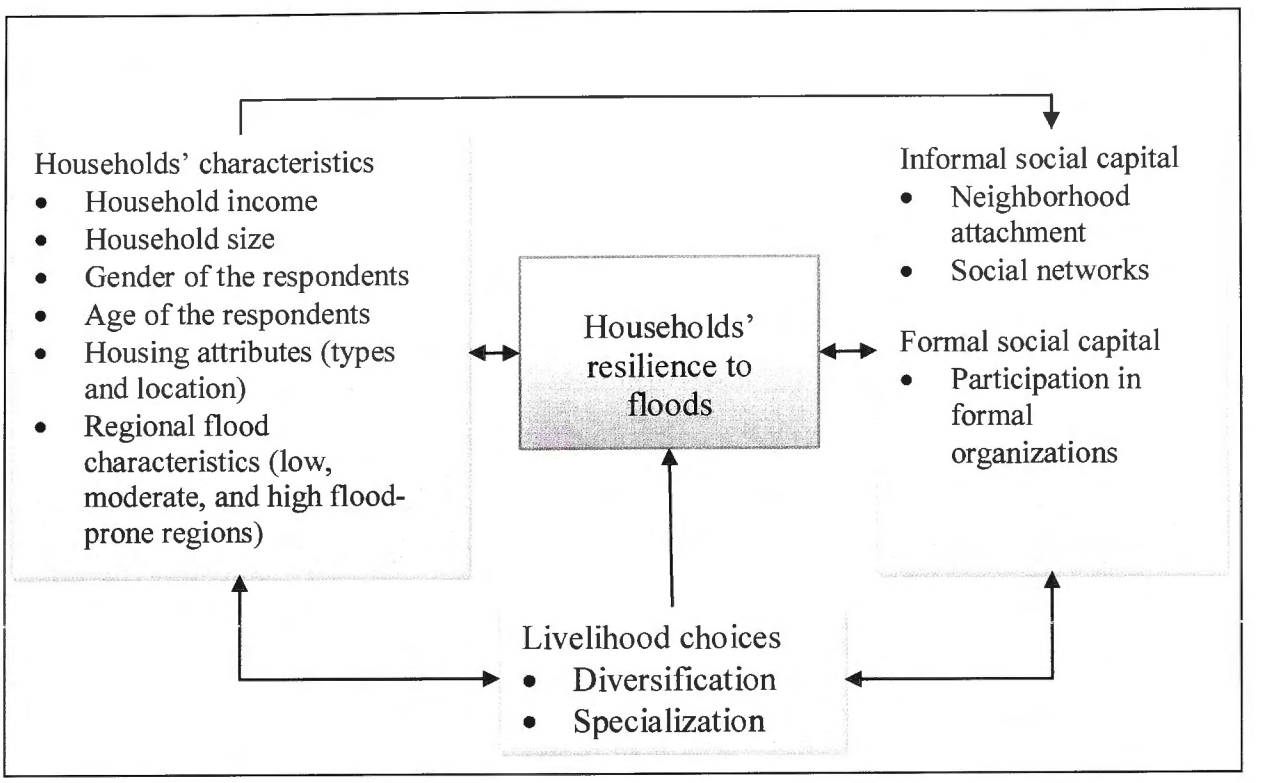

Figure 1. 1: Analytical framework for examining the relationship between social capital, livelihood adaptation and households' resilience to floods in the MRD

1.6 The contribution of this thesis

Flooding can be either a constraint or an opportunity for rural households to develop livelihoods in the MRD. Some social groups may adapt well to the annual flood events, while others are vulnerable and worried about the occurrence of the flood season. In particular, the flood season is often perceived as 'beneficial' for rice farmers and fishermen because they can maintain their livelihoods thanks to the water season. However, poor people may experience difficulty during the flood season as the flood often submerges their homes. 'Living with the flood' is perceived as a common term in the MRD because local people have a long tradition of coping with flood events. Resilience is a useful concept to study the capacity of households to cope with, adapt to and benefit from floods in the MRD. However, in the literature, this concept remains in an abstract form; little testing of the appropriateness of the concept has been conducted in the natural hazard field. Especially, households' resilience to floods is a multi-dimensional concept. This thesis argues that it can be operationalized in the context of living with floods in the MRD by identifying different dimensions of households' capacity to cope with and adapt to floods. In this context, the concept of resilience to floods is operationalized at household level to track households' capacity to live with floods in their own perceptions. These capacities include the confidence to secure food,

income, health, housing, and human life, and safe evacuation during the flood event and capacity to recover after the flood event. This operationalization of the concept of resilience to floods in a real context (MRD) is one of the main contributions of this study.

Livelihood diversification is argued to be a resilient strategy for rural households in developing countries to reduce the vulnerability to climate change and natural hazards. However, other scholars argue that livelihood diversification does not necessarily help rural households to improve their income because of the high cost of diversification. To support the positive side of livelihood diversification, other researchers argue that diversification of livelihood activities from farm to off-farm, and non-farm will help rural households to be less reliant on agriculture that is perceived to be vulnerable to impacts of natural hazards. This is a way to reduce risk too. Therefore, this debate is further investigated in the context of 'living with floods' to explore whether diversification of livelihood activities is 'good' or 'not good' for rural households in the MRD to live with six months of the flood season. Engagement in this debate in this thesis is one of its main contributions.

Furthermore, investing in social capital is acknowledged to benefit rural households to cope with climate change and natural hazards. However, what type of social capital is important for households in the MRD to invest in for coping with the flood event? This issue has been neglected in previous studies on flood management in the region. The results of this thesis provide an insight into the perceptions of the flood event, flood impacts, their coping behaviours, their capacity to live with floods, and the determinants of households' resilience to floods, thereby contributing to the literature on social capital, and to the methodology of carrying out such an empirical study.

Generally, the resilience of households is determined by socio-economic conditions of households, the geographical setting, the flood characteristics, the level of social capital and the livelihood choices that the households adopted. However, the livelihood choices of the households are often determined by various factors such as the socio-economic conditions, social capital and geographical setting of the households. These factors are interrelated to each other, and their lies another contribution of this thesis, that is, the testing of these relationships in the real-life context of the MRD.

1.7 Structure of the thesis

The thesis comprises nine chapters. Chapter one introduces the research issues, the research questions, research aim and objectives. It reviews the theoretical perspectives on resilience, livelihood diversification, and social capital. The analytical framework is developed to explore the complex relationships among socio-economic conditions of the households, their social capital and livelihood adaptation. Chapter one sets out what contributions the thesis makes to theory and practice.

Chapter two discusses the methodological perspectives, research methods used to quantify households' resilience, social capital and livelihood diversification as well as qualitative approaches. Within chapter two, the sampling and data collection approaches are described in detail. Finally, the analytical data approach adopted to answer the research questions is presented.

Chapter three provides the background information on the MRD, including its geographical setting, socio-economic conditions, flood characteristics and their impacts on rural livelihoods, and the policies related to living with floods in the past and the present. In the final section of chapter three, the socio-economic conditions of the three study sites in the MRD are presented in detail.

Chapter four presents the perceptions of and adaptations to flood events by different socio-economic groups using data from the field work. Data is drawn from focus group discussions, in-depth interviews, field observations and a household survey. In addition, secondary data on the perceptions of flood events is collected from national and local newspapers. This chapter will address the specific research question one to explore the social variation in the flood perceptions and adaptation in the MRD.

Chapter five critically analyses the impacts of the three different flood levels on household livelihoods to address research question two. Regional and socio-economic variation in the flood impacts is explored in this chapter.

Chapter six briefly conceptualizes households' resilience to floods in the MRD. In the first part of the chapter, the qualitative accounts of households' resilience to floods are explored. In the second half of the chapter, the quantitative findings of households' resilience to floods are presented to operationalize the resilience concept using a factor

analysis approach. Three factors that conceptualize households' capacity to live with floods are found.

Chapter seven discusses the formation of social capital of households in the MRD and investigates the relationship between households' resilience to floods and social capital to address research question three. The social capital of households is investigated in both aggregated and disaggregated forms in the multiple regressions. The disaggregated form of household's resilience is examined in the multiple regressions to assess whether there is a statistically significant relationship between households' resilience to floods and social capital.

Chapter eight explores the effect of livelihood diversification on households' resilience to floods. Both qualitative and quantitative approaches are used to explore the research question four. In the first part of the chapter, quantitative data is used as a basis for analyzing the diversification of livelihood activities of households and individual members of the households. The income approach is presented in qualitative terms to illustrate the income distribution among different sources at household level. In the second half of the chapter, the in-depth qualitative account of livelihood diversification is discussed critically to argue that diversification of livelihood activities does not necessarily improve resilience for some social groups. However, diversification of livelihood activities into off-farm and on-farm income may help some social groups to enhance the benefit from floods. Migration is not always a good livelihood strategy for the poor. However, poor people often do not have a wide range of livelihood choices, so their adaptation strategy is more likely to be to migrate out of the village during the flood season.

The conclusion and policy implications are presented concisely in chapter nine.

Chapter 2

Research design, methodology and methods

2.1 Introduction

Researchers have used various approaches in the past to study social capital, livelihood adaptation and resilience. One approach focuses on qualitative grounded theory to study social capital and livelihood adaptation, employing semi-structured, in-depth interviews and focus group discussions (Grant 2001, Adger 2003, Adger and Kelly 1999). Natural hazard researchers attempt to use the qualitative approach to explore the effects of social capital such as bonding, bridging and linking networks in coping with natural hazards (Hawkins and Maurer 2010, Moser 1998, Sanderson 2000, Pelling and High 2005, Pelling 1998, Airriess et al. 2008). Other researchers have attempted to quantify social capital or model the effects of social capital on households' wellbeing (Narayan 1999, Narayan and Pritchett 1997, Haddad and Maluccio 2000, Grootaert 2002, Grootaert et al. 2002, Nguyễn Văn Hà et al. 2004), and individual health outcomes (Ziersch et al. 2005).

In resilience studies, most ecological sociologists employ a qualitative approach to explain social-ecological resilience to environmental change (Walker et al. 2006). Some researchers have developed a framework for measuring resilience using a surrogate approach (Cumming et al. 2005, Tompkins and Adger 2004). Other social researchers have attempted to construct indices of household and individual resilience to food insecurity using a quantitative approach (Alinovi et al. 2010).

Alternatively, researchers combine qualitative and quantitative approaches to measure resilience. According to Creswell (1994: 174) a combined method study is one in which the researchers use multiple methods of data collection and analysis. The combined method is also referred to as the mixed method. A combination of qualitative and quantitative methods is used to provide a comprehensive analysis of a complex relationship (Ziersch et al. 2005: 72) and to capture the full picture of human behaviour and experience (Morse 2003). Marschke and Berkes (2006) were successful in using both qualitative and quantitative approaches to explore households' and villages'

livelihood resilience in the Cambodian context. For a qualitative approach, they used community workshops and focus group discussions, and the participatory rural appraisal approach. For the quantitative approach, these researchers used a livelihood survey with local households. Marshall and Marshall (2007) successfully used mixed methods to conceptualize the concept of social resilience in adapting to institutional changes by resource users in Northern Australia.

Studying social capital, livelihood adaptation and resilience to floods in the MRD is a complex process which requires multiple approaches. This study combines qualitative and quantitative approaches to explore and examine the relationship between social capital, livelihood adaptation and household resilience to floods in the MRD. The qualitative findings will be used to complement the quantitative results.

This chapter is divided into six sections. Section one describes the qualitative methodological approach and methods for collecting primary qualitative information. Section two describes the approach adopted to collect secondary information. Section three discusses methodology and methods used to collect quantitative information. Section four provides a detailed explanation of analytical data approaches for measuring social capital, livelihood diversification and households' resilience to floods. Section five discusses the analytical data framework for addressing the research questions. Section six is the conclusion.

2.2 Qualitative studies for social capital, livelihood diversification and households' resilience to floods

2.2.1 Selection of study sites

Three communes were selected to represent the different flood regions of the MRD (Figure 2.1). The first research site, Phu Duc commune in Tam Nong district, Dong Thap province, is located in the most flood-prone region. The second study site, Thanh My Tay commune in Chau Phu district, An Giang province, is located in a moderately flood-prone area. The third study site, Trung An commune in Co Do district, CanTho City, is situated in the region with the lowest risk of flooding. The socio-economic conditions and livelihood activities of the three locations are presented in Table 2.1.

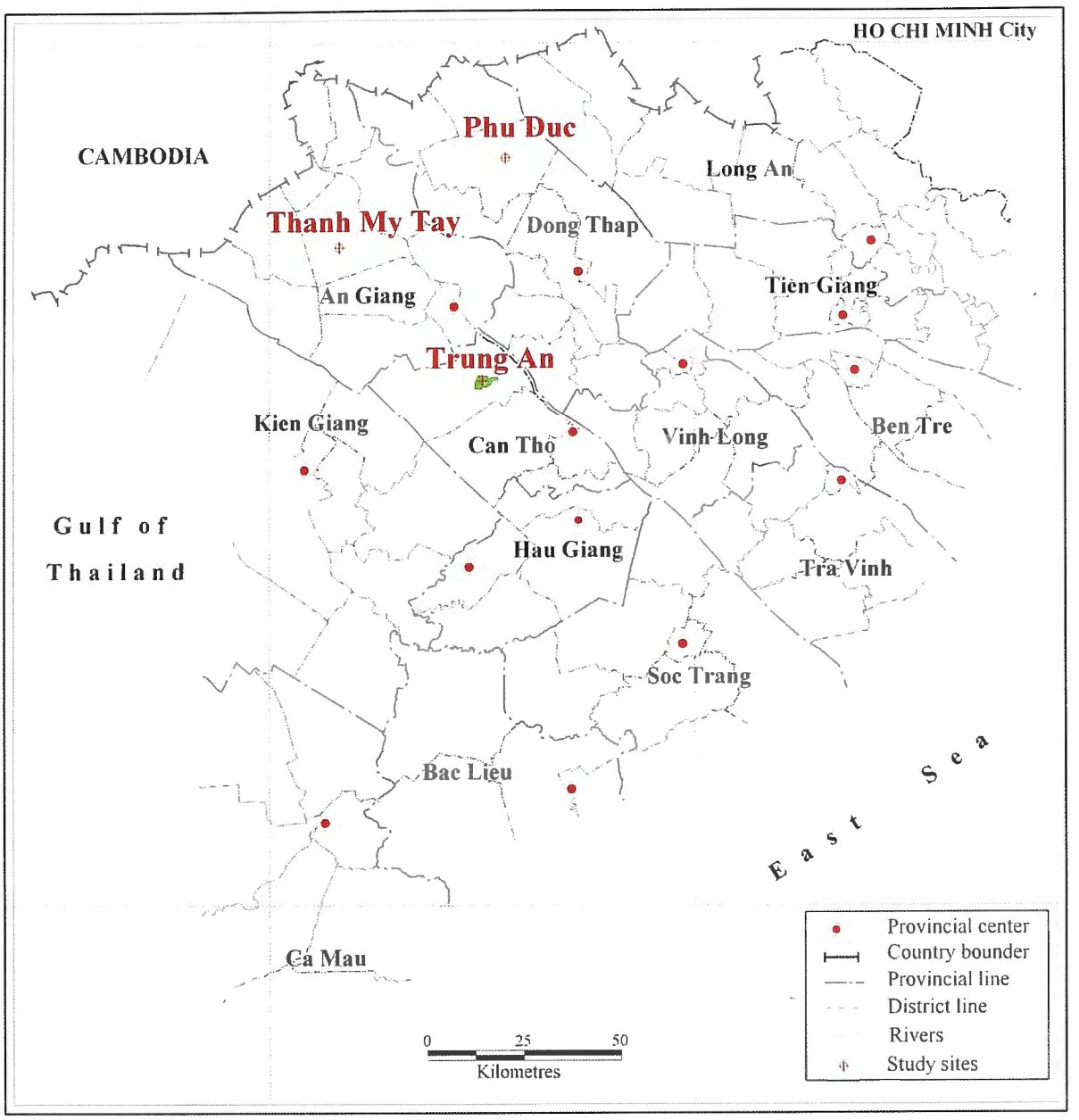

Figure 2. 1: Map of the three study sites

Source: Pham Van Quang (2012)

Table 2. 1: Socio-economic conditions and livelihood activities of the three study sites

Socio-economic, demographic and flood characteristics	Selected sub-districts		
	Phu Duc commune (site1)	Thanh My Tay commune (site2)	Trung An commune (site3)
Population (number of people)	6,940	25,100	13,606
Population density (person per sq km)	212	637	194
Households	1,586	5,141	2,362
Land area (ha)	5,170	3,656	1,197
Poverty (%)	11.4	11.5	12.0
Flood depth	>2.5 m (over 5 months)	1.5-2.5 m (4-5 months)	<1.5 m (<3 months)

Source: Thanh My Tay People's Committee (2009), Phu Duc People's Committee (2009), and Trung An People's Committee (2009)

2.2.2 Methodological approaches to qualitative research

Qualitative research focuses on gaining an in-depth understanding of the issues under examination. A qualitative methodology can address questions about the meanings of events, and the activities of people involved (Banyard and Miller 1998 cited in Ibañez et al. 2003: 5). According to Liamputtong (2009: 4), ethnography is one type of qualitative research which aims to provide:

> an insider perspective on everyday life through the researcher's engagement with people over time and [to] explore human experience and social interaction as well as the meaning people apply to their experiences, that is, their symbolic world.

Participant observation, in-depth interview, focus groups, and life histories are usually employed in anthropological research. Phenomenology attempts to generate knowledge about how individuals experience things (Liamputtong 2009). In-depth interviews, observation, life history, and narrative are commonly used in phenomenological studies (Liamputtong 2009). Symbolic interaction means that individuals construct their perception and meanings as a result of their interaction with others (Liamputtong 2009). Group discussions and interviews with key informants are mostly used in symbolic studies (Liamputtong 2009).

Social capital, livelihood adaptation and resilience can be studied using qualitative data collection approaches. Focus group discussions (FGDs), in-depth interviews with key informants using semi-structured interviews have been undertaken by many researchers. A focus group is a group discussion that gathers together people from similar

backgrounds or experience to discuss a specific topic of interest to the researcher (Stewart and Shamdasani 1990). The moderator guides the discussion, introduces topics for discussion and helps the groups participate in a natural discussion. FGDs can provide insights into how a group thinks about its capacity to live with floods, identify the key flood impacts on their livelihoods and their livelihood adaptations to cope with annual water events. FGDs provide interaction among participants and are good for seeking opinions, attitudes and perception about the particular issues. FGDs are very useful for getting meaningful indicators of resilience to floods and social capital in the context of adaptation to annual water events. Information from FGDs is useful for designing structured questionnaires in the household survey.

Generally, there are several disadvantages of FGDs. FGDs are difficult to arrange and conduct in a sensitive situation. People may not report their real income or livelihood strategies in a group; in-depth interviews will be more suitable for obtaining such information. FGDs may discourage individual members from speaking against the group norm (Smyth 2004). In addition, FGDs cannot be used to make statements about the wider community; they can indicate a range of views and opinions, but not their distribution. Participants may agree with responses from fellow group members, so caution is required when interpreting the results (Smyth 2004). If the moderator is not well trained, she or he can easily influence participants to answer in a certain way. FGDs have limited value in exploring the complex beliefs of individuals, so in-depth interviews are a more appropriate method for this purpose (Minichiello et al. 1995). Therefore, it is important to mitigate the possible biases by having a well-trained moderator, using multiple qualitative research approaches to collect information and triangulating the results. In this context, the key investigator was the moderator because he understood the research topic very well.

In-depth interviews were repeated in face-to-face encounters between researchers and informants directed toward understanding informants' perspectives on their lives, experiences or situations as expressed in their own words (Taylor and Bogdan cited in Minichiello et al. 1995). In-depth interviews are good for probing an individual's behaviour, opinions and attitudes and for sensitive issues that people may not wish to present in focus group discussions. However, the limitation remains that it is difficult to know whether informants are telling the 'truth' or not. Crosschecking through subsequent interviews can be used to assess the accuracy of information (Minichiello et al. 1995).

2.2.3 Sampling strategies for qualitative research

The research employs both qualitative and quantitative approaches to study households' resilience to annual flood events in the MRD. For qualitative data, a purposive sampling strategy is used to select information-rich cases for in-depth understanding of issues of living with floods, flood impacts, flood perceptions and resilience to floods.

Two main qualitative methodological approaches were employed in this study: phenomenology and symbolic interaction. The former theory attempts to explain how an individual experiences a phenomenon in real life, while the latter is concerned with the subjective meaning that individuals attribute to their activities and environments. Phenomenological studies often employ in-depth interviews as a means to generate a description of reality. Other researchers have also used field observation, life history and narrative approaches. On the other hand, focus groups and group interviews have become prominent methods and are widely adopted in the symbolic interaction theoretical framework (Liamputong 2009: 4-6).

There are two common sampling strategies in use for collecting qualitative data: purposive and convenience sampling. The former aims to select information-rich cases for in-depth understanding while the latter allows researchers to access individuals who are convenient and willing to participate in a study (Liamputtong 2009: 11-12). In this study I used the purposive sampling approach to select individuals who could provide in-depth information about living with floods and about different primary livelihood activities, occupations, social groups, gender, and age.

There are several kinds of purposive sampling strategies: typical case, extreme or deviant case, intensity, maximum variation, and homogenous sampling (Creswell 1994). Typical sampling will select members of a group who are typical or average, while extreme and deviant sampling selects cases that are unusual or extreme or at the end of the distribution or outliers, for example, those who represent outstanding success or noticeable failures related to the research topic. In this study, the extreme and deviant sampling approach was used to select informants who were successful or unsuccessful in living with floods. Intensity sampling was also used to seek rich examples of living with flood cases, but not extreme or deviant cases. Maximum variation sampling was also adopted to find heterogeneous samples across wider sample groups (males, females, poor, medium and better-off). Qualitative research was undertaken from December 2009 to February 2010. Field observations, 10 in-depth interviews with key

informants and four focus group discussions (FGDs) were undertaken at each study site. The findings from the qualitative research were used for designing the structured questionnaires.

2.2.4 Methods of data collection for qualitative research

2.2.4.1. Focus group discussion (FGDs)

The aim of focus group discussions in this study is to explore the past experience of local people of the impacts of annual flood events on the livelihoods of different social groups in three diverse flooded regions. Local indicators of household resilience to floods and indicators of social capital of the respondents were explored through FGDs. Perceptions of flood impacts, and livelihood adaptation of different social groups to floods were also explored in FGDs (see Appendix 2.1 for the FGDs guidelines).

In each study site, four key social groups were selected (see Appendix 2.2 for FGDs design). The first group was poor males. The second group was poor females. The third group was better-off males. The fourth group was better-off females. Male and female groups were separated to avoid gender-dominated issues. A range of ages and occupations was included in each FGD. Detailed socio-economic and demographic characteristics of participants in FGDs are presented in Appendix 2.3.

The criteria for selecting poor and better-off groups relied entirely on local knowledge of the key informants. Local leaders are familiar with the socio-economic conditions, the demographic characteristics and livelihood activities of households in the hamlet. Some hamlet leaders have served the village for many years so they are knowledgeable about their residents. They can provide such information as total number of households, name of each household head, types of households (poor and better-off groups) and even their occupations (rice farmers, small business traders, rice retailers, fishers, vegetable farmers, migrants and agricultural or industrial workers). However, I am aware that the local leaders may select participants from their networks of family members, relatives, or close friends. This situation occurs very often in rural areas of Vietnam. To mitigate these possible biases, I used a participatory approach in which representatives of different actors within the communes are engaged in the selection process. For example, the leaders of the farmer's association, women's association, veteran's union, people's committee, youth Union and Red Cross are involved in the processes of sample section. This is an effective way to reduce possible biases of

selecting representative samples if we rely on one or two representatives of the commune.

Based on these criteria, I consulted with hamlet leaders to select participants from the household list of the hamlet using a purposive sampling approach (Table 2.2). Each FGD includes six to eight participants. The FGDs were conducted at a farmer's home in the afternoon because it is convenient for most participants to participate when they have completed their farm work. FGDs were carried out from December 2009 to February 2010. The information obtained from FGDs were used for designing household survey questionaries.

Table 2. 2: Characteristics of each member in focus group discussion

Group names	Group member	Characteristics
FGD_PD01: Mixed poor and medium male group	1. Mr Trong 2. Mr Tien 3. Mr Kich 4. Mr Moi 5. Mr Chien 6. Mr Hong	1. aged 34, 7 years in school 2. aged 35, 9 years in school 3. aged 68, 5 years in school 4. aged 65, 2 years in school 5. aged 49, 6 years in school 6. aged 57, 6 years in school
FGD_PD02: Better-off male group	1. Mr Gom 2. Mr Sang 3. Mr Nhat 4. Mr Dan 5. Mr Nhat 6. Mr Duy 7. Mr Canh 8. Mr Thanh	1. aged 43, 2 years in school 2. aged 31, 5 years in school 3. aged 32, 4 years in school 4. aged 56, 3 years in school 5. aged 26, 12 years in school 6. aged 40, 10 years in school 7. aged 41, 12 years in school 8. aged 55, 10 years in school
FGD_PD03: Better-off female group	1. Ms Thuy 2. Ms Ca 3. Ms Nuoc 4. Ms Thi 5. Ms Lien 6. Ms Tho	1. aged 44, 4 years in school 2. aged 28, illiterate 3. aged 39, 2 years in school 4. aged 38, 9 years in school 5. aged 25, 5 years in school 6. aged 44, illiteracy
FGD_PD04: Poor female group	1. Ms Tu 2. Ms Hanh 3. Ms Tran 4. Ms Phuong 5. Ms Vet 6. Ms Thich	1. aged 33, 5 years in school 2. aged 26, 8 years in school 3. aged 32, 5 years in school 4. aged 25, 4 years in school 5. aged 44, 3 years in school 6. aged 26, 5 years in school
FGD_TMT01: Better-off male group	1. Mr Be 2. Mr Bau 3. Mr Tuan 4. Mr Nho 5. Mr Chien 6. Mr Khoe 7. Mr Tung 8. Mr To	1. aged 54, 5 years in school 2. aged 42, 6 years in school 3. aged 61, 5 years in school 4. aged 37, 3 years in school 5. aged 41, 12 years in school 6. aged 30, 2 years in school 7. aged 58, 3 years in school 8. aged 38, 3 years in school

FGD_TMT02: Poor male group	1. Mr Canh 2. Mr Muoi 3. Mr Phong 4. Mr Thuy 5. Mr Hoa 6. Mr Liet	1. aged 37, 76 years in school 2. aged 39, 7 years in school 3. aged 35, 2 years in school 4. aged 44, 10 years in school 5. aged 54, 4 years in school 6. aged 36, illiteracy
FGD_TMT03: Poor female group	1. Ms Le 2. Ms Dut 3. Ms Cuon 4. Ms Khang 5. Ms Thuy 6. Ms Sinh 7. Ms Tu 8. Ms Thuy	1. aged 57, only can write and read 2. aged 58, non-school 3. aged 35, 3 years in school 4. aged 54, 4 years in school 5. aged 39, 7 years in school 6. aged 50, 2 years in school 7. aged 46, cannot write and read 8. aged 32, non-school
FGD_TMT04: Better off female group	1. Ms Lan 2. Ms Khanh 3. Ms Bieu 4. Ms Nguyet 5. Ms Phuong 6. Ms Hang	1. aged 40, 12 years in school 2. aged 39, 4 years in school 3. aged 42, 5 years in school 4. aged 58, 7 years in school 5. aged 42, 4 years in school 6. aged 40, 5 years in school
FGD_TA01: Poor male group	1. Mr Hai 2. Mr Phuong 3. Mr Duong 4. Mr Rang 5. Mr Quoi 6. Mr Sau	1. aged 61, 11 years in school 2. aged 39, 3 years in school 3. aged 36, 2 years in school 4. aged 50, 2 years in school 5. aged 46, 6 years in school 6. aged 67, 3 years in school
FGD_TA02: Better off male group	1. Mr Sanh 2. Mr Doi 3. Mr Binh 4. Mr Tong 5. Mr Phai 6. Mr Sinh 7. Mr Tu	1. aged 64, 4 years in school 2. aged 60, 10 years in school 3. aged 24, 6 years in school 4. aged 39, 4 years in school 5. aged 47, 6 years in school 6. aged 21, 12 years in school 7. aged 42, 5 years in school
FGD_TA03: Poor female group	1. Ms Thoa 2. Ms Nhu 3. Ms Chinh 4. Ms Du 5. Ms Tam 6. Ms Suong 7. Ms Ut	1. aged 36, 3 years in school 2. aged 35, 3 years in school 3. aged 39, 6 years in school 4. aged 43, 2 years in school 5. aged 45, illiteracy 6. aged 38, 5 years in school 7. aged 29, 3 years in school
FGD_TA04: Better off female group	1. Ms Sam 2. Ms Nga 3. Ms Tuyet 4. Ms Ba 5. Ms Se 6. Ms Chon	1. aged 49, 5 years in school 2. aged 47, 2 years in school 3. aged 42, 5 years in school 4. aged 45, 5 years in school 5. aged 53, 4 years in school 6. aged 46, 5 years in school

Each FGD was conducted within one and half hour by the key investigator and a secretary. Firstly, I (the key investigator of this thesis) played the role of moderator to

introduce the purposes of the research to participants, the reasons for undertaking the FGDs and the ways of operating the FGDs. Then, I introduced the role of secretary as a note taker to participants. Before implementing the FGDs, I also asked their permission to conduct the FGD by giving them an oral consent form to make sure that all participants are clear about our research aims and objectives and to en sure that they were happy to be involved. During the FGD, I raised the issues or questions and facilitated discussion of the focused issues. If someone is not very involved in the discussion, I tried to provide them with opportunities to discuss. In reality, some of the participants did not want to express their views because they were shy or had never been in a group meeting. Dealing with this situation, I encouraged them to participate using gentle persuasion. Similarly, the participants may be not very familiar with recording information during the discussion. They thought that the record would be delivered to government officials or other actors in the village. So, I explained to them very carefully that the information is only used for my research and I will not use this for other purposes.

2.2.4.2 In-depth interviews

In-depth interviews were used to highlight the local experience of living with floods. This method allows the researcher to understand and interpret social reality through the meanings that informants attach to their life experience (Minichiello et al. 1995). The depth of understanding is explored by focusing on one person. In total, 30 in-depth interviews with different social groups and occupations were conducted. These included the poor, better-off, different primary occupations (farm and non-farm, and non-farm income sources), local governmental staff (sub-district president, staff of flood mitigation committee), leaders of farmer associations, women's association, retired soldiers, Red Cross, and other social groups, in three selected naturally flooded regions (low, moderate and high floods).

Ten in-depth interviews were also conducted with key informants to enrich the experience of living with floods in each study site (Table 2.3). These were poor people whose livelihoods are fragile during the flood season in the study site. Some key informants are poor but evidence that the flood season is good for them is also included in the interviews. Many farmers who use local knowledge to develop flood-based farming activities to adapt to the annual floods were selected for interview as well. There are better-off families who successfully cope with floods, even turning floods

from hazards into beneficial assets, taking the opportunity provided by floods to improve their households' income during the months of flood. Some floodplain residents who seek non-farm or off-farm jobs by seasonal migration to maintain their income during the flood season were invited to share their views about living with floods. Government staff who are in charge of flood management at communal, district and provincial levels were consulted about the local government's livelihood strategies for living with the floods. In addition, teachers, small businesspersons, water and boat transporters and other occupations were also considered. The guideline for in-depth interviews is presented in Appendix 2.4.

Table 2. 3: Characteristics of key informants for in-depth interviews

Names of key informants	**Socio-economic-demographic characteristics**	**Representative for**
Thanh My Tay commune – Chau Phu District – An Giang province		
Mr Tuan	aged 61, living in Thanh My Tay commune – Chau Phu district	Poor households living in the flood prone area –the migration group
Mr Luot	aged 45, living in Thanh My Tay commune – Chau Phu district	Medium-income households – living in the flood prone area – exploit the flood-based livelihoods from floods by collecting golden snails.
Mr Dat	aged 50, living in Thanh My Tay commune – Chau Phu district	Better-off households – living in the flood prone area – developing the flood-based livelihoods from floods by growing *neptunia prostrate* and growing rice during the dry season.
Mr Bieu	aged 40, living in Thanh My Tay commune – Chau Phu district	Medium-income households - – living in the flood prone area – developing the flood-based livelihoods from floods by raising prawns during the flood season.
Mr Cai	aged 63, living in Thanh My Tay commune – Chau Phu district	Medium –income households living in a residential cluster (flood shelter) to relocate from flooding.
Mr Cam	aged 58, living in Thanh My Tay commune – Chau Phu district	Poor households living in a residential cluster (flood shelter) – living on daily hired labour and *neptunia* collecting
Mr Hieu	aged 35, living in Thanh My Tay commune – Chau Phu district	Better-off households – middle men trading vegetables in the local market during the flood season

Mr Binh	aged 40, living in Thanh My Tay commune – Chau Phu district	Better-off households – growing vegetables during the flood season and doing off-farm activities such as ploughing soils for neighbouring farmers
Mr Ngoc	aged 40, living in Thanh My Tay commune – Chau Phu district	Leader of farmer's association – talk about the way of living with floods in the villages in terms of livelihood perspectives
Mr Nguot	aged 55, living in Thanh My Tay commune – Chau Phu district	Leader of red cross in the commune – talk about the history of living and coping with floods in the past 20 years
Mr Sieu	aged 45, living in Thanh My Tay commune – Chau Phu district	President of the commune – talk about socio-economic development and the way of living with floods at the commune.
Phu Duc commune – Tam Nong District – Dong Thap province		
Mr Bong	aged 50, living in Phu Duc commune of Tam Nong district	Leader of k9 hamlet, phu duc commune, talk about the history of living with flood in the commune
Mr Sang	aged 30, living in Phu Duc commune of Tam Nong district	Poor households – fishermen in the village
Mr Tai	aged 61, living in Phu Duc commune of Tam Nong district	Medium-income households – fishermen and aquaculture – talk about the way of living with flood by exploiting and growing fish
Mr Ngoc	aged 63, living in Phu Duc commune of Tam Nong district	Better-off households – talk about rice farming – exploiting fish – storm surge and risky livelihoods during the flood season
Mr Han	aged 50, migrant from other provinces to residential cluster in Phu Duc commune of Tam Nong district	Poor households – talk about the vulnerable context and difficulties of living with floods in the past, current and future livelihoods
Mr Phu	aged 30, living in Phu Duc commune of Tam Nong district	Medium – income households – talk about migration and living with floods
Mr Binh	aged 37, living in Phu Duc commune of Tam Nong district	Leader of farmer's association – talk about the government policies and programs for living with floods in the commune
Mr Canh	aged 37, living in Phu Duc commune of Tam Nong district	A primary teacher – talk about the difficulties in teaching and evacuating due to floods – participation in NGOs programs

		on disaster risk reduction
Mr Anh	aged 38, living in Phu Duc commune of Tam Nong district	Leader of k8 hamlet – talk about ways of living with floods in their hamlet
Mr Ranh	Aged 44, living in Phu Duc commune of Tam Nong district	Medium-income household – professional fishermen – talk about strategies for living with floods
Mrs Hue	Aged 50, living in a residential cluster (flood shelter) in Phu Duc commune of Tam Nong district	Poor households – water hyacinth collector and handicraft making – daily hired labour
Trung An commune – Co Do district – Cantho City		
Mr Quang	Aged 62, living in Trung An hamlet, Co Do district	Better-off households – growing rice and integrated rice-duck-fish systems
Mrs Bay	Aged 58, living in Trung An hamlet, Co Do district	Medium-income household – talk about their integrated chicken – fish- and rice for sustainable livelihoods
Mr Tong	Aged 60, living in Trung An hamlet, Co Do district	Better-off households – talk about the idea of integrated rice-fish system to adapt to floods in the commune
Mrs Nhan	Aged 52, living in Trung An hamlet, Co Do district	Poor households – hired labour and fishing – talk about the unstable livelihoods during the flood season and unsuccessful story of migration to Malaysia for doing labour work
Mrs Hue	Aged 40, living in Trung An hamlet, Co Do district	Poor –fishery households and hired labour – talk about their daily income from fishing and hire labour – and difficulties in coping with flood
Mr Cuong	Aged 35, living in Trung An hamlet, Co Do district	Poor households – main income from hired labour for the local rice mill – talk about the difficult life during the flood season
Mrs Hoa	Aged 30, living in Trung An hamlet, Co Do district	Poor households – income from off-farm activities – her husband dug soils and sold to the neighbours for upgrading house foundation during the floods.
Mrs Hai	Aged 35, living in Trung An hamlet, Co Do district	Medium income households – income from a small hairdressing shop – non-farm activities – talk about their livelihood strategies for coping with floods
Mr Qui	Aged 62, living in Trung An hamlet, Co Do district	A medium-income household – a retired teacher – income from

		rice and pension – talk about his past experience of living with floods
Mrs Be	Aged 35, living in Trung An hamlet, Co Do district	A medium – income household – a middle woman for rice – talk about her livelihood strategies for off-farm rice business – a way of living with floods

2.2.4.3 Field observations

Field observations and field notes were used during the survey period (see Appendix 2.5). Taking photos and notes when conversing with respondents helps researchers understand the in-depth life history of rural people who cope with the flood events. Photos illustrate flood characteristics, structural and non-structural measures for coping with floods and livelihood activities undertaken during the floods.

2.3 Secondary data collection

Secondary data is very important for understanding the background of research sites, flood characteristics, socio-economic conditions, as well as livelihood activities of the communities. The secondary data used in this thesis was obtained from different sources: annual local government reports on socio-economic development, statistics year-books, recorded information about the impacts of flood on property, water resources and human health, and unpublished papers and national conference proceedings on flood management, agricultural development, and socio-economic development of the MRD. I visited various institutions to obtain the local government reports on the living with flood programs as well as data recorded on annual flood damage from communes, districts and provinces. I also made use of local libraries to access local archived newspapers that contained the flood news since 1996 and conference proceedings of flood studies in the MRD.

Three main types of newspapers at local, regional and national levels were used in the analysis of perceptions of flooding. The *An Giang* newspaper was used to access local daily news. The *Can Tho* newspaper represented regional news, while the *Tuoi Tre, Thanh Nien, Dai Doan Ket, Nhan Dan, Nong Nghiep* represented the national newspapers. For the *An Giang* newspaper, archived data was collected from 1996 to 2010. The *Dai Doan Ket* archived data was obtained from 1994 to 2000. The *Tuoi Tre* data was from 2000 to 2011; and *Can Tho* newspaper data from 2000 to 2011. The

local, regional and state level perceptions of flood will be explored through the content analysis of that news. The household survey, in-depth interviews, and focus group discussions provided in-depth analysis of individuals' perception of floods at community level.

2.4 Methodological approaches to measuring social capital, livelihood diversification and households' resilience to floods

2.4.1 Sampling strategies for quantitative research

The stratified sampling approach was used to divide the total population of the delta into sub-populations of 'three communes' based on the existing socio-economic and natural flood characteristics of the delta. Within each stratum, five hamlets were randomly chosen and 30 households were randomly selected from the wealth ranking of households (poor, medium and better-off) in each hamlet. This stratification is closely linked to the informal classification commonly used in Vietnamese villages. In case of Phu Duc commune, 50 samples were collected in each hamlet as there are only three hamlets in this commune. The total sample size in each case study was 150, as illustrated in Table 2.4. The exception was Thanh My Tay commune, where there were 159 samples.

Table 2. 4: Sample distribution by socio-economic group and region

Location of study sites	**Socio-economic group**			**Total**
	Poor	**Medium**	**Better off**	
N	181	132	146	459
Phu Duc commune (High flood-prone region)	69	40	41	150
Thanh My Tay commune (Moderate flood-prone region)	56	50	53	159
Trung An commune (Low flood-prone region)	56	42	52	150

The local classification of well-being was obtained from the results of the participatory research using FGDs and in-depth interviews with key informants. Key informants are those who have lived in the hamlet for a long period of time, and have a good understanding of their community. The samples were chosen on the basis of socio-economic groups: poor, medium and better-off households and ownership of agricultural land (see Appendix 2.6). This approach has been widely used in rural development and natural hazard studies in developing countries (Smith et al. 2001,

Phóng Trần et al. 2008, Bosma et al. 2005). Through FGDs with respondents in the three study sites, the level of well-being was determined using the following criteria: access to natural resources (ownership of agricultural land); housing quality (simple, semi-permanent and permanent houses); level of income; and a primary income source. For example, a poor household was defined as one that has the following characteristics: ownership of land less than 0.5 ha; average income per capita of each adult in the household is less than VND[10] 250,000 per month (12 USD/month); income source is primarily from daily wage labour and off-farm fishing during the flood season; and owning a simple house. Medium households often own agricultural land (from 0.5 ha to less than 2.0 ha), derive an income from a mix of farm and off-farm labouring and fishing activities, and have semi-permanent houses. Better-off households often own more agricultural land (more than 2.0 ha), receive income from a specialization in rice farming, are less likely to engage in off-farm wage labouring, and often have a good quality home. However, ownership of agricultural land may not always reflect the wellbeing of rural households in the three study sites. In particular, some better-off households have less than 2.0 ha of land (Table 2.5). The reason for this difference is that some better-off households may specialize in non-farm business such as running a coffee shop, a grocery shop, rice mill or rice storage, so they are less likely to own large agricultural land areas for rice farming.

Table 2. 5: Agricultural land ownership by socio-economic group

Land ownership (agricultural land)	**Socio-economic group**			**Total**
	Poor	**Medium**	**Better off**	
N	181	132	146	459
<= 0.5 ha (%)	88.4	31.1	19.2	49.9
0.5 - <= 2.0 ha (%)	9.4	48.5	29.5	27.0
=> 2.0 ha (%)	2.2	20.5	51.4	23.1

2.4.2 Conducting the household survey

2.4.2.1 Questionnaire design

Information from the qualitative research was used in designing the structured questionnaires in the household survey from August to October 2010. The questionnaires were carefully prepared before the fieldwork with useful feedback from supervisory panel members and quantitative researchers at the Australian Demographic

[10] One USD (in September 2011) is roughly equivalent to Vietnamese Dong (VND) 20,830

and Social Research Institute, the ANU. The questionnaire comprises eight sections (Table 2.6).

Table 2. 6: Description of the questionnaire

Section	Description
I	• Demographic information for the respondents Age, gender, education, religion, and occupation of the respondents
II	• Demographic information for each household member Age, gender, education, religion and occupation of each household member
III	• Perceptions of the respondents about natural characteristics of floods and negative and positive impacts of different flood levels on community and household livelihood activities and assets. • The binary responses were used to design questions on flood impacts on different livelihood activities and assets (see Chapters four and five)
IV	• Information about household livelihood activities, household income and income sources in the last 12 months before the date of interview and households' livelihood strategies for coping with floods. • The respondents were asked to estimate their rough income from different sources in local currency (VND). For income from agricultural production such as rice, fish, prawn and vegetable farming, the net benefit of each source was calculated using local currency value. The total household income is the sum of different income sources in local currency before converting it to USD at the time of interview (see Chapter eight).
V	• Informal and formal social networks of the household representatives (the respondents) • Informal social capital o Neighborhood attachment - respondents were asked to rate their level of satisfaction about neighborhood attachment using 12 statements on a five point Likert scale (see Chapter seven). o Supportive social networks beyond the immediate family members – respondents were asked to indicate whether or not they receive support from the networks (see Chapter seven). • Formal social capital o Participation in local groups and organizations – respondents were given a list of 17 local groups or organizations to indicate if any household member belongs to any groups and organizations (see Chapter seven).
VI	• Household's resilience to floods • Respondents were asked to rate their level of satisfaction about their capacity to cope and adapt to floods using the five point Likert scale (see Chapter six). The items were designed based on the subjective wellbeing approach (ten items).
VII	• Gender roles and coping with flood season
VIII	• Information about household livelihood assets (fixed assets and live assets such as cows, pigs and chickens, radios, TVs, etc).

Note: The household questionnaire is presented in Appendix 2.7.

2.4.2.2 Training of interviewers

Interviewers were fourth-year undergraduate students and my colleagues at An Giang University in MRD. The students were undertaking undergraduate study in Integrated Rural Development at An Giang University. These students had experience in interviewing local people. The selected students had conducted several interviews in their main courses and had undertaken previous social research with lecturers at the university. Gender was considered during the selection process: the students included both females and males. The principal researcher sent the sample questionnaires to each interviewer before the training week in order for them to understand the questionnaires. Interviewers were trained about the content of the questionnaires, the wording issues of each question. The training was done twice to ensure that interviewers understood well all parts of the questionnaire.

2.4.2.3 Pre-test

The questionnaire was pre-tested before the actual survey was carried out. Twenty percent of the sample (30 samples for each commune) was selected for pre-testing. Interviewers were asked to take notes during the pilot interviews to check every question in the questionnaire. The wording of each question was also checked to ensure questions were understandable. Questions relating to social capital and social resilience using the Likert scale were quite new to respondents. Therefore, the interviewers had to explain the level of satisfaction in local terms so that respondents understood well the ways to answer the questions. After undertaking the pre-test, the questionnaires were finalized (see Appendix 2.7).

Probing with local authorities is very important for the success of field surveys in the MRD. There are many ways of probing with local authorities. Presenting the research project clearly to local leaders helps to interest them in the research project. Legally, the researcher must be introduced by his research institution (An Giang University) to the communes for undertaking fieldwork (see Appendix 2.8). After that is done, local leaders are willing to help the research team to undertake field work successfully. Interviewing was undertaken at the respondent's house at a convenient time. The duration of each interview was about one hour.

2.4.3 Characteristics of respondents

Respondents' (household heads) socio-economic and demographic characteristics are presented in Table 2.7. The average age of respondents was 52 years old. The youngest respondent was 25 years old and the oldest one was 96 years old. The proportion of male respondents was higher than that of female respondents (85.4 per cent of respondents were male). Most male respondents were married (89.8 per cent) and were the head of the household. Some 8.5 per cent of the respondents were widowed and very few respondents were single or separated.

The education level of respondents was generally low. The majority of the respondents had completed only primary education (53.6 per cent), while 23.3 per cent had completed secondary education. The proportion of illiterate respondents was relatively high, and very few respondents had completed a vocational education, or attended college or university. The sample also illustrates that the education level of family members was relatively low. Some 10.0 per cent of family members did not know how to read and write. Some 43.0 per cent of family members had completed primary school, while only 29.0 per cent of family members had finished secondary school, and 12.0 per cent had completed high school. A very small proportion of family members had completed vocational training (2.0 per cent).

The average household size was 4.7. The maximum household size in the sample was eight, while the minimum size was one. The average number of children aged less than 15 in the household was 0.9 (range: 1-4) while the average number of adults was 3.2 (range: 1-7), and the average number of people aged more than 60 was 0.5 (range: 1-3). The gender ratio was equally distributed. The average number of females in a household was 2.3 (range: 0-6) and 2.3 (range: 0-7) for male members. Most respondents followed Hoa Hao Buddhism (61.4 per cent) and Buddhism (31.2 per cent), while very few respondents belonged to the Cao Dai religion (3.5 per cent) or were Catholic (2.0 per cent).

Poor households accounted for 39.4 per cent of the sample, followed by well-off households (31.8 per cent) and medium households (28.8 per cent). Nearly half of the respondents (49.9 per cent) reported that they are landless[11] or own less than 0.5 ha of rice land and 27.0 per cent of respondents own from 0.5 ha to less than 2.0 ha. Some

[11] 'Landless' in this context refers only to those people who reported that they do not have any agricultural land; the ownership of residential land was not included in the local definition of 'landless'.

23.0 per cent of the respondents own more than 2.0 ha of rice land. Average household income was VND 60.8 million per year. However, the average income of poor households was VND 15.9 million per year. For medium-income households it was VND 53.1 million per year, while better-off households had an average income of VND 123.4 million per year. The per capita income was VND 12.5 million per year. Per capita income in poor households was VND 3.5 million per year. In medium-income households per capita income was VND 12.0 million, and it was VND 24.2 million in better-off households.

Table 2. 7: Socio-economic and demographic characteristics of the respondents

Respondent (household) characteristics	**Value**
Total number of respondents (persons)	459
Respondent average age (median value in years)	52 (51)
Minimum age (years)	25.00
Maximum age (years)	96.00
Percentage of male respondents in the sample (%)	85.40
Marital status of respondents (%)	
Single	1.50
Married	89.80
Widowed	8.50
Separated	0.20
Education levels of respondents (%)	
Never gone to school (illiterate)	13.90
Primary education	53.60
Secondary education	23.30
High school	8.10
College	0.90
Undergraduate and above	0.20
Respondents' religion (%)	
Hoa Hao Buddhism	61.40
Cao Dai	3.50
Buddhism	31.20
Catholic	2.00
No religion	2.00
Household economic level – self reported (%)	
Poor households	39.40
Medium households	28.80
Better off households	31.80
Land size (%)	
0.0 - <=0.5 ha	49.90
0.5 - <=2.0 ha	27.00
=> 2.0 ha	23.00
Average household size (range)	4.73 (1-8)
Gender distribution in the household (%)	
Percentage of females	49.00
Percentage of males	50.00
Educational level of households' members (%)	

Percentage of illiterate people	10.00
Percentage of people completing primary education	43.00
Percentage of people completing secondary education	29.00
Percentage of people completing high school (%)	12.00
Percentage of people completing vocational education	2.00
Percentage of people completing a college degree	1.00
Percentage of people completing a university degree	2.00
Household income in VND million (VND million/year) (std.)	
Average household income (VND million/year) (std.)	60.83 (219.15)
Average income of poor households	15.94 (76.36)
Average income of medium households	53.18 (54.13)
Average income of better-off households	123.40 (367.84)
Average per capita income (mil. VND/year) (std.)	12.56 (35.31)
Average income per capita of poor households	3.51 (14.02)
Average income per capita of medium households	12.02 (13.83)
Average income per capita of better-off households	24.28 (57.29)
Household types (%)	
Policy households[12]	5.40
Households with one disabled or one chronically ill person	8.90
Relief households[13]	6.10
Households belonging to ethnic or minority group	0.20

2.5 Quantifying social capital, livelihood diversification and households' resilience to floods

2.5.1 Methodology and methods for measuring households' resilience to floods

The resilience concept was first introduced by Holling (1973). For a long period, researchers attempted to define the concept of resilience; very few studies operationalized the concept in practice especially in developing countries. Since resilience is defined as the capacity of a system to recover from disturbance, most natural hazards researchers measure resilience as the speed of recovery (Bruijn 2004). Recently, resilience has been seen to be not only about recovery, but also about innovation, creativity and transformation (Folke et al. 2002, Berkes and Seixas 2005). Therefore, the conventional approach to measuring resilience may not capture its full dimensions. Cumming et al. (2005: 976) note that resilience is a multidimensional concept, so it is difficult to operationalize in practice. Coping with this problem, they develop a surrogate approach for measuring resilience of the ecological-social system, because it is difficult to measure resilience directly. The surrogate measure is different from the indicators approach (Carpenter et al. 2005: 967). The surrogate approach was

[12] Those who have family members who are veterans or who died in the war.

[13] Those households rely on relief to survive during the flood season. They are the highest priority group for relief distribution according to the leader of the Thanh My Tay commune [in-depth interview with Mr Sieu on 15th Sept 2010].

also used for measuring resilience by Carpenter et al. (2005). Regarding the surrogate approach for measuring resilience of the social-ecological system, Berkes and Seixas (2005) found four key factors that affect resilience: (1) learning to live with change and uncertainty; (2) nurturing diversity for re-organization and renewal; (3) combining different kinds of knowledge; (4) and creating opportunities for self-organization. These factors are considered the benchmark for comparing different systems.

Although a surrogate framework for measuring resilience of a social-ecological system has been developed, very few studies attempt to operationalize the framework in practice. Marschke and Berkes (2006) adopted the surrogate approach to operationalize resilience from livelihood perspectives in rural Cambodian villages. They argued that using the concept of wellbeing is an appropriate surrogate for studying households and community resilience. The wellbeing approach can be measured through either objective or subjective means. However, the subjective wellbeing approach is widely accepted in poverty and livelihood studies in developing countries (Narayan et al. 2000, Copestake and Camfield 2009b). It is argued that wellbeing is what people think and feel about their life (Copestake and Camfield 2009a). In a study of subjective wellbeing, researchers ask respondents about how they define a good quality of life using local terminology of wellbeing. Marschke and Berkes (2006) found this approach was useful to explore a local definition of resilience from community members instead of using outsiders' perspectives. In the resilience study in Cambodia, researchers found that the term resilience was not in the Cambodian/Khmer language, so they could not ask the question about resilience directly (Marschke and Berkes 2006). As an alternative, they asked what constitutes subjective wellbeing (translated into Khmer) in relation to their livelihoods, and analysed the responses to understand local notions of resilience. However, Marschke and Berkes (2006) only explored the wellbeing of households and communities in a qualitative manner; they did not attempt to quantify resilience indicators at household and community levels.

In relation to natural hazards, most researchers have attempted to quantify social vulnerability through using various scales of analysis. Some researchers attempt to construct social vulnerability indices to see whether different social groups or communities are vulnerable to natural hazards (Cutter et al. 2003, Cutter et al. 2000, Cutter et al. 2008, Fekete 2009). Cutter et al. (2003) developed a place-based vulnerability framework and validated it using census data from county level in the US, while Fekete (2009) used different sources of data to validate social vulnerability to

extreme flood events in Germany at the individual level. Other researchers examine specific proxies as vulnerability indicators to measure coping capacity in relation to climate change. Adger (1999) used resource dependency and inequity as proxies for measuring individual and collective indicators of social vulnerability to climate change at household and community levels. Brouwer et al. (2007) measure households' vulnerability to floods in Bangladesh using specific vulnerability indicators such as income, income sources, and distance from house to river, depth of flood water and economic losses. The limitation in measuring vulnerability is the difficulty encountered in identifying a social group or community that lacks the ability to cope with stresses in terms of wellbeing losses.

The concept of social resilience not only concerns the ability to respond positively to stresses, but also addresses the innovative aspect of resilience, or the capacity to learn and to transform (Walker et al. 2004). Resilience indicators are not always the same as vulnerability indicators (Paton and Johnston 2006). For example, if someone lives in the flood plain, she or he may be vulnerable to the impacts of the floods. However, if she or he has adequate social insurance, they can recover more quickly from the impacts. This is resilience to floods. Especially, the concept of resilience in living with floods is defined as the capacity of the system to learn, adapt to and benefit from floods in the MRD. So far, no research has operationalized the different components of the resilience concept in the context of living with floods.

Although some researchers conceptualize and operationalize the resilience concept in the field, their work focuses on institutional change rather than natural hazards. For example, Marshall and Marshall (2007) measured households' resilience to institutional changes in the fishing industry in Northern Australia. They argue that the capacity of fishermen to respond positively to fishing policy changes is related to the anticipated wellbeing of the households. In contrast to the subjective wellbeing approach, the researchers ask respondents about their responses to planned [expected] change in resource policy. They also argue that knowledge of the proximity of resource users to their "coping threshold" must be obtained from the experience of people who cope with the event (Marshall and Marshall 2007). This experience is related to the expected wellbeing of the fishermen in response to policy change. In particular, if fishermen report a high level of wellbeing, they are expected to be socially resilient whether they remain within the industry or not.

The item approach was commonly used in measuring individual resilience in psychology and sociology. Items with Likert scores were first developed for measuring individuals' resilience to stress in the psychology discipline in Western society (Wagnild and Young 1993: 168). After that, the Connor-Davidson resilience scale was developed for measuring individuals' coping capacity to stress (Connor and Davidson 2003) Yu and Zhang (2007) validated successfully the Connor-Davidson item scales in the Chinese context. In the ecology-sociology discipline, items with Likert scales were used to construct fishermen's resilience to institutional change (Marshall and Marshall 2007). The multi-item approach has become popular in measuring multidimensional concepts such as resilience.

Resilience is also a dynamic concept. However, most researchers investigate resilience at one point in time, while stresses or shocks are more likely to appear over a period of time. For example, floods or droughts often occur from several days or months to years. To cope with this potential bias, Alinovi et al. (2009) incorporated a shock between T_0 and T_1 (a given time) to measure resilience to food insecurity. Whether shocks are endogenous or exogenous, households have to cope by using available options or coping behaviours. It is assumed that resilience of households at a given time (T_0) is dependent on options available to a household to make a living. Alinovi et al. (2009) argue that a household's resilience to food insecurity is a function of the stability of the system over time. If households show a high adaptability and high stability they are more likely to have high social resilience. In contrast, households are less likely to be resilient if they show low adaptability and low stability. The households' resilience index was created separately for two different points. However, this approach requires panel data, and such data is often unavailable in developing countries.

Most studies measure the resilience of individuals in fields from psychological studies to ecological sociology. However, this thesis explores social resilience to natural hazards at the household level because this is the level at which most risk management, livelihood adaptation and coping strategies are implemented, especially the informal strategies that are most readily available to poor households in developing countries.

Rural households have experienced the occurrence of the annual flood events for years in the MRD. Some of them experience the flood as hardship, while others can benefit from the floods for maintaining rural livelihoods. 'Living with floods' is a well-known term that expresses people's adaptation to annual flood events in the MRD. The term,

'living with floods', can be seen popularly in everyday communication and academic discourse as well as in government documents (Ministry of Agriculture and Rural Development (MARD) 2004, Lebel et al. 2010, Nguyễn Hữu Ninh et al. 2007, MRC 2005). However, different actors have different views about the context of living with floods. Lebel et al. (2010: 26) refer to living with floods as adaptation to flood regimes. Local people may incorporate the flood events into their social life and continue to cope with, adapt to and benefit from floods; this is recognized as resilience. Recognizing the advantages of using the subjective wellbeing approach as a surrogate for resilience measures, this thesis adapted and modified these approaches for measuring households' resilience to floods in the MRD.

As discussed in section 1.4.1, the resilience concept has three common properties: (1) the degree to which the system is capable of self-organization; (2) the amount of disturbance a system can absorb and still remain within the same state or domain of attraction; and (3) the degree to which the system can build and increase the capacity for learning and adaptation. In particular, the resilience concept in the context of 'living with floods' in this thesis is defined as the ability of households to confidently live with, adapt to and benefit from floods. The ability of households to cope with, adapt to and benefit from floods must be related to their subjective wellbeing. If a household has a high level of wellbeing, they are demonstrating their resilience capacity and they expect to be resilient to floods. Because there is no concept of resilience in the Vietnamese language, we asked what people understood by the term, 'living with floods', in their livelihood context. In particular, this thesis explores the local definition of 'living with floods' by community members who come from different socio-economic backgrounds such as poor, medium, better-off, young and old, men and women, different occupational groups (rice farmers, fish or prawn farmers, and local authorities), and living in different geographical flood-prone regions (low, moderate and high flood-prone regions). The term 'living with floods' was discussed freely in 12 FGDs by different socio-economic group. The results from the FGDs summarize local perspectives on 'living with floods' in the three study areas (Table 2.8).

Table 2. 8: What do you understand by 'living with floods' in the area where you live?

At household level	At community level
• Prepare to reinforce housing structure before the flood season • Have a good quality house to stay safe during the flood season • Have sufficient food and income during the flood season • Have a stable job during the flood season to secure income and food • Have a little boat, fishing nets or fish traps for fishing during the flood season • Secure health for family members especially protecting children from drowning during the flood season • Exploiting the natural benefit of the floods in an innovative way. For example, conducting flood-based farming activities such as collecting snails, crabs, fish, and other aquatic resources, growing vegetables (*Neptunia prostrate*) or raising fish, prawns in the flooded fields during the flood season	• Have mobile kindergartens to take care of children during the flood season • Have mobile rescue teams (community-based team) to enhance community confidence to live with floods • Have dikes and trees on the dikes that can reduce the severe impacts of winds and giant flood waves on houses • Have residential clusters to relocate poor people to live permanently and avoid the annual impacts of flooding on houses

Note: Summarised from the FGDs and in-depth interviews

Perceived indicators of living with floods were documented in government reports, media, scientific research and other reports. The local newspapers described livelihood insecurity during the extreme flood event in 2000. Poor people lived in unsafe conditions (in simple houses without protective materials inside the flooded fields, see Figure 2.2) which were easily destroyed by flooding during storms. Most poor households were at risk of food insecurity because the primary income source from agricultural wage labour was disrupted significantly by flooding. So, having a stable job during the flood season was perceived as an important indicator of wellbeing of the poor since they can secure food. Additionally, having a boat and nets for fishing was thought of as a useful indicator of wellbeing for most people in the flood prone region.

Figure 2. 2: Simple houses without protective materials inside the flooded fields

Building livelihood security is an important indicator of resilience to floods as farmers test and conduct different types of livelihood activities during the flood season for making a living. They engage in different flood-based farming activities that are appropriate to floods. People are more likely to diversify livelihood activities within fishing to maintain household income. Some people engage in fishing using nets, while others use fish traps.

Local participants in the FGDs also said that 'living with floods' meant people must be prepared to cope with, adapt to and benefit from annual flood events. Preparedness reflects the capacity of households to reinforce houses, stabilize income, food, and secure health for family members before, during and after the flood event. Preparedness also reflects the capacity to utilize the benefit of floods such as fishing, cultivating fish or prawns, and growing aquatic vegetables during the flood season instead of doing nothing. Those critical concerns expressed by local participants about the flood season can be grouped into different livelihood dimensions such as housing, health, income and food, and taking opportunity from the flood disturbance.

Different socio-economic groups have different capacities to cope with, adapt to and benefit from floods. Their capacity is determined by the level of wellbeing. Poor people often worry about a shortage of rice to eat, lack of money to purchase food, houses collapsing and children's lives being at risk. Poor households are more likely to construct houses in unsafe conditions as they often build simple houses on stilts or low

ground which are subject to the impact of flooding. On the other hand, richer families often build houses on high ground or on good quality stilts or concrete foundations that are more likely to cope with flood waves. Most households prepare fishing nets and boats for the harvest season to maintain household income and expenditure during the flood season. However, poor households may not have the financial resources to engage in fishing activities. Seasonal migration is the more likely way for them to secure an income for survival during the flood season. If their income stream is disrupted by the occurrence of flooding, they may find it difficult to survive without external assistance from other communities. Conducting flood-based farming is a new way of living with flooding, but not all people can cultivate prawns, fish or vegetables. These aspects can be explained by the heterogeneity of sources of wellbeing of different social groups.

After conducting qualitative research to identify the local definitions of 'living with floods', I developed ten statements that relate to household capacity to cope with, adapt to and benefit from flooding (see Chapter six). Most of the participants in the qualitative studies addressed key indicators of living with floods. These include security of houses, health, food and income, and undertaking new ways of living with floods. Therefore, the items were designed to reflect the capacity of households to cope with, adapt to, and benefit from flooding. A representative of each household was asked to indicate their level of disagreement and agreement with each statement. The respondents were given the alternatives of strongly agree, agree, neither agree nor disagree, disagree and strongly disagree. Statements were checked and pre-tested in the field before the survey. Ten pre-test samples were undertaken in the study areas prior to the actual survey. Some researchers use four-point Likert scales to measure the resilience of individuals (Marshall and Marshall 2007). Others use a seven-point Likert scale for measuring individual resilience (Wagnild and Young 1993). However, a five-point Likert scale is mostly used to measure resilience (Connor and Davidson 2003). This study adapted a five–point Likert scale to design questions that related to wellbeing of households during and after the flood season. As noted by deVaus (2002: 180 - 181) it is beneficial to use multiple indicators to measure the complexity of a concept. Additionally, some distortions or misclassifications can arise if we use single-item measures of a complex concept (deVaus 2002: 181). Multiple items also help to increase the reliability and precision of the measure. In particular, if one question is used, the response could be a function of the wording of the question which may be prone to subjectivity and biases. As discussed in previous sections, social resilience to the flood season is a complex

concept so using multiple-item scales can help to avoid misunderstanding and also reflect the true capacity of rural households to cope with, adapt to and benefit from floods.

Factor analysis is a means to combine related variables into 'composite' variables for measuring social capital and resilience. Factor analysis helps identify this sort of patterning in response to a set of questions (deVaus 2002: 186-196). The purpose of this technique is to reduce a large number of variables to a smaller set of underlying variables by creating measures or factors such as resilience and social capital variables. Factor analysis is widely accepted in creating social vulnerability indexes (Cutter et al. 2003, Cutter et al. 2000, Fekete 2009), and social capital indexes (Nguyễn Văn Hà et al. 2004, Li et al. 2005), individuals' resilience to stress (Wagnild and Young 1993, Yu and Zhang 2007, Connor and Davidson 2003, Wagnild 2009), and individuals' resilience to institutional changes (Marshall and Marshall 2007). There are four main steps in forming scales using factor analysis: (1) selecting variables; (2) extracting an initial set of factors; (3) extracting a final set of factors by 'rotation'; (4) constructing scales based on the results at step 3 for further analysis.

When selecting variables for factor analysis, it is important to be able to assume that correlations between the variables will not be causal. To avoid this potential bias, researchers have to test for multicolinearity among variables. It is important to ensure that the variables to be analysed have at least reasonable correlations with some other variables in the analysis. There are several ways of assessing whether a set of variables in a correlation matrix is suitable for analysis. According to deVaus (2002), KMO (Kaiser-Meyer-Olkin) statistics are used for this assessment. KMO explains the proportion of variance in the variables that may be caused by underlying factors. A reliable KMO for this assessment is greater than 0.7. In practice, KMO values above 6.0 indicate an acceptable level (Fekete 2009, Gray and Kinnear 2012)

To ensure variables have a unique scale measurement, variables were first standardized to equal intervals from zero to one before undertaking a factor analysis[14]. One of the

[14] To obtain a standardized score I must subtract the mean from the individual score and divide by the standard deviation. A standardized z-score represents both the relative position of an individual score in a distribution as compared to the mean and the variation of scores in the distribution. A negative z-score indicates the score is below the distribution mean. A positive z-score indicates the score is above the distribution mean. Z-scores will form a distribution identical to the distribution of raw scores; the mean of

first steps concerns the normalization of the data. It is very important to normalize data when dealing with parameters of different units and scales (Saitta 2007). In this context, nine items were used a five-point Likert scale, while a binary scale was used for the tenth item. This approach was used by Fekete (2009) and Cutter et al. (2003). In this thesis, items were standardized prior to undertaking a factor analysis. Missing values were often replaced with the mean value of the variables (Fekete 2009, Cutter et al. 2003). However, the data has no missing values for this section, so no mean value was applied. The result of frequency of distribution is presented in Chapter six.

Two decisions are necessary to extract factors. The first is to decide which of a number of methods of extracting the factors is to be used (Kim and Mueller 1978). The principal component factor method is used in this analysis in order to find a linear combination of variables that account for as much variation in the original variables as possible (Fekete 2009: 395). The second is to work out how many factors to extract. To clarify which variables belong to which factor, and to make the factors more interpretable, factor rotation is undertaken. A number of methods for rotation of variables can be used (Kim and Mueller 1978: 29) including the quartimax, the equamax and varimax. One of the most widely used methods is varimax, which attempts to minimize the number of variables that have a high loading on particular factors (Wagnild and Young 1993). There are three approaches: varimax rotation, quartimax rotation and the eqaumax rotation method. The varimax rotation will enhance the interpretability of the factors (Utomo 1997), and produce more interdependence among the factors (Cutter et al. 2003). The quartimax rotation often results in a general factor with high to moderate loadings on most variables. The equamax method is a combination of the varimax method, which simplifies the factors, and the quartimax method, which simplifies the variables (Norušis 1993: 65). In this thesis, the varimax rotation method was chosen so as to maximize interpretation of the factors. The eigenvalue was used to determine the best factor. The eigenvalue is a standardized variance associated with a particular factor. The higher this value, the more variance is explained. To be retained, factors must have an eigenvalue greater than 1. The results of factor analysis are illustrated in Chapter 6.

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z-scores will equal zero and the variance of a z-distribution will always be one, as will the standard deviation.

The formulation is $$Z = \frac{X_i - \overline{X}}{S} \quad (1)$$

Communality is used to test which variables are problems. Communality ranges from zero (0) to one (1). The higher the figure the better the set of selected factors explains the variance for that variable. If the communality figure is low, it means that the variance for that variable is not explained by the selected factors. Normally it is best to drop variables with low communalities and thus increase the total variance by the two factors.

It is important to look at each item to see if it really belongs to the scale. This process of assessing each item is called 'item analysis'. There are two aspects: uni dimensionality and reliability (deVaus 2002: 184). To undertake the unidimensionality test, a correlation between responses on the items with their responses on the set of items that make up the rest of the scale was conducted. Correlation coefficients range between zero and one. The higher the coefficient, the more clearly the item belongs to the scale. The rule of thumb is that if it is less than 0.3 then the item is dropped from the scale (deVaus 2002). Briggs and Cheek (1986) state that if there are fewer than ten items, the appropriate inter-items correlation should range from 0.2 to 0.4.

A reliable scale is one in which individuals obtain much the same scale scores on two different occasions. An unreliable scale is the result of unreliable items, so I need to test each item for its reliability. Item-item correlation is used to see the consistency of a person's response on an item compared to every other scale item. The index of this is given by a statistic Cronbach's alpha coefficient. This ranges between zero and one. The higher the figure the more reliable is the scale. As a rule of thumb, alpha should be at least 0.7 before we can say that the scale is reliable (deVaus 2002, Marshall and Marshall 2007).

In this thesis, the resilience factor scores derived from the factor analysis will be used as latent variables for a further analysis to test the relationship between socio-economic variables and household resilience to floods. By using factor scores of different components of resilience, demographic variables such as age of respondents, sex, household size and social capital of respondents of households can be analysed using both bivariate and multivariate analysis (see Chapter seven).

2.5.2 Methodology and methods for measuring livelihood diversification at household level

Diversification of income sources is likely to be a viable livelihood strategy to maintain income during months of flooding. For example, diversification of livelihood activities during the floods will help rural families to maintain income. Previous studies identify diversification of livelihood activities as the ability to reduce risk of income losses arising from environmental risks (Brouwer et al. 2007).

Two common ways were adapted to measure livelihood diversity. In assessing household vulnerability to climate change in Vietnam, Adger (1999: 252) used the number of income sources as a proxy of livelihood diversity at the household level. Brouwer et al. (2007) also used household income sources as a proxy to measure resource-dependency of the households in the flood prone areas of Bangladesh.

An index approach provides an alternative to measure livelihood diversity in developing countries. In rural livelihood studies, an 'inverse Herfindahl-Hirschman index' (IHHD) is used to construct the income diversity index which reflects the level of livelihood diversification at household level. The IHHD is used in studies of biodiversity and is also found in financial economics (Ellis 2000: 213). This approach for example was used to measure diversification of income sources at the household level in rural Tanzania (Ellis 2000) and in rural India (Anderson and Deshingkar 2005). The index is calculated for each household using the entire range of income sources rather than group income sources. The IHHD is measured using the following equation.

$$\text{IHHDi} =; \left[\frac{1}{\sum a_j^2}\right] \qquad (2)$$

Where each a_j represents the proportional contribution of each income source j to household i's overall income. The minimum value is 1 if all income is from one source only while the maximum possible value of this index is the total number from different income sources that is attained if total income source is distributed equally between each source (Ellis 2000). For example, if a household has 25 percent for each of four income sources (rice, fish, livestock, and wage labour), the IHHD is maximized. The advantage of this approach is that it can measure a household's diversity of income which reflects the proportional distribution of income sources. On the other hand, the simple approach of measuring total numbers of income sources does not reflect the

proportional distribution of income sources. However, this method requires well-designed questionnaires to capture a full range of livelihood activities of households in different periods of time. A further limitation of this approach is that it cannot apply to a community with a single livelihood activity. If all members of the community have only one income source such as rice, this index is not applicable.

This study investigates livelihood diversification using both qualitative and quantitative approaches. In the qualitative study, I examine the diversity of occupation of household head and adult members in the household, the contribution of actual income sources of households in the last 12 months, type of livelihood activities during the flood season, and the relationship between livelihood diversity index and resilience index. The importance of each income source and the livelihood strategy of households during the flood season were examined using qualitative data to provide an in-depth analysis of household resilience in terms of food and income security.

For production activities such as rice and fish farming, the net benefit of each activity was estimated using the local currency at the time of interview. These would be subjected to inflation during a period of 12 months. However, this study attempts to use the rough estimated income, so inflation is not taken into consideration.

2.5.3 Methodology and methods for measuring social capital of households

Social capital can be measured at individual or collective levels. In economic and health studies, most researchers are concerned with social capital of individuals. They attempt to examine the effects of individual social capital on households' wellbeing. Many studies have explored the effects of membership of groups and associations on households' income or expenditure (Grootaert 2002, Grootaert et al. 2002, Nguyễn Văn Hà et al. 2004, Narayan 1999, Narayan and Pritchett 1997, Ziersch et al. 2005). In health studies, neighbourhood attachment of individuals (bonding social capital) can be seen as an important social asset for improving the health outcome of individuals (Ziersch et al. 2005). Researchers also examine effects of social capital of individuals on job attainment (Li et al. 2005, Lin 1986, Lin 1999). However, in resource management and climate change adaptation, most studies investigate collective social capital at the community level (Uphoff and Wijayaratna 2000, Adger 2003). Natural disaster researchers attempt to explore the roles of different forms of social capital (bonding, bridging and linking) on both the individual and the community during and after natural disasters (Hawkins and Maurer 2010, Pelling 1998, Mathbor 2007).

However, no study attempts to quantify the social capital of individuals and investigate its relationship with household's resilience to floods. This study attempts to fill this gap by analysing the relationship between different forms of social capital of individuals and household resilience to floods.

2.5.3.1 Measures of informal social capital: neighbourhood attachment of households

Neighbourhood attachment is seen as an important resource for coping with natural hazards. Neighbourhood attachment is considered one indicator of individual social capital (Ziersch et al. 2005). 'Neighbourhood' is defined as census block groups which are the smallest geographical areas in which an average of 1500 people reside (Caughy et al. 2003: 228). Neighbourhood connection has been commonly measured using multiple items with Likert scales. Caughy et al. (2003) use the individuals' attachment to neighbourhood as an indicator of social capital in studying mental health outcomes of children in an African country. The indicators of individuals' attachment were measured by a set of 13 Likert-scale items as a perceived psychological sense of community based on how well one knows their neighbours (Caughy et al. 2003). Li et al. (2005) identified neighbours as important resources for individuals in seeking jobs in the UK. According to Li et al. (2005: 111) "neighbourhood attachment means the degree to which people are attached to their neighbours". They used both attitudinal and behavioural statements to ask the respondents about their level of attachment to the neighbourhood using the Likert scale items. Eight items of an ordinal nature for neighbourhood attachment (ordinal scale, five categories) were developed by Li et al. (2005). Most researchers are aware that there may be inconsistencies in measures using a set of items, but factor analysis can help to identify the related items.

It has been recognized that neighbours are resources for coping with, adapting to, and benefitting from floods in the MRD. Close attachment to neighbours can build livelihood resilience for rural households during the flood season. This thesis adopts a multiple item approach using a five-point Likert scale for constructing an index of neighbourhood attachment as an indicator of bonding social capital of individuals. Both attitudinal and behavioural statements were designed to ask the respondents about their attitudes towards their neighbours. Neighbourhood in this context is different from the definition of neighbourhood in Western society as defined by Caughy et al. (2003: 228). The block definition of neighbourhood may not be appropriate in this context. In Vietnam, the commune is the lowest administrative unit, but the boundary of the

commune is so large that it cannot be seen as a neighbourhood. From my experience in living and working in the rural areas of the MRD, I identify 'neighbourhood' as a group of households who live together in a hamlet. I do not use hamlet or communal boundaries to set up the neighbourhood because one household in one hamlet may be a good neighbour of neighbouring hamlets.

In the Vietnamese language, the term 'neighbourhood' is translated as (*hàng xóm, láng giềng*). Traditionally, most rural households are situated along a dike or river bank *(tuyến dân cư)* in the flood prone areas of the MRD (Biggs et al. 2009). Before the colonial period, migrants came to the MRD and settled in a group of several families on high grounds *(gò cao)*. The term 'neighbourhood' (*hàng xóm)* originated from this period. After the steam dredge was introduced to the delta in the 19th century, the population grew rapidly during colonial times. They settled along the river and canal banks where they could easily access water for irrigation, domestic uses and transportation. Populations were distributed in a scatter pattern until the 1980s. The reclamation programs that dug many new canals facilitated expansion of the population. Consequently, the canals have become heavily populated in recent years. The term 'neighbours' means *(bà con hàng xóm láng giềng)* in the Vietnamese language to identify people who live next to each other and exchange material and symbolic resources to maintain a neighbourly relationship *(quan hệ hàng xóm láng giềng)*. The neighbourly relationship is cultivated through everyday reciprocity. For example, neighbours help each other to repair a house, share labour to harvest rice *(đổi công)*, help neighbours when they are sick or exchange labour to organize family events (wedding, ancestor death ceremonies), and exchange goods such as especially delicious food. The neighbour relationship is also developed through participation in religious events in the community (temple and pagoda ceremonies) and participation in neighbourhood events (wedding parties, ancestor death ceremonies, the first month after birth ceremony, the first birthday, funerals, and sporting activities). Thirdly, they participate in formal events in the neighbourhood such as conflict resolution and hamlet meetings. Finally, drinking coffee and playing sport with neighbours may also be the means of accessing information for living with floods. This type of relationship is very important for coping with daily shocks as well as the flood events.

Respondents were asked their level of disagreement or agreement on twelve statements that reflect their connection to their neighbours. The statements were developed from local perspectives through FGDs with different social groups in the study sites. The

statements are related to the neighbour relationship to cope with shocks as well as coping with floods. The statements also reflect a diversity of neighbourhood relations including (1) the value of the neighbourhood, (2) advice from neighbours, (3) daily meetings with neighbours at local coffee shops, (4) helping neighbours when they are sick or ill, (5) discussing ways of 'living with floods' with neighbours, (6) participating in recreational activities with neighbours, (7) participating in cultural and religious activities with neighbours, (8) participating in hamlet meetings to discuss ways of coping with floods, (9) helping neighbours to recover if they are affected by floods, (10) helping with money and rice when neighbours are in need, (11) attending parties in the neighbourhood, and (12) participating in conflict resolution activities of the local community. The frequency of the responses is shown in Chapter seven.

This study does not attempt to identify the characteristics of neighbourhoods in the way in which public health studies are concerned with this issue. This study also does not differentiate between kin and neighbour relationships. In particular, neighbours may be either kin or friends or strangers in the study sites. Traditionally, people in the MRD occupied a large land area. Two common types of settlement patterns are the clustered settlement and settlements along streams, canals, roads, and footpaths which were formed in scattered or isolated farmsteads[15] (Hickey and Bùi Quang Đa 1960: 10). When their children grew up and married, they established a new family next to their parents' homes. This traditional form of resettlement is repeated for generations. Therefore, neighbours may also be kin. Moreover, this study did not explore in-depth the history of kinship networks, but focuses on neighbours.

Similar to resilience measures, factor analysis was used to construct an index of neighbourhood attachment of the respondents. Factors which have Eigenvalue greater than 1 are selected. Reliability test of scale was used to select factors if their Cronbach's alpha is suitable. The factor scores derived from neighbourhood attachment will be treated as an independent variable for testing its relationship with household resilience factor scores which are created in Chapter six.

[15] A farmstead includes a house, and if the owner has livestock, a stable which also serves as a place to store tools, fish traps, and farm implements. Some farmsteads have chicken coops and/or pig sties. Most homesteads are surrounded by a sizeable plot of land enclosed by a hedge growth of cactus, bushes of many kinds, clumps of bamboo, and a variety of prickly tropical plants. Hickey, G. C. and Bùi Quang Đa (1960) *The study of a Vietnamese Rural Community - Sociology*, Lansing: Michigan State University and Vietnam Advisory Group.

2.5.3.2 Measures of informal social capital: social supportive networks of households

It is important to differentiate between study of social networks and social support. Smith and Christakis (2008: 407) explain that the study of social support focuses on the relationship between individuals that support each other, while social network studies characterize the web of social relations around individuals, who the contacts are and the nature of the ties that connect them. Social support studies assess the quality and quantity of a person's social ties; social network studies treat the ties themselves as objects of study. In other words, social network analysis focuses on measuring the quantity of networks. Network density is used to map the characteristics of actors within the network and weigh its strength (Paldam 2000).

Three common approaches were used for measuring the social capital of individuals. A name generator is traditionally used to measure social networks. The name generator works by posing one or more questions about ego's[16] contacts in certain role relationships (relatives, neighbour), content areas (work matters, household chores), and intimacy qualities (confiding, most intimate) (Lin 1999:476). A question is posed such as "who do you usually discuss work problems with?" and a sampled respondent is asked to provide a list of names of those who provide service and exchange. Lin (1999) noted that the name generator has advantages, such as customized content areas and ego-centred network mapping. However, there are problems associated with name generators in measuring social capital including variations in distributions being affected by the content or role and number of names (Lin 1999). Additionally, the number of names is limited, from one to five, so the constructed network is of limited range and scope (Lin 2005). As a result, the data tends to reflect stronger ties, stronger role relations, or ties in close geographic limits.

The social network of individuals can be measured using the position generator. Lin (1986) developed the position generator using structural positions in a society (occupations, authorities, work unit, class or sector) and asking respondents or ego to indicate contact (e.g., those known on a first-name basis), if any, with each of the positions. Relationships between the respondent and each position can be identified through the network. The strength of the position generator is in measuring access to structural positions rather than the specific names. This approach has many advantages including being content free, having sample hierarchical positions, and multiple

[16] Ego means the person whom we want to interview (respondents). It can be found in Lin, N. (2001) *Social Capital: a theory of social structure and action,* Cambridge: Cambridge University Press.

resources mapped, direct and indirect access. However, this approach requires educated interviewers and long interviews focused specifically on measuring social networks. It may not be appropriate to apply in measuring social supportive networks in coping with floods because the aim of the study is not to measure structural position, but measure the capacity of households to access resources in coping with floods.

The resource generator has advantages over the name and position generators in measuring social networks of individuals. Gaag and Snijders (2005) use questions related to resources to generate a list of contacts ranging from three to five or as many as are volunteered by the respondents. From the list of resources, the relationships between ego and contacts and among contacts, as well as contacts' characteristics, were generated. Social networks are constructed to reflect the contacts' diversity and range of resources (education and occupation) as well as characteristics (gender, race and age).

The social supportive network of individuals can be measured using the hierarchical mapping approach. In this approach respondents are asked to present a set of three concentric circles with the word YOU in the middle (Ajrouch et al. 2005). In the first inner circle, respondents are asked about people they feel are so close and important it is hard to imagine life without them. In the middle circle respondents are asked about the people whom they may not feel very close to, but are still very important to them. In the outer circle, respondents are asked to place the names of people who are not close and important enough, but still in their network. Then the respondents were asked to answer a series of questions about 10 people who are located in their network. However, this technique focuses on exploring the characteristics of a network rather than understanding the social supports from ego within the networks.

Social supportive networks can be quantified using a direct approach in social support studies. Respondents are asked to state their supportive networks. This approach was used to examine social capital in wellbeing studies. Copestake and Camfield (2009a: 6) measure social supportive networks by asking questions like "where do you find support when needed?" in subjective measures of wellbeing in Bangladesh, Ethiopia, Peru and Thailand. This approach was also used to identify the social safety net in accessing household resilience to food insecurity (Alinovi et al. 2010). This approach allows the respondents to locate sources of support easily. It does not simply imply the location of support they can receive but draws inferences from who supports them.

Social networks beyond immediate family and neighbours can be resources for different social groups. It is argued that different forms of social capital have different effects on different types of disasters (Hawkins and Maurer 2010, Adger 2003). According to Li et al. (2005: 112) "a social network is to measure people's interaction with those beyond immediate family, and the extent to which people feel they have supportive networks". Li et al. (2005) found disadvantaged groups are more likely to draw resources from informal social networks, while advantaged groups are more likely to benefit from formal social networks. Li et al. (2005) used eight statements which capture a wide range of supportive networks of the respondents using a three-point ordinal scale. A factor analysis was used to construct a latent variable from the set of items. The item approach has been used to measure social support in studying post-traumatic stress disorder among flood victims in Hunan, China (Feng et al. 2007). In this study, researchers divided social supports into three realms: objective support, subjective support, and support utilization. The four-point ordinal Likert scale was used for rating the levels of support. Total score for the 10 items was used as a measure of current social support. Feng et al. (2007) treated each item equally when they aggregated the score.

This thesis adopts the approach of designing items that measure the social supportive networks of the respondents in coping with floods. However, a modification was made with regards to the construction of the responses to the items that address issues of living with floods. Dichotomous choice questions (Yes, No) were used to ask respondents to check their agreement or disagreement with the supportive networks for coping with daily life and floods. This study has a limitation as the respondents play a representative role for all household members in reporting their supportive networks. It may be argued that the respondents may miss out important networks of each household member if they are living far away from home at the time of the interview. The frequency distribution of the social supportive network is presented in Chapter seven. Many young people in the study sites migrate to HCM city to work in non-farm sectors, and may form new supportive networks. However, this thesis did not ask about supportive networks for each individual in every household, but assumed that the respondents know about the supportive networks of their households.

In contrast to other studies, this thesis applied a weighted measure for each item in constructing social supportive network scores. The weight used for each item is the reciprocal of the proportion of respondents who answered Yes they need a network of

support. This approach was used by Utomo (1997: 105) when creating an index of sexual behaviour from a set of items. The approach demonstrates that the item with a higher level of frequency means 'less important' because most people have the same access status. On the other hand, if an item has a lower level of response, it will be given a greater weight as they maintain a different access status. The weight is calculated by dividing the total number in the sample to the number of "Yes" responses. Each item was replaced by a weighted score if they said 'Yes'. Otherwise, each item was replaced by 0 if they said 'No'. The index of social supportive networks for each respondent is the sum of those weighted scores (see Chapter seven). Respondents with higher weighted scores have more social supportive networks. This index was treated as a latent variable to examine the relationship between social networks and households' resilience indexes.

2.5.3.4 Measuring formal social capital as membership of groups and associations

Economists often attempt to construct an index of social capital from participation in groups and associations. Because social capital inheres to the quality and quantity of group membership, an index is created as a proxy to measure associational activities (Narayan 1999, Narayan and Pritchett 1997, Grootaert 2002, Grootaert et al. 2002, Nguyễn Văn Hà et al. 2004, Maluccio et al. 2000). Narayan and Pritchett (1997: 2) see social capital as "quality and quantity of associational life and related social norms". Associational life social capital is measured by a composite index of group membership, characteristics of groups of which households are members, levels of trust in various groups, and perceptions of social cohesion. Respondents were asked a set of questions related to group membership and characteristics of each group of which individuals were members including (1) kin heterogeneity of membership, (2) income heterogeneity of membership, (3) group functioning, (4) group decision making (5) voluntary membership. One or two questions were asked for each component in different discrete scales. The scales were converted into a unique scale which ranges from 0 to 100 for creating a single numeral index with arbitrary assumptions. The index was normalized into mean 0 (zero) and standard deviation 1 (one) for further analysis which was treated as an instrumental variable in the household expenditure model.

Maluccio et al. (2000) identified the weaknesses of Narayan's approach to measuring social capital as the index is affected by arbitrary assumptions which can be difficult to interpret. To solve this problem, Maluccio et al. (2000) constructed a simple social

capital index based on a raw number of groups per household. The index was derived from three components: density or number of groups per household; average performance of most important groups in the household; and participation in the most important groups in the household. Questions for the last two components were asked using five-point scales to represent level of performance and attendance. Performance and attendance scores were nominalised by dividing their mid-point, and the index was created by multiplying the three components. However, Nguyễn Văn Hà et al. (2004) used the per capita number of groups and association memberships in the household as a measure of associational activities or participation in groups in the Vietnamese context.

Drawing on the measures of associational life, a form of social capital in previous studies, this study adopts the approach from Nguyễn Văn Hà et al. (2004) for the Vietnamese context. The lists of social groups and associations were obtained from government documents, in-depth interviews with key informants, and focus group discussions with local people living in the study areas. The respondents were asked to check whether anyone in their household was a member of any of the 17 local groups found in the community (see Chapter seven). The number of members of groups and associations is treated as an indicator of formal social capital or associational life. If a household has more than one member belonging to one group or association, this study treated it as a single membership only. There is no weight placed on particular groups or associations. The index of participation in groups and associations is the number of memberships that a household belongs to. If a household has a greater number of memberships, they are more likely to have more formal social capital. The raw scores were standardized and treated as an independent variable for further analysis.

2.6 Analytical data approaches

2.6.1 Qualitative data analysis

A narrative approach was employed to analyse qualitative data. The narrative analysis refers to the whole of a person's account (Ezzy 2002: 95). Stories are used to illustrate the social and cultural contexts that facilitate everyday practices. Narrative analysis is used to illustrate perceptions of flood impacts on different social groups, their coping and adaptation to floods, perceptions of social capital and resilience to floods. The content analysis is employed to analyse secondary data such as government policies, reports, and newspapers.

2.6.2 Quantitative analysis

2.6.2.1 Definition of variables

Variables are defined, calculated by mean and standard deviation prior data analysis in the bivariate and multiple regression analysis (Table 2.9).

Table 2. 9: Definition of variables used for quantitative data analysis

Variables	Definition	Mean	Standard deviation
Resilience properties			
Resilience property one	The capacity of households to secure food, income and health during the flood season (continuous, standardized form, mean 0, std 1), (min : max)	0.00 (-2.20:1.67)	1.00
Resilience property two	The capacity of households to secure houses in a big flood event such as the 2000 flood (continuous, standardized form, mean 0, std 1), (min : max)	0.00 (-2.69:1.90)	1.00
Resilience property three	Interest in learning and doing new flood-based livelihoods for adapting to the flood season (continuous, standardized form, mean 0, std 1), , (min:max)	0.00 (-1.63:2.35)	1.00
Social capital indices			
Aggregated social capital	Sum scores of disaggregated social capital, (min : max)	2.98 (-9.30:11.36)	2.37
Neighborhood attachment index (standardized data)	Neighborhood attachment index (NAI), measured by factor analysis from eight final items (continuous, standardized form, mean 0, std 1), (min:max)	0.00 (-3.49: 2.45)	1.00
Supportive network index (standardized data)	Social supportive network index (SSNI), measured by sum scores of nine weighted items (continuous, standardized form, mean 0, std 1), (min:max)	0.00 (-5.41: 6.18)	1.00
Membership index (standardized data)	Participation in groups and association index: number of groups and associations a household is member of (continuous, standardized form, mean 0, std 1), (min:max)	0.00 (-3.30:4.80)	1.00
Socio-economic characteristics			
Household socio-economic status	Dummy (1=poor, 0=non-poor)	0.61	0.48
Household size	Number of household members (continuous), (min : max)	4.73 (1:8)	1.52
Gender of the respondent	Gender of the respondents (dummy, 1=male, 0=female)	1.28	0.45
Age of the respondent	Age in years (continuous), (min:max)	52.35 (25:96)	13.4

Housing characteristics			
Concrete house	Houses built on concrete permanent stilts or on ground above the flood level in 2000 (dummy; 1= yes; 0=no)	0.39	0.48
Simple house	Houses built on simpler floor and stilts, dummy; (dummy; 1= yes; 0=no)	0.61	0.48
Houses in a residential cluster	House located in residential clusters (dummy; 1= yes; 0=no)	0.14	0.34
Houses inside dikes	House located inside dikes or road (dummy; 1= yes; 0=no)	0.55	0.49
Regional flood factors			
High flood region	Households located in the high flood region (dummy, 1=yes, 0=no)	0.33	0.47
Moderate flood region	Households located in the moderate flood region (dummy, 1=yes, 0=no)	0.35	0.47
Low flood region	Households located in the low flood region (dummy, 1=yes, 0=no)	0.33	0.47
HH types			
Policy household	Households have a member who is a veteran or died in the war (dummy 1= yes; 2=no)	1.83	1.16
Health household	Household has one disabled or chronically ill person (dummy, 1=yes, 0=no)	1.79	1.16
Relief household	Households wait for relief when a flood occurs (dummy, 1=yes, 0=no)	1.82	1.16
Educational factors			
Respondent with no school	Respondents who never went to school (dummy, 1=yes, 0=no)	1.86	0.34
Respondent with primary school (years 1-5)	Respondents who have completed primary school (dummy, 1=yes, 0=no)	1.46	0.49
Respondent with secondary school (years 6-9)	Respondents who have completed secondary school (dummy, 1=yes, 0=no)	1.77	0.42
Respondent with high school (years 10-12)	Respondents who have completed high school (dummy, 1=yes, 0=no)	1.92	0.27

2.6.2.2 Bivariate analysis

Several bivariate tests were conducted to identify the relationship between perceived impacts of floods on rural livelihood activities and assets, the relationship between social resilience scores and livelihood diversity, and social capital scores. Cross tabulation (based on Chi-square statistical analysis) was used to examine the relationship between two discrete variables. The F-test was used to determine the relationship between a discrete variable and a continuous variable if discrete variables had more than three or more categories. In case two variables were both continuous, it was found to be useful to use Pearson's correlation to examine the relationship of two variables.

2.6.2.3 Multiple regressions

Pearson correlations were used to identify the relationship between social resilience scores and socio-demographic variables, social capital scores, and livelihood diversity (disaggregated and aggregated forms). This approach was used for testing 'autocorrelation' among independent variables prior undertaking multiple regressions. In multivariate analysis, all factors of households' demographics, social capital indices, livelihood diversity index, and flood dependency income variables were included in the regressions as potential explanatory variables whereas resilience factor scores were included as the dependent variables. If the resilience score was treated as a continuous variable, multiple OLS regressions were used to examine the effects of independent variables on resilience factor scores. Demographic variables such as gender were made into dummy variables before being used in the multivariate model, while other variables such as income, livelihood diversification index, social capital factor scores and indices were already in the form of continuous variables. Demographic variables included in the analysis were age and gender of household's head. Several multivariate stepwise regressions were examined.

Resilience factor scores = f(socio-demographic variables, social capital factor scores and indices, livelihood diversification index)

In the regression models, both disaggregated and aggregated measures of households' resilience scores were examined to see the variation in a fixed set of independent variables. The multiple regressions for the resilience score of each factor were conducted separately to see the effects of socio-economic factors, social capital, and

livelihood adaptation strategy on households' resilience factor score. For social capital, both disaggregated and aggregate measures were incorporated into each disaggregated resilience model to see which one had a better estimation. This approach was used by Nguyễn Văn Hà et al. (2004) when they studied the effects of social capital of individuals on the wellbeing of paper recycling in households in Vietnam.

In each disaggregated regression model, analysis of the interaction effect between social capital of households and household economic status (poor or non-poor) on resilience variables was undertaken. This occurred when the effect of an independent variable on the dependent variable varied by different levels of another independent variable. In this context, different economic status of the households may have a different level of social capital that leads to a different level of resilience.

2.7 Conclusion

Studying social capital and livelihood diversification in the face of natural hazards is a complex process. However, the use of a mixture of methods can help researchers adequately explore the complexity of living with floods. The qualitative approach explores in-depth local experiences and perceptions of living with floods and supports the quantitative methods in designing questionnaires to collect data on households' socio-economic conditions, as well as perceptions of flood impacts and adaptation at household level. The index approach in measuring households' resilience to floods and neighbourhood attachment using factor analysis captures a wide range of issues related to living with floods at local community level. The significant benefit of using the subjective wellbeing approach in measuring households' resilience to floods is that it reflects the true capacity of households to cope with natural hazards. Additionally, neighbourhood attachment is also a multiple concept in this context. The advantage of using the multiple item approach is that it can capture the wider dimensions of neighbourhood attachment in living and coping with floods. Factor analysis was found to be an appropriate approach for constructing indices of households' resilience as well as households' neighbourhood attachment in the MRD. The weighted approach in measuring social supportive networks addresses the importance of social networks in coping with floods. The IHHD index is more appropriate than a simple measure of income sources in measuring the diversity of livelihoods.

The total sample size adequately represents the information about the regional flood characteristics in the MRD. However, more males were in the sample than females

because in rural Vietnam, males are more likely to participate in social events at community level and often represent the households to discuss family issues. This may lead to gender bias in representing the perceptions of floods and their impacts on rural livelihoods as well as their perceptions of their capacities to live with floods. Only 14.6 percent of respondents were female. Interpretation of the results should thus be taken with caution in relation to gender representation. Additionally, the methodology for assessing the impacts of flood events relies heavily on self–reporting of positive and negative impacts and this may lead to biases. There may be a neutral impact which means neither negative nor positive, but the questions allow only negative or positive responses. However, through qualitative research, I identified that almost all respondents had negative or positive views about the impacts of flood events on their livelihoods. Furthermore, the flood event repeats every year, so they are more likely to remember the impacts and their self-reporting should be very reliable in this context.

The next chapter will give background information about the socio-economic conditions of the MRD, the floods and their impacts on rural livelihoods, and the socio-economic characteristics of the three study sites.

Chapter 3

The Mekong River Delta and the Floods

(Quê tôi nước mặn đồng chua, nữa năm nắng hạn, một mùa nước dâng)

My home is a place of salt water and acid fields.

For half of the year it is affected by drought,

and for the other the water is on the rise

(Miller 2003: 77)

3.1 Introduction

The Mekong River Delta is a rich agricultural zone located in the South of Vietnam. However, every year people in the delta have to face from four to six months of flooding in the wet season, and six months of drought and saline intrusion in the dry season. The impacts of the flood event vary among the different socio-economic groups. Some social groups are vulnerable to the presence of flooding, while others are more resilient to the flood events. The main objective of this chapter is to provide background information on the socio-economic conditions, the characteristics of floods in the MRD and their recorded impacts on rural communities of the MRD. Before moving into Chapter four, this chapter also provides details of the socio-economic and environmental background of the study sites. This chapter consists of eight sections. Section one is the introduction. Section two presents the geographical characteristics of the MRD. Section three discusses economic status of the MRD. Section four provides the flood characteristics of the region. Section five is the discussion of the impacts of flooding. Section six examines past and present 'living with flood policies' in the MRD. Section seven introduces the socio-economic and environmental conditions of three study sites. Section eight is the conclusion.

3.2 Geographical characteristics of the MRD

The Vietnamese Mekong River Delta is located in the south-western part of Vietnam. The delta consists of 4 million hectares (ha) of land, accounting for 12.3 per cent of Vietnam's total land area (Figure 3.1). The delta is divided into 13 provinces: Long An,

Tien Giang, Ben Tre, Vinh Long, Tra Vinh, An Giang, Dong Thap, Kien Giang, Can tho, Hau Giang, Soc Trang, Bac Lieu and Ca Mau. The average elevation of the delta is slightly (<2 m) above mean sea level (Võ Tòng Xuân and Matsui 1998).

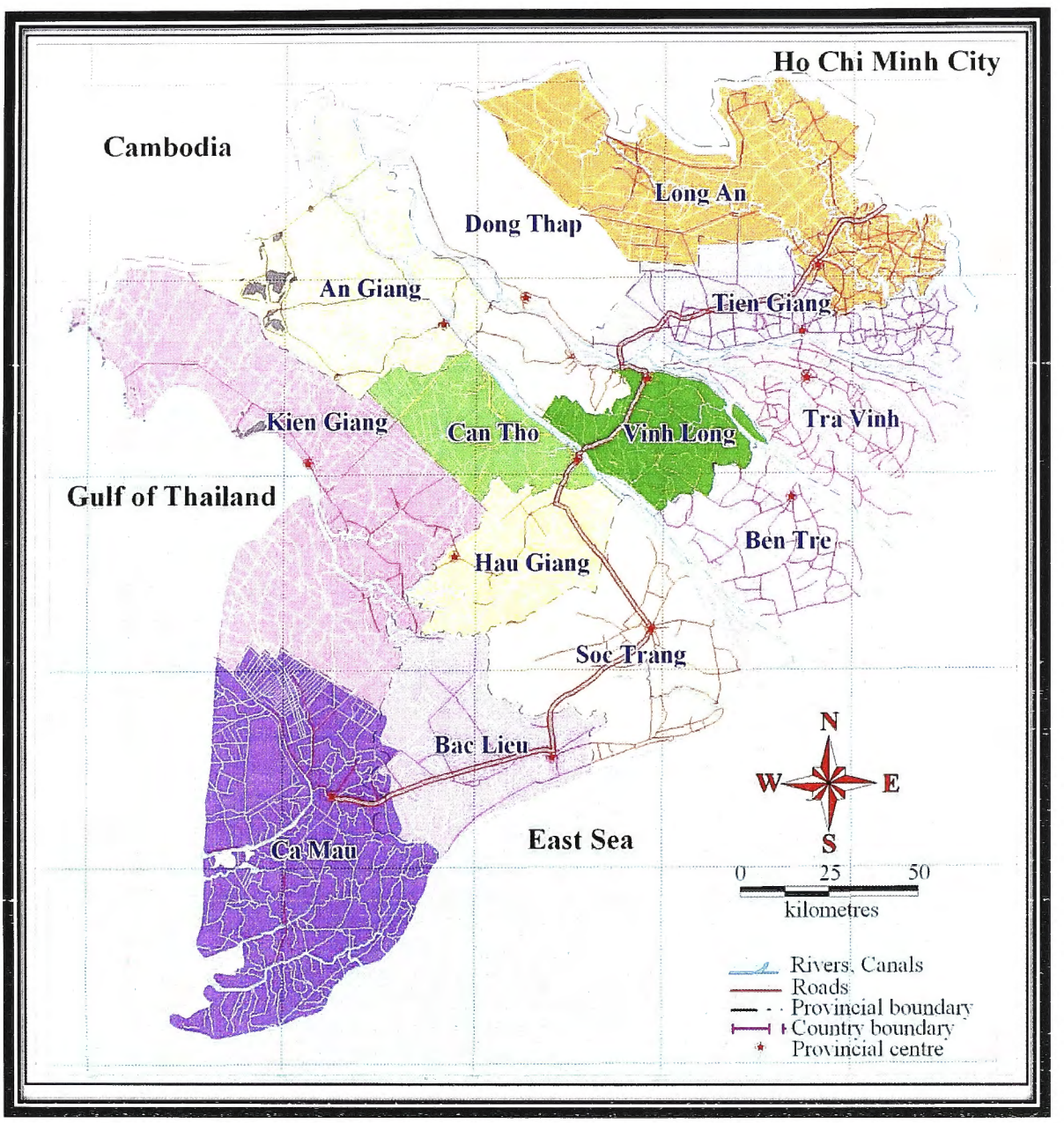

Figure 3. 1: Map of the Mekong River Delta

Source: Pham Van Quang (2012)

According to Võ Tòng Xuân and Matsui (1998) the soils of the delta can be grouped into three main types: alluvial, acid sulphate and saline (Figure 3.2). The alluvial soils are found along the Tien and Hau rivers (Trans-Bassac Depression) and account for 28.0 per cent of the delta (1,100,000 ha); this soil is very suitable for growing rice. The acid sulphate soils comprise the largest proportion of the delta (41.0 per cent), around 1,590,000 ha of which can be found in the back swamps of the floodplains, the Plain of

Reeds[17], the Long Xuyen-Ha Tien Quadrangle[18]. Saline soils are located along the coast, accounting for 21.0 per cent of the delta.

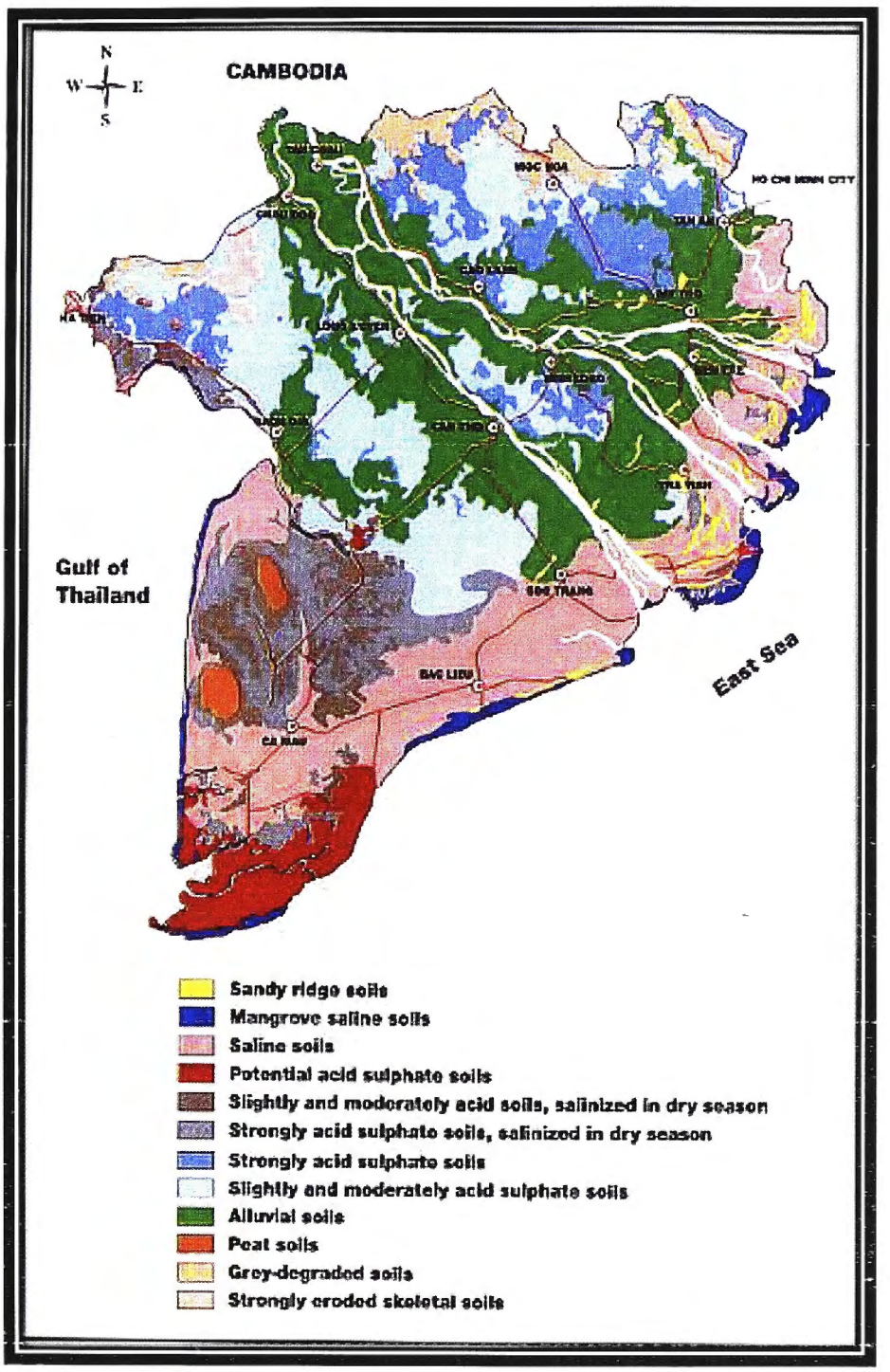

Figure 3. 2: Distribution of soil status in the MRD

Source: Võ Tòng Xuân and Matsui (1998)

[17] The Plain of Reeds is the most flood prone area. It is located in Dong Thap province of the Mekong River Delta and covers about 500,000 ha of natural land. It is the lowest zone of the delta (0.5 m below MSL). The key soil group of the Plain of Reeds is acid sulphate; rice is the main crop. Võ Tòng Xuân and Matsui, S., eds. (1998) *Development of farming systems in the Mekong Delta of Vietnam* Ho Chi Minh City: Ho Chi Minh City Publishing House.

[18]This zone covers an area of about 400,000 ha in the West of the Mekong River Delta, which is dominated by acid sulphate soils. See in

3.3 Economic conditions of the MRD

The delta plays an important economic role for Vietnam. Rice is the main agricultural crop, amounting to 18.1 million tonnes of paddy, providing 50.0 per cent of the total rice production of Vietnam (GSOV 2010a). Aquaculture is the second most important product in the Delta. Approximately 2.0 million tonnes of aquaculture products were produced in 2006 (GSOV 2006), of which shrimp production was estimated at 287.1 thousand tonnes (GSOV 2006). The Delta's annual economic growth was 12.2 per cent in 2010 (VCCI Can Tho nd). Currently, the MRD is the second most populated part of Vietnam with 17.2 million people living in the delta (Central Population and Housing Census Steering Committee 21 July 2010), of whom 8.5 million have settled in the flood areas (Nguyễn Hữu Ninh et al. 2007). Approximately 76.7 per cent of the population live in rural areas; the livelihoods of 77.0 per cent of the population are based on agriculture, aquaculture and forestry (AusAID and UNDP 2004, GSOV 2010b). In addition, 12.6 per cent of the population lives below the poverty line (GSOV 2010b).

3.4 Floods in the MRD

'Flood' in the Vietnamese Mekong Delta is defined as riverine flood, which is caused by upstream discharge, heavy rainfall in the Delta itself and variation in the tides of the East Sea and the Gulf of Thailand (Wassmann et al. 2004, Võ Tòng Xuân and Matsui 1998). Two main rivers, Tiền River or Mekong River, and Hậu River or Bassac River bring floodwaters from upstream Cambodia across the Vietnamese border to the delta (Can Tho University 1995: 102). Floods start in June, and gradually increase to reach a peak in August or September, and recede in November or December each year (Figure 3.3).

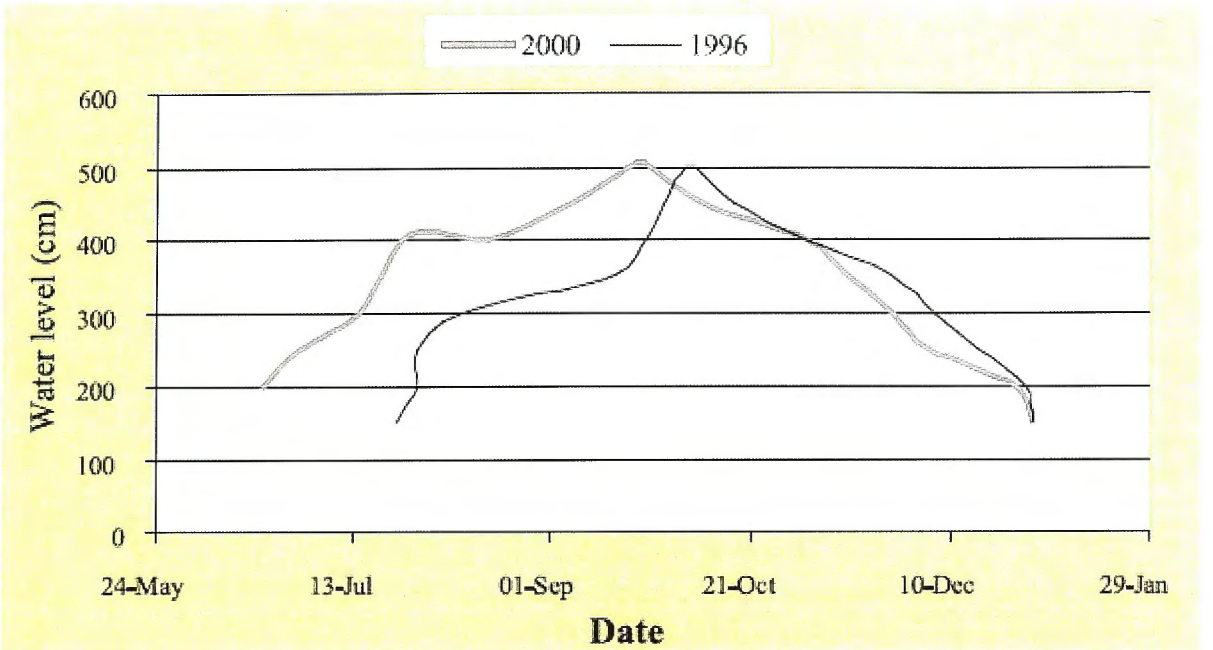

Figure 3. 3: Flood peaks at Tan Chau Gauging Station in 1996 and 2000

Source: Lê Anh Tuấn et al.(2007: 35)

Hydrologists classify floods into four warning levels (alarm levels I, II, III, and over III), based on information from the Tan Chau Gauging Station (Table 3.1). Alarm level I occurs if the flood level at Tan Chau is less than 3.0 metres (m) above mean sea level (MSL). If the flood level ranges from 3.0 m to less than 3.6 MSL, it qualifies as alarm level II. Alarm level III is achieved if the floodwaters reach over 3.6 m, but are less than 4.2 m. If the flood level exceeds 4.2 m, then over alarm level III, the most dangerous flood level, has been reached. Officially there are nine Hydraulic Gauging Stations across the delta, but the measure of flood peak in the MRD is based on the flood level at Tan Chau Gauging Station located in An Giang province (Lê Anh Tuấn et al. 2007).

Table 3. 1: Flood characteristics in the MRD

Levels	Gauging Stations		Description
	Tan Chau (Tiền River	Chau Doc (Hậu River)	
I	≤3.0	≤2.5	Possible flood conditions – river water level is high; threat to low height embankments; flooding of very low-lying areas; infrastructure safe.
II	≤3.6	≤3.0	Dangerous flood conditions: flood plain inundation expected; towns and cities still generally protected by flood defenses; high velocity of river flows pose danger of bank and dike erosion; bridge foundations at risk; infrastructure generally safe.
III	≤4.2	≤3.5	Very dangerous flood conditions – all low-lying areas submerged, including low-lying areas of cities and towns; safety of river protection (dikes) in jeopardy; damage to infrastructure begins.
Over III	≥4.2	≥3.5	Emergency flood conditions – general and widespread uncontrollable flooding; dike failure a certainty and probably uncontrollable; damage to infrastructure severe.

Source: Lê Anh Tuấn et al.(2007: 30)

The flood level is usually moderate. Small floods are rare, but big floods occur more often than small floods. The flooding of 1998 is thought to have been the smallest flood in the past 80 years (Figure 3.4). According to Nguyễn Như Khuệ (1995) a big flood occurs every five years. There were 11 big floods in the past 80 years which occurred in the years: 1937, 1961, 1966, 1978, 1984, 1994, 1995, 1996, 2000, 2001 and 2002 (Can Tho University 1995, Ministry of Agriculture and Rural Development (MARD) 2004). The floods have been more severe in the northern parts of the delta. The 1961 flood started in August, and peaked at 5.0 m in October. However, the 1966 flood started earlier than the 1961 flood (in July) with a peak similar to the 1961 flood peak. The 1978 flood was considered as one of the most dangerous events because it occurred early in July and lasted longer. There were two peak periods during this flood. First, the flood reached a peak (4.8 m) on 31st August, and achieved a second peak on 9th October (4.94 m). The 1978 flood was caused by heavy storms and heavy rains in the upstream part of the river. The 1984 flood reached its peak in September and lasted for three months. The 1991 flood came late in August and ended in late November. The 1994 flood was most severe because it came in early July and the peak flood lasted for 30 days. Additionally, the 1994 flood had two tidal peaks on 15th August and 15th September. The 1994 flood caused inundation in most of the Long Xuyen-Ha Tien Quadrangle and the Plain of Reeds region. At the other end of the scale, small floods

are rare. The flooding of 1998 is thought by local people to have been the smallest flood in the past 80 years. A small flood often does not cause damage to property, houses, crops and other livelihood activities and assets. However, a small flood affects rural livelihoods in different ways. Poor people are more likely to lose their income from fishing as they cannot catch much fish during the flood season. The flood depth of these flood events is illustrated in Figure 3.3.

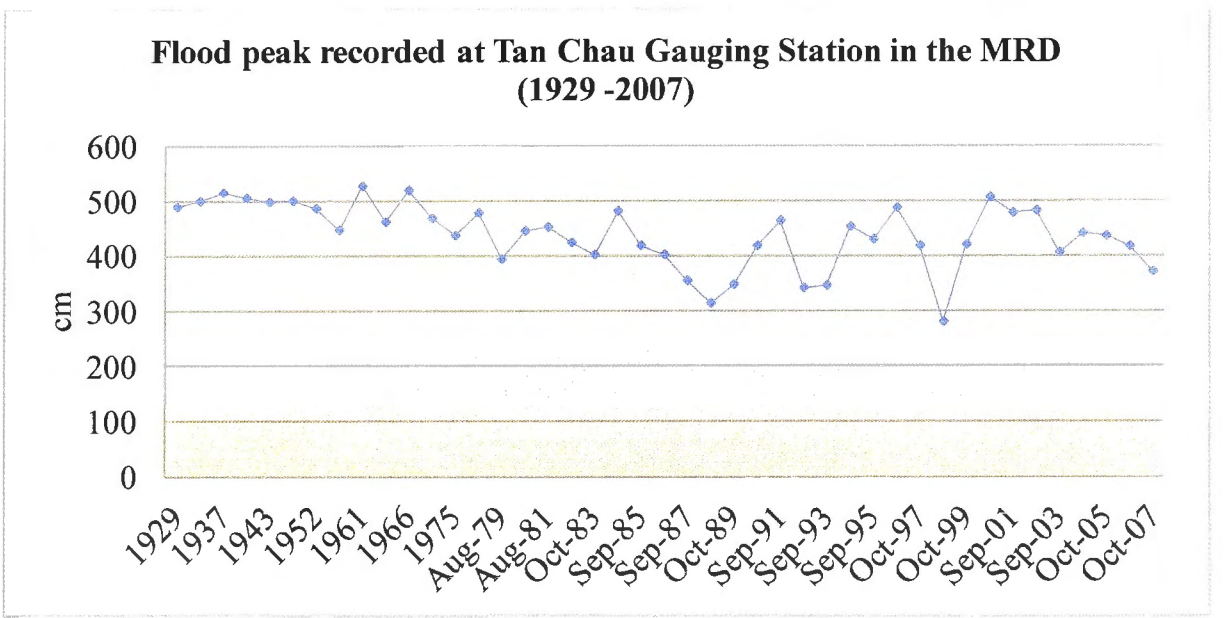

Figure 3. 4: Flood peak recorded at Tan Chau Gauging Station in the MRD (1929 - 2007)

Source: An Giang Department of Statistics (2009)and Lê Anh Tuấn et al. (2007)

From a hydraulic point of view, flooding in the MRD is categorized into three key zones (MRC 2005) (Figure 3.5). According to flood depth, the flood can be divided into three inundation zones: (1) deep inundation area (> 2 m), (2) average inundation area (1-2 m) and (3) low inundation area (<1 m). The provinces of Dong Thap, An Giang and Long An (the Vàm Cỏ River Basin) are classified as deep inundated provinces, while other provinces are considered as average or low inundated ones (Figure 3.5). Four major basins are subjected to annual monsoon floods from August to December: the Plain of Reeds, the Long Xuyen Quadrangle, the Trans-Bassac Depression and Ca Mau Peninsula (Biggs et al. 2009).

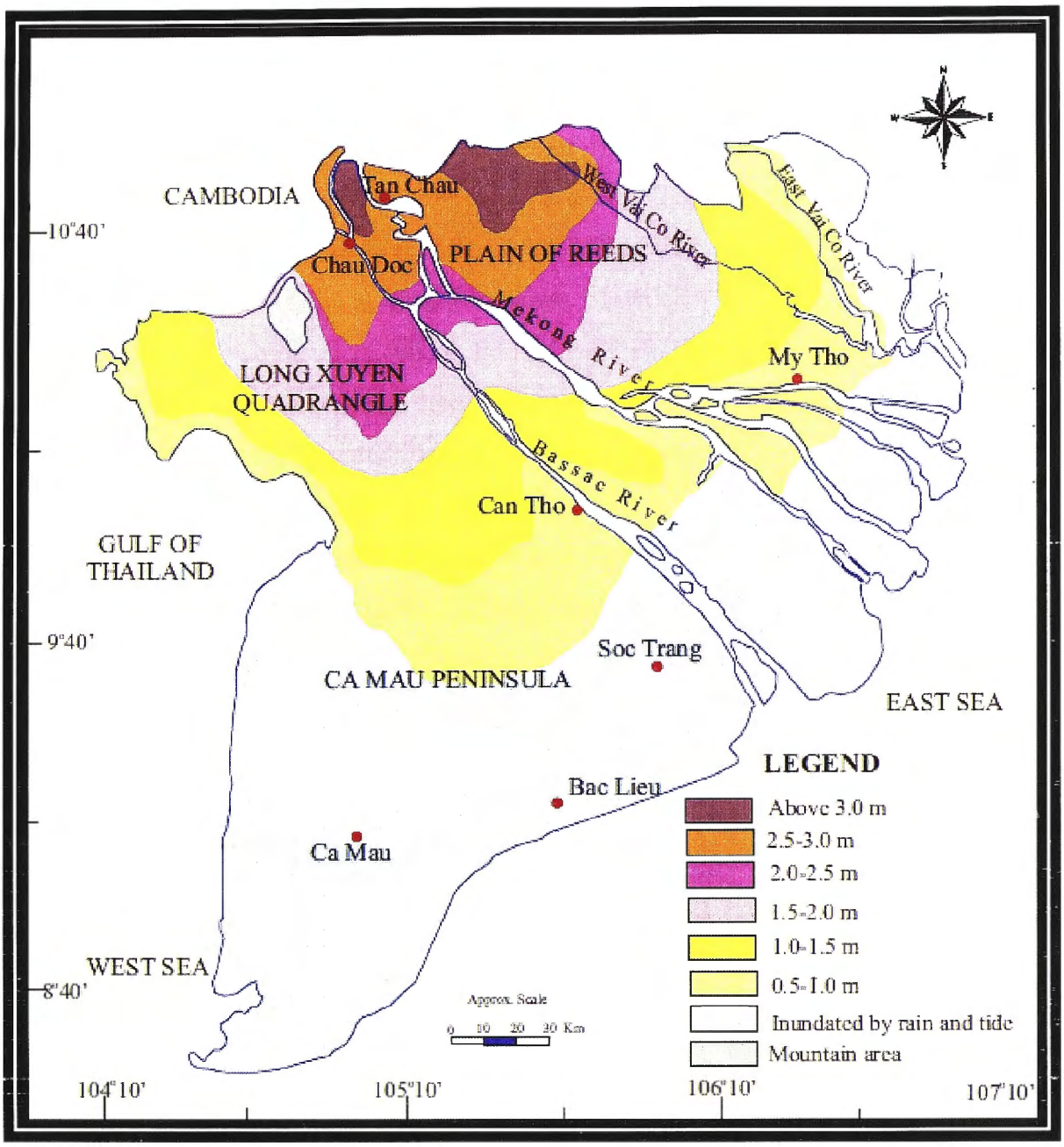

Figure 3. 5: Depth of the 2000 flood in the MRD

Source: Ghassemi and Brennan (2000)

3.5 Impacts of flooding on rural communities in the MRD

3.5.1 Costs of flooding in the MRD

Big floods bring costs to rural people (Table 3.2) and include damage to rice crops and houses, livestock and human losses, injuries, and water-borne diseases (Đào Công Tiến 2001b, Dương Văn Nhã 2006, Nguyen Van Kien 2006, Đặng Quang Tính and Phạm Thanh Hằng 2003, Few et al. 2005). The flood in 1994 killed 407 people and caused economic damage of around VND 2,284 million (Ministry of Agriculture and Rural Development (MARD) 2004). The flood in 1995 killed 199 people and caused economic losses of VND 700 billion. There were 217 deaths and property loss of VND

2,182 billion (USD 141 million) in the 1996 flood (Đào Công Tiến 2001a). The 1997 flood killed 607 people (most of them are children) and destroyed 173,606 houses (MRC 2005). The flood also caused the loss of 19,785 ha of rice, while 251,341 ha of rice were affected by decreased yields. It is estimated that the 1997 flood damage amounted to VND 6,996 billion (MRC 2005). The worst flood, in 2000, affected 11 million people living in 610 flooded communes, of which 4.5 million people lived in the 77 most affected sub-districts where flood levels exceeded 3 metres (Nguyễn Đình Huân et al. 2003). In addition, more than 800,000 houses were inundated, 50,000 households had to be evacuated, 500,000 households needed emergency support, and 800,000 high school students had to stop their studies in the 2000 flood (Đào Công Tiến 2001a: 3). About 46,402 ha of the rice crop was completely destroyed and an additional 197,652 ha of rice was inundated and so had to be harvested immediately (Đặng Quang Tính and Phạm Thanh Hằng 2003: 5). The 2000 flood killed 481 people (335 children). Total direct economic cost of the 2000 flood was estimated at VND 4,000 billion (Đào Công Tiến 2001b: 3).

Table 3. 2: Impacts of floods on people, housing and rice crops in the MRD

Year	Deaths	Child deaths	Rice area destroyed	Rice with reduced yield	Houses collapsed	Houses damaged
	People	People	ha	ha	Number	Number
1991	143.0		72,140	61,482	2,977	278,546
1992	N/A	N/A	N/A	N/A	N/A	N/A
1993	N/A	N/A	N/A	N/A	N/A	N/A
1994	407	265	26,865	202,186	2,807	779,119
1995	199	101	11,101	62,399	696	203,874
1996	217	166	60,368	132,309	42,358	836,773
1997	607	5	19,758	251,341	74,368	99,238
1998	N/A	N/A	N/A	N/A	N/A	N/A
1999	N/A	N/A	N/A	N/A	N/A	N/A
2000	481	335	46,402	197,652	4,093	891,406
2001	407	321	4,553	53,267	1,000	341,614
2002	170	151	335		960	286,660
2003	N/A	N/A	N/A	N/A	N/A	N/A
2004	38	34	N/A	115	193	690
2005	44	39	185	2,723	N/A	4,472

Source: Adapted from MRC (2005) and (Southern Institute of Water Resource Planning Management (SIWRPM) 2000)

The impact of flooding on human health is one of the critical issues in the flood-prone region. Deaths and injuries are reported to be the most common problems. Children are most prominent among the mortalities (Nguyễn Hữu Ninh et al. 2007, MRC 2005, Đặng Quang Tính and Phạm Thanh Hằng 2003, Few and Pham Gia Tran 2010).

3.5.2 Benefits of flooding in the MRD

Despite these inevitable costs, the floods in the Mekong Delta have also traditionally been known to bring benefits which contribute significantly to sustainable agriculture development in the region. First, the 'beautiful' floods provide natural fish, other aquatic animals and aquatic vegetables that improve local food security and livelihoods. It is estimated that the average fish capture in the Delta is about 500 kg per household per year, which provides a significant protein source for local people (Nguyen Van Trong and Le Thanh Binh 2004, Mekong River Commission (MRC) 2002). Second, floods deposit 150 million tonnes of sediment on paddy fields every flood season which are a natural fertilizer (Đào Công Tiến 2001b). This helps to replenish the soil and maintain soil fertility for rice cultivation. Evidence shows that after every flood season, local rice farmers not only gain higher yields, but also use less fertilizer because of the nutrient sediment (Đào Công Tiến 2001b). In addition to these direct benefits, floods have important biological functions; for example, floods help to recharge groundwater, clean farm residuals, maintain biodiversity, improve the navigation transport, flush contaminated water caused by sulphate soils, and transport salted water towards the South China Sea (Cuny 1991, Nguyễn Hữu Ninh et al. 2007). Farmers have recently developed flood-based farming practices using floodwaters as resources for farming development (Nguyen Van Kien 2008). The benefits of floods for growing vegetables and raising prawns can be seen in Figure 3.6.

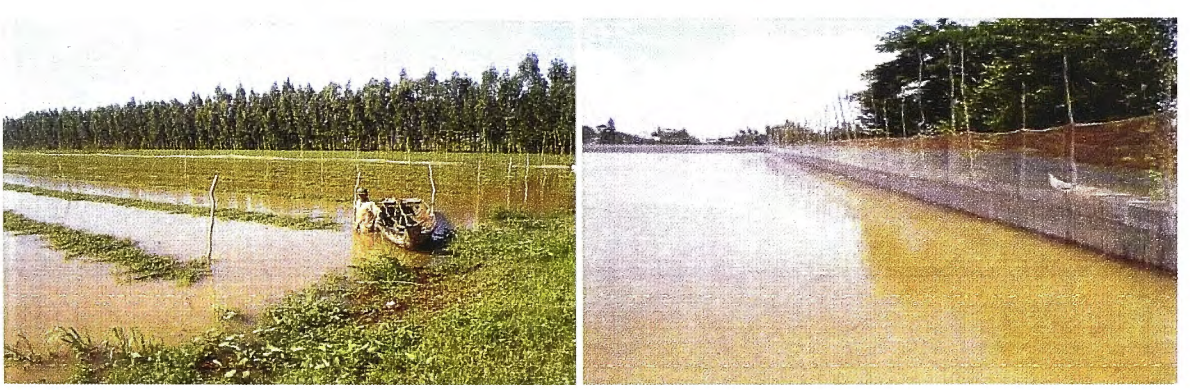

Figure 3. 6: Neptunia prostrate (left) and prawn (right) farming during the flood season in Thanh My Tay commune, Chau Phu district, An Giang province

Source: Photo by Nguyen Van Kien (2010)

3.5.3 Potential impacts of flooding due to projected climate change in the MRD

There is evidence that sea level rise caused by climate change will add a new risk of flooding in the MRD which will affect the livelihoods of millions of people (Eastham et al. 2008, Wassmann et al. 2004, Dasgupta et al. 2007, Phạm Thị Thúy Hạnh and Furukawa 2007). With 700 km of coastline, the MRD will be highly vulnerable to sea level rise due to climate change. Wassmann et al. (2004) estimated that 2.3 million ha (60.0 per cent of the MRD) was highly vulnerable, while between 0.6 million ha (15.0 per cent) and 1.0 million ha (25.0 per cent) experienced medium to low vulnerability due to sea level rise. The Asian Development Bank (ADB) (1994) cited in (Phạm Thị Thúy Hạnh and Furukawa 2007) concluded that 1.5 to 2 million ha in the MRD would be at higher risk of high tidal threat. About 35 per cent of the GDP will disappear because of sea level rise. Wassmann et al. (2004) concluded that these adverse impacts could affect all three rice cropping seasons in the delta. It is predicted that if sea level rises up to 1.0 m, about 10.5 per cent of Vietnam's population or about 20 million people will be displaced (Dasgupta et al. 2007). The sea level has actually risen by 20 cm in the past 50 years and is expected to increase 75 cm by the end of the 21st century in Vietnam's Mekong Delta (Ministry of Natural Resources and Environment 2009). The majority of the affected population lives in the MRD and the Red River Delta. The livelihoods of the rural people will be negatively impacted, if no adaptation measures are undertaken. As a result, the regional economy will be under threat.

3.6 Policies of 'living with floods' in the MRD: past and present

The 'living with floods policy' can be divided into four periods which can be characterized from total adaptation to total control. Before the 19th century, people were more adapted to floods. The delta was covered by wild dense *Melaleuca* forest *(rừng tràm)* and population density was very low (10-20 people per square km). Vietnamese and Chinese people first migrated to the Mekong Delta from Biên Hòa in the 1600s (Biggs 2003: 79). In this period, migrants settled on high ground along canals and creeks, and built houses on stilts. Local livelihoods totally relied on harvesting wild floating rice *(lúa ma hay lúa trời)* and fish in the flood plain (Võ Tòng Xuân and Matsui 1998: 36, Nguyễn Hữu Chiếm 1994: 345). Rice paddy expanded along rivers or creeks during 17th and 18th centuries. In the second period, during the 19th century under the Nguyen dynasty or pre-colonial period (1705 - 1858), three main canals were dug to serve national defense, resettlement, and rice cultivation (Võ Tòng Xuân and Matsui 1998: 33). In 1876, the Bao Dinh canal was dug to connect Vam Co River to the My

Tho River. The Thoai Ngoc Hau canal linked Long Xuyen to Rach Gia (gulf of Thailand). The Vinh Te canal was dug from 1814 to 1824 to connect Chau Doc to Ha Tien. Low yield floating rice was mostly grown in the deep flood areas in the Plain of Reeds and Long Xuyen Quadrangle. Until 1900, local people seasonally inhabited the floodplain to harvest floating rice, fish and to hunt (Biggs 2003: 81).

During the colonial period (1858–1945), the French controlled the delta. The steam-power dredge was introduced in 1880s which speeded up the excavation and reclamation processes. In particular, the dredge moved 165,000 cubic metres of earth from 1890 to 1930 (Biggs et al. 2009: 207). The French colonial government established many enclosed resettlements called "*casiers*" (French for compartment). The canal and '*casier*' development led to a rapid population growth, from 500,000 in 1860 to 4.0 million in 1930 (Biggs et al. 2009: 207). The dredged canals provided an opportunity for increasing the cultivated area from 200,000 hectares (ha) in 1879 to 2.4 million ha in 1929 (Biggs 2003: 79). During this period, floating rice[19] *(lúa nổi)* was still grown in the deep flood areas of Long Xuyen Quadrangle and the Plain of Reeds (Nguyễn Hữu Chiếm 1994: 345). Farmers did not need to apply fertilizers to rice fields thanks to the alluvium that fills up paddy fields every year (Nguyễn Khắc Viên 1985). In the high flood region, a garden is watered and fertilized every day by the semi tides from rivers, where the owners can catch fish and shrimps brought in by the Mekong water. In the low flood plain, where hundreds of thousands of hectares are submerged by Mekong floods up to the depth of two to three metres, people used to sow floating rice.

The canals were rapidly developed in the MRD for land reclamation during 1945 (after the French War) and 1975 (during the American War). Many canals were dug to develop new settlements in the flood plain. At least 17 new canals were dug during this period. These include (1) Cho Gao canal; (2) Saintard canal; (3) Xa No canal; (4) Lai Hieu canal; (5) Thot Not – Thi Doi canal; (6) Thoi Lai canal; (7) O Mon canal; (8) Bac

[19] Floating rice can elongate its culm rapidly when the water level rises during flooding. Floating rice grows as quickly as the water rises, sometimes up to 10 centimetres within 24 hours. Rice is broadcast in April when the first rain falls. Farmers use water buffaloes to harrow the soil in order to cover the seeds to prevent bird and mice damage and to guarantee good soil moisture for seed germination. During the flood, rice plants elongate when the water rises. When the flood waters recede in November, the rice plants fall on the ground and flower. Rice is harvested by sickle between December and January Nguyễn Hữu Chiếm (1994) 'Former and present cropping patterns in the Mekong Delta ', *Southeast Asian Studies* 31(4), 345-384.. See also Võ Tòng Xuân and Matsui, S., eds. (1998) *Development of farming systems in the Mekong Delta of Vietnam* Ho Chi Minh City: Ho Chi Minh City Publishing House.

Lieu – Ca Mau canal; (9) Rach Soi – Vam Cong canal; (10) Tron canal; (11) Quang Lo Phung Hiep canal; (12) Ngan Dua canal; (13) Phuoc Long canal; (14) Chac Bang – Song Trẹm canal; (15) Pho Sinh – Gia Rai canal: (16) Huyen Su - Ho Phong canal; and (17) Thap Muoi canal (Figure 3.7).

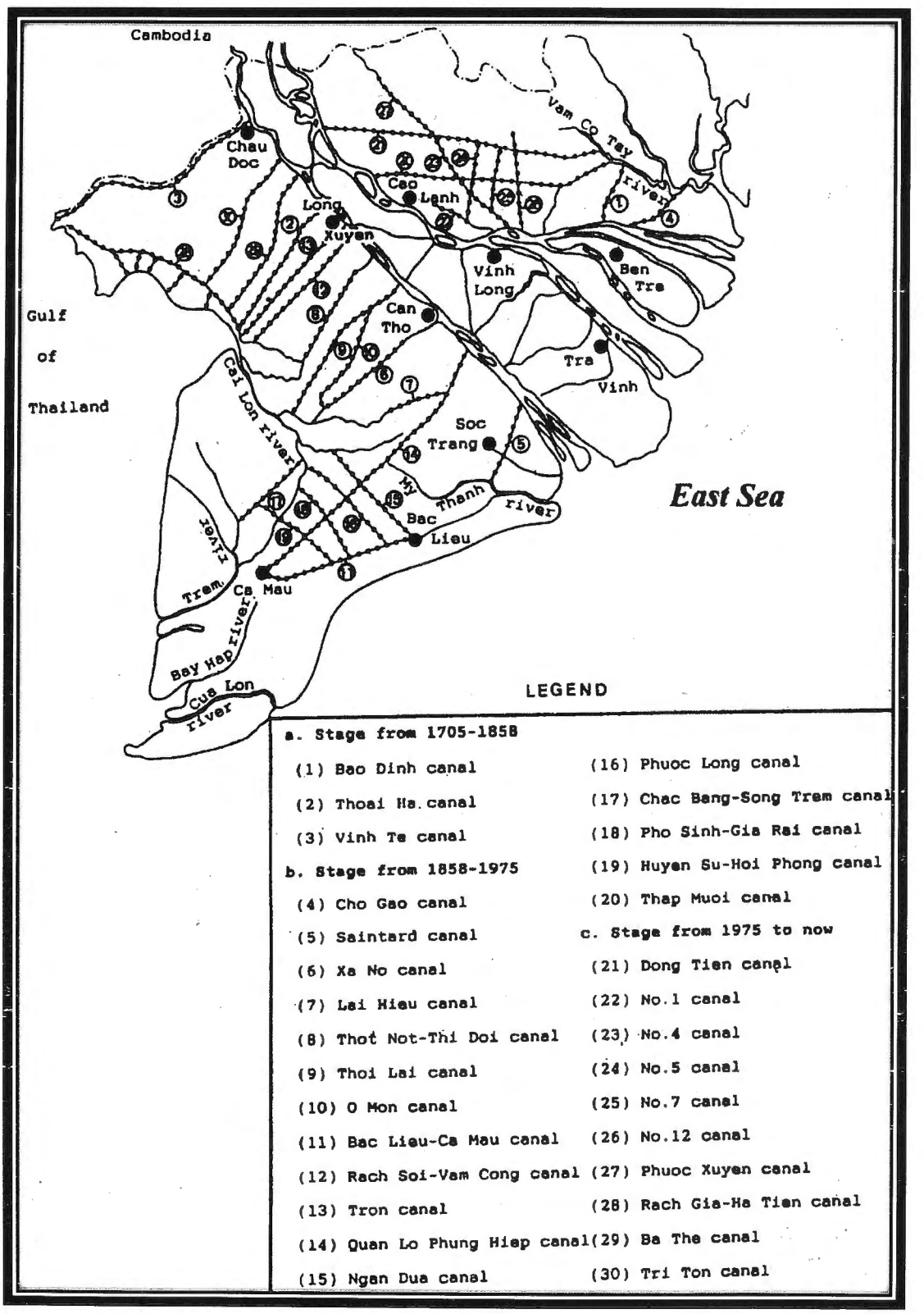

Figure 3. 7: Map of canal excavation in the Mekong River Delta, 1705 - present

Source: Võ Tòng Xuân and Matsui (1998)

The structural measures for coping with floods such as dikes and canals were accelerated after 1975. In particular, the flood in 1978 killed more than 700 people and the floating rice crop was destroyed; this was the starting point for the flood control ideology in the MRD (Biggs 2003: 210). Importantly, the Vietnamese government commenced a 'rice everywhere' policy to cope with food insecurity during the 1980s. This policy required that more canals for irrigation be dug as well as draining acid sulphate from the soils for rice farming in the Long Xuyen Quadrangle and the Plain of Reeds in early 1990. A series of canals was dug including (1) Dong Tien canal; (2) No. 1 Canal; (3) No. 2 canal: (3) No. 4 canal; (4) No. 5 canal; (5) No. 7 canal: (8) No. 12 canal; (9) Phuoc Xuyen canal: (10) Rach Gia-Ha Tien canal: (11) Ba The canal; and (12) Tri Ton canal. In addition, thousands of small canals were dug to serve irrigation for rice crops and to protect the rice crop from being damaged by flooding in August, called 'August Dikes'[20] *(đê bao chống lũ tháng tám)* (Trương Thành Hối 2006). Significantly, the Doi Moi policy reforms from collectivization to privatization of agriculture in 1986 increased rice production considerably. Land reclamation for rice production was accelerated during the 1990s in the Plain of Reeds and Long Xuyen Quadrangle. As a result, the area of floating rice was reduced dramatically in An Giang province, from 250,000 ha to 18,000 ha, while the area of irrigated rice rose significantly from 35,000 in 1975 to 175,000 ha in 1994 (Karonen 2008, Võ Tòng Xuân and Matsui 1998).

3.6.1 Housing and 'living with floods' policy in the MRD

Housing has become more vulnerable to floods due to the movement of people towards the flood plain onto the new artificial canals. The pioneer Vietnamese founded settlements in places suitable for rice production (Võ Tòng Xuân and Matsui 1998). The population usually settled along rivers, levees and canals, creating a water-river civilization (Lê Anh Tuấn et al. 2007: 22, Nguyễn Khắc Viên 1985: 338-387). When canals are excavated, people start to settle on the canal banks resulting in housing development growing along the canals. As rural populations grew very quickly, these areas become populated. When the population grew quickly, they were more likely to settle in the high flood zone which was exposed to flooding (Figure 3.8).

[20] 'August Dikes' were designed to protect the summer-rice crop from flooding in August each year.

Figure 3. 8: Houses located on the internal canal [level 2][21] in Phu Xuan hamlet, Phu Duc commune, Tam Nong district, Dong Thap province which is exposed to flooding

Source: Photo by Nguyen Van Kien (2010)

However, the "August dike" schemes did not work adequately to cope with the big flood events in 1994 and 1996. Recorded data shows that hundreds of thousands of hectares of the summer-autumn rice crops were destroyed by these floods; thousands of houses were destroyed, and hundreds of people were killed in the 1994, 1996, and 2000 floods (MRC 2005). This new challenge required new strategies for coping with floods. The idea of high dikes that were strengthened initially to protect rice crop and properties was developed by farmers in Kien An commune, Cho Moi district of An Giang province (Dương Văn Nhã 2006). Notably, the government issued Decision No 99/1996 TTg to invest dikes/residential clusters in the MRD (Thủ Tướng Chính Phủ (Prime Minister) 1996). As a result, 12,000 km of high dikes were constructed which formed 1,200 dike compartments in the frequently flooded provinces (Thanh Nien Online 2008) (Figure 3.9). In An Giang province, 526 dike compartments have been built up to 2009, of which, 111,176 ha were covered by the August dikes, and 87,907 ha were built by the high dikes (An Giang Department of Agriculture and Rural Development 2009). Together with dike development, 742 residential clusters were established in the flood prone provinces to relocate vulnerable populations to the new settlements (Văn Phòng Chính Phủ (Government Office) 01/10/2008).

[21] A small canal was dug for irrigating paddy fields.

Figure 3. 9: High dikes (left) and houses in residential clusters (right) in the MRD

Source: Photo by Nguyen Van Kien (2011)

For many decades, the 'living with floods' polices have concentrated on structural measures, while non-structural approaches for coping with floods have been neglected. Flood warning, mobile kindergartens, flood safety training and mobile rescue teams have recently been documented as non-structural approaches for living with floods. In 2001, the provincial government in the MRD undertook a program to provide social supports for poor families. Several mobile kindergartens have been established for taking care of children, enabling working parents to earn a living during floods (Đặng Quang Tính and Phạm Thanh Hằng 2003: 5). The funding was provided by provincial authorities, international donors and women's associations. Besides this, international donors also provided support for training in swimming skills for children. Significantly, local authorities have also established mobile rescue teams *(đội xung kích, cứu hộ cứu nạn)* to provide emergency support for victims of floods.

3.7 Background of the three study sites in the MRD

3.7.1 Phu Duc commune of Tam Nong district, Dong Thap province

Phu Duc commune is located in the highest flood-prone area in Tam Nong district of Đong Thap province (in the Plain of Reeds) (Figure 3.10). The Phu Duc has 5,170 ha of natural lands (Phu Duc People's Committee 2009), of which there are 3,797 ha of agricultural land and 1.056 ha of *Melaleuca* forest located in the Tram Chim National Park. There are about 1,586 households (6,940 people) residing in three hamlets: K-8, K-9 and Phu Xuan. The majority of the population belongs to Hoa Hao Buddhism, followed by Buddhism; very few people are Catholics.

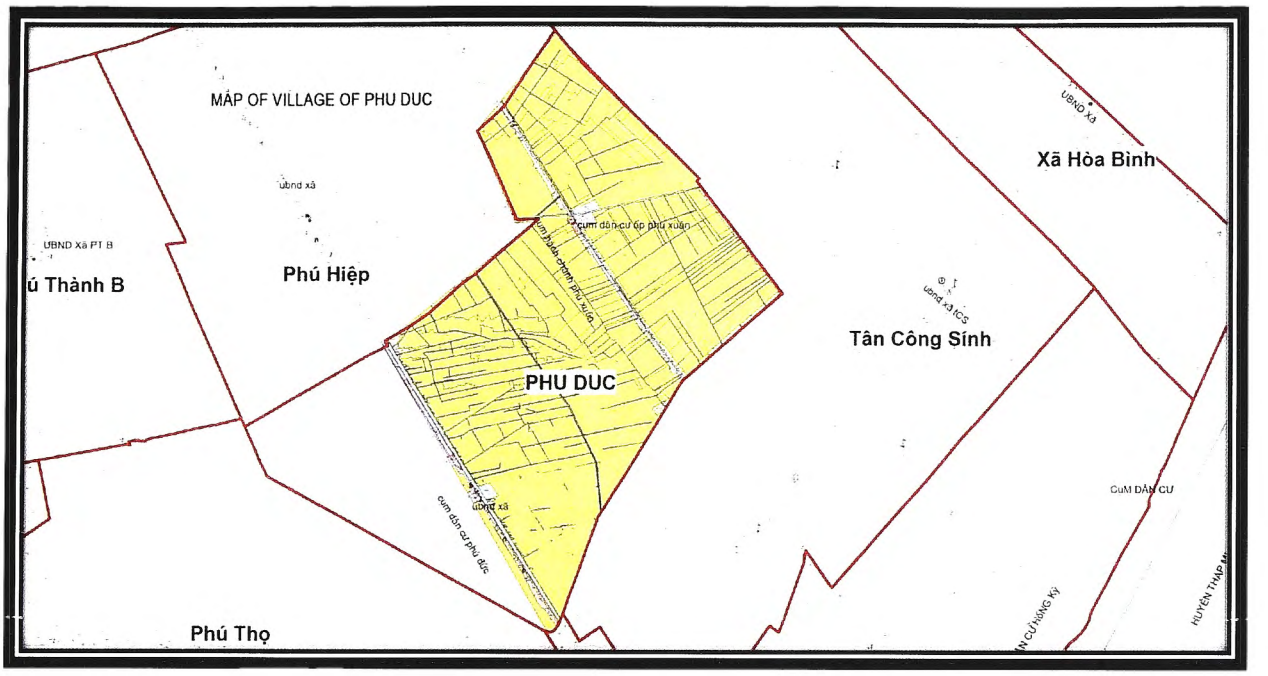

Figure 3. 10: Location of the Phu Duc commune, Tam Nong district, Dong Thap province

Source: Pham Duy Tien (2012)

During the colonial period, this vast area was covered by *Melaleuca* forest. Very few inhabitants lived on the scattered naturally high ground. During the post-colonial period, the Ngo Dinh Diem government dug the Gò Gia canal to create some residential areas and sent Northern migrants to the commune during the 1960s [in-depth interview with Mr Bong, a leader of K9 hamlet, Phu Duc commune, on 15th Sep 2010]. The dredge excavated mud to set up several settlement areas for the migrants. At this time, there was no concrete road for local transportation, so people primarily travelled by boat. Very few settlers lived here at this time. The commune's population increased rapidly after 1978 (during the South-West War), when many Vietnamese refugees returned from Cambodia to settle in Phu Duc commune.

The annual flood starts to overwhelm the surface of rice fields in the Phu Duc commune in June, gradually rising to reach its peak in September and gradually receding in November. The flood peak varies from 2.5 to over 4.0 m above the rice fields in the moderate or big flood years. The flood peak period often stays from 20 to 30 days. In the small flood years, the flood peak reaches only 1.5 m above the rice field surface.

The distribution of infrastructure is unequal among the three hamlets. A provincial dirt road (the 843 Road), was upgraded to a concrete surface *(đường nhựa)* in 2004 to link the K8 and K9 hamlets with the district town (Tam Nong town) (Figure 3.9). The road

design is 8 m wide, and 0.5 m above the highest flood level, in 2000. Respondents in FGDs and hamlet leaders assert that this road could cope well (protect from high waves and winds) with high water events such as the 2000 flood, but they are not sure what might happen during future severe floods in the context of climate change. On the other hand, the Phu Xuan hamlet is isolated in the remote and deep flood-prone area where there are about 760 households residing [in-depth interview with Mr Sy on 15th September 2010]. At present, a small dirt road is the major means of local transportation from the hamlet to other neighbouring hamlets and other communes. To access the Phu Xuan hamlet, local residents have to cross the Go Gia canal (about 30 m wide) by a small ferry and take a motorbike into the village in the dry season. However, it is difficult to travel by motorbike in the wet season, so water transportation by a tiny motor boat is the most common way for local residents in the Phu Xuan hamlet to access the outside world.

Schools, local temples and roads are utilized as shelters for temporary evacuation during extreme flood events. The commune has five schools, one Hoa Hao Buddhism temple and two pagodas. As reported by Mr Bong, leader of K9 hamlet, most people whose houses were submerged and destroyed by the floods in 2000, 2001 and 2002 were evacuated to those schools and pagodas as temporary shelter [in-depth interview on 15th September 2010]. Buffaloes, cows, chickens and property were moved onto the national 843 road which the flood had not submerged.

Flood impacts on housing vary in the different locations in the three hamlets. In K8 and K9, most households reside along both sides of provincial 843 Road. However, most poor households are situated on the river-side of the road, which is subject to strong waves from the water season each year, while better-off families have built their houses on the inner side of the road (not the river-side). They are less likely to be affected by strong winds and high waves during the months of flooding because there is a *Melaleuca* forest to reduce the force of giant waves from the floods. Moreover, most poor families construct a tiny house on temporary wooden stilts (From *Eucalyptus* trees or *Melaleuca* trees) which are more likely to be swept away or moved by high waves due to flooding (Figure 3.11). On the other hand, better-off households often construct their houses on concrete or rock stilts or on the high artificial mud ground and are less likely to be swept away by strong winds or giant flood waves.

Figure 3. 11: Houses of the poor (left) and of the better-off households (right)

Source: Photo by Nguyen Van Kien (2010)

In coping with the flood disaster in the year 1997 and 2000, the local authorities implemented a 'residential clusters project' which aimed to relocate most vulnerable households[22] to the new residential clusters. At present, there are two residential clusters in the commune to which at least 328 households were relocated. One cluster is built in the K9 hamlet (178 households) and one is located in Phu Xuan hamlet (150 households).

The key livelihood activities of people in the commune are on-farm, off-farm, and seasonal non-farm migration. The primary household income source is from rice production (70.0 per cent of rice farmer households in the commune), while the remaining population rely on off-farm agricultural wage labour, off-farm fishing and remittances from non-farm workers in HCM city. Interestingly, rice farmers also engage in fishing for their own subsistence during the flood season. Some 30.0 per cent of households are landless, but about 10.0 per cent of households own a lot of land. The landless people often lack the natural (agricultural land) and financial resources for coping with natural hazards.

Local industry is still weak and fragile; it does not provide sufficient jobs for local poor labourers. In particular, there are only two mini rice mills in the commune and 13 private flatbed rice dryers (a family-based business). There are two small handicraft clubs including candle making *(làm nhan)* and water hyacinth *(lụt bình)* making in the K8 hamlet. The handicraft clubs support permanent jobs for about 40 women in the

[22] According to local authorities of Phu Duc commune, a vulnerable household is defined as a poor household which is landless or residing in the interior rice fields *(vùng nội đồng dễ bị ảnh hưởng bởi lũ)* [in-depth interview with Mr Bong, Mr Anh, and Mr Sy, hamlet leaders of K9, K8 and Phu Xuan, on 15th September 2010].

commune. Importantly, seasonal migration is an emerging livelihood strategy for the poor families in this commune. During the flood, most young labourers from landless and moderately wealthy families migrate to HCM city or other non-flood areas to seek temporary jobs to maintain their income and expenditure. According to the communal government, at least 1,038 young labourers migrated to HCM city for working in the non-farm sector as construction workers in 2008 [in-depth interview with Mr Binh, a leader of Farmers' Association, Phu Duc commune on 20th September 2010]. Recently, during flood year 2010, nearly 100 households closed up their houses in the Phu Xuan hamlet to go to Binh Duong[23] province to seek jobs for temporary survival during the flood season. Services are still under-developed. There are only three agricultural machinery repair shops, nine agricultural services, one pharmacy shop and one gas station.

3.7.2 Thanh My Tay commune, Chau Phu district, An Giang province

Thanh My Tay is located in the moderate flood zone of Long Xuyen Quadrangle, which is situated in Chau Phu district of An Giang province. The commune has a total of 3,656 ha of land, of which 2,889 ha are agricultural land, and the remaining land is used for other purposes (rivers, canals, residential and public land). The commune is divided into eight hamlets: Thanh Hoa, My Binh, Tay An, Bo Dau, Long Chau, Ba Xua, Cau Day, and Thanh Phu (Figure 3.12). There are 23,271 inhabitants distributed in 5,141 households (Thanh My Tay People's Committee 2009). Population density is relatively higher than that of the Phu Duc commune (637 people per km^2 compared to 212 people per km^2). Of those households, there are 475 poor households with a 'poor certificate'[24] (9.5 per cent of the total households in the commune). There are 14,505 people in the active labour force in the commune, of which 55.0 per cent are male and 45.0 per cent are female. Most people belong to the Kinh ethnic group (4,877 households) with the exception of one Vietnamese-Chinese family. The majority of the population belong to Hoa Hao Buddhism (81.0 per cent), followed by Buddhist (18.0 per cent), Catholics (only three households), Cao Dai (five households), Islam (one household) and others (seven households).

[23] Binh Duong is an industrial zone where most migrants from the Mekong River Delta go to seek non-farm jobs.

[24] If an average household member has income less than VND 250,000 per month, the household is given a 'poor certificate'. Poor households with a certificate can access public welfare assistance from the government such as no school fees for children [in-depth interviews with leaders of Trung An, Thanh My Tay and Phu Duc communes, from 15th to 20th October 2010].

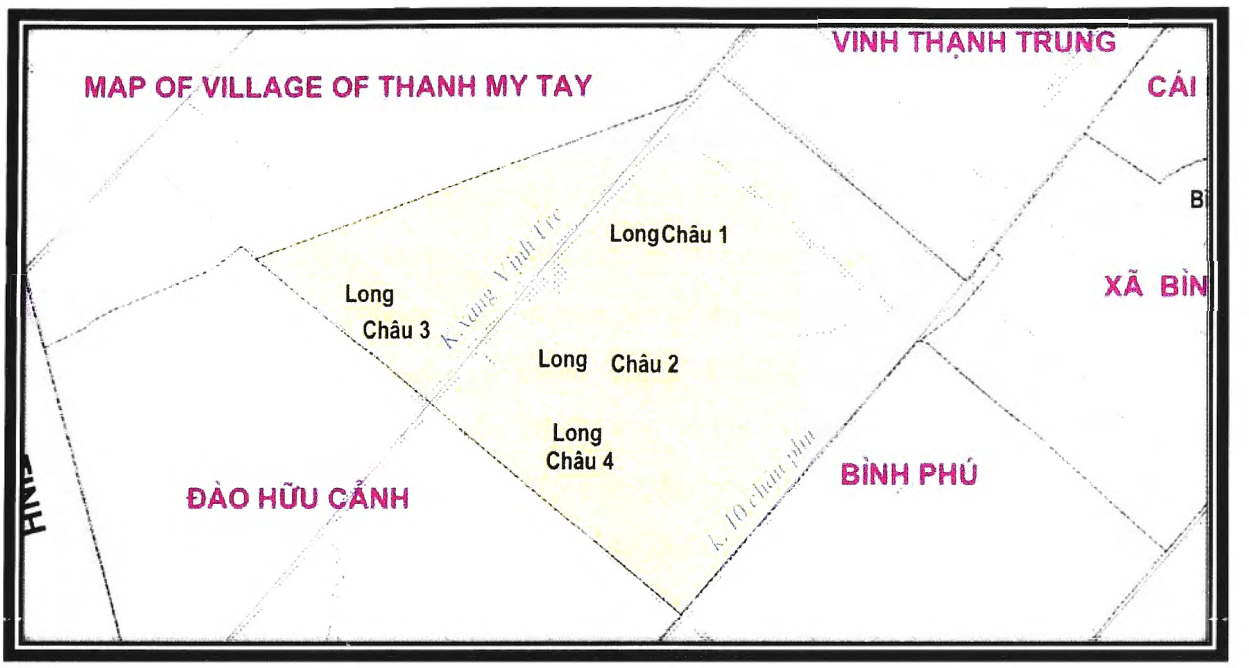

Figure 3. 12: Map of Thanh My Tay commune (yellow area), Chau Phu district, An Giang province

Source: Pham Duy Tien (2012)

The proportion of households accessing permanent housing, clean water and septic toilets is relatively low in the commune. Only 181 households (5.6 per cent) have permanent concrete houses, while the majority of the population live in semi-permanent houses (65.4 per cent), followed by temporary houses (26.6 per cent) and houses with a permanent timber skeleton with a brick or tin roof or thatched roof (4.2 per cent) (Chau Phu Bureau of Statistics 2009). Similar to the Phu Duc commune, most houses are traditionally built on stilts with the exception of several new houses which have been constructed in the high mud ground above the highest flood level of 2000. Importantly, only 32.5 per cent and 29.4 per cent of households can access clean pipe water and septic toilets, respectively.

The natural flood starts to submerge the paddy fields in early June, gradually rising to reach a peak (2.5-3.0 m) at the end of August or early September, and naturally recedes in November each year. Compared to the Phu Duc commune, the depth of flood at its peak is relatively lower. The flood peak often stays one month and varies according to the low, moderate or high water season. According to local respondents [FGD_TMT01 on 7th January 2010] and local authorities, the flood peak is relatively high in some extreme events such as the floods in 1978 and 2000, 2001, 2002 but others are moderate or low. For example, the flood peak reached up to 2.5 m above the rice fields in 2000 while it was about 2.0 m in 2009.

The income sources of local residents in this commune consist of agriculture, off-farm, commercial, small industry and services. However, agricultural households comprise the highest proportion (73.9 per cent of total households), followed by commercial (12.1 per cent), small industry (4.7 per cent), services (3.6 per cent) and others (Chau Phu Bureau of Statistics 2009). In agriculture, rice crops provide the main income source of the local population, followed by remittances from seasonal migration, flood-based vegetables (*Neptunia prostrate*) *(rau nhút)*, and off-farm activities (fish capture, vegetables and snail collection). In 2008, 416 households were engaged in farming during the water season, of which, 125 households cultivate *Neptunia prostrate*, 16 households grow *Sesbania sesban (bông điên điển)*[25], *Nymphaea (bông súng)*, and 56 households collect golden snails (Figure 3.13). Those flood-based livelihood activities created 1,000 jobs and the average income per capita was from VND 25,000.0 to 40,000.0 per day [in-depth interview with Mr Ngoc, a leader of Farmers' Association of Thanh My Tay commune, on 25th September 2010]. As reported by the president of the commune, there were 5,000 seasonal out-migrants from the commune to HCM city for work in non-farm sectors in 2009.

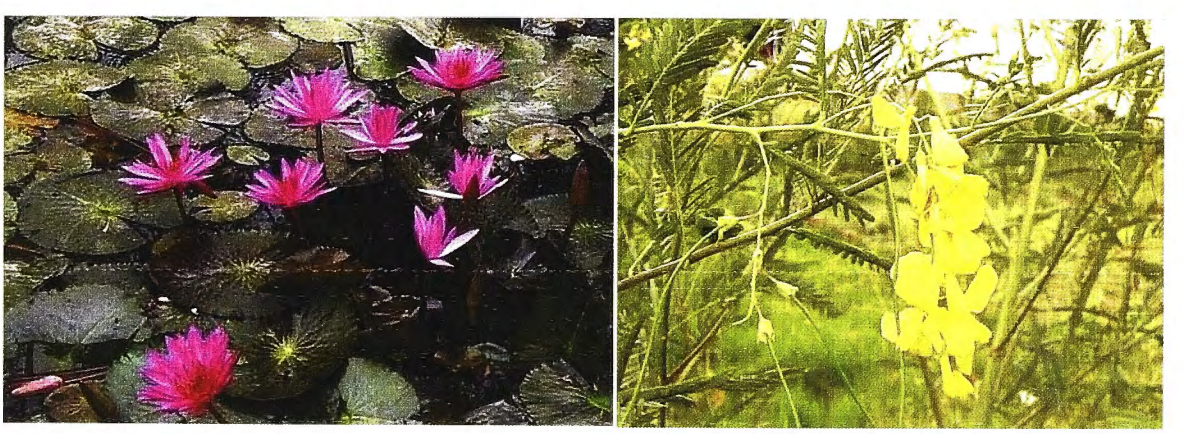

Figure 3. 13: Wild vegetables collected in the floodplain during the flood season: Nymphaea (water lily roots) (left) and Sesbania sesban (right)

Source: Photo by Nguyen Van Kien (2010)

The commune has several high polders that allow farmers to produce from two to three rice crops each year. According to the local government, the communal strategy for coping with the annual flood is to raise the existing August dikes into high polders to produce three rice crops per year and intensify agricultural activities in 2010. However, local people are more likely to retain the floodwaters, and just grow two rice crops each

[25] Wild flowers grow naturally in the flood plain. Poor people collect them during the flood season to sell at the local market to augment household income.

year [FGD_TMT02 on 8th January 2010]. Alternatively, the commune has established several residential clusters to relocate most poor and landless households into the new clusters as permanent shelters for coping with the floods.

3.7.3 Trung An Commune of Co Đo district, Can Tho City

Trung An commune is located in low naturally flooded areas in Co Do district of Can Tho City (Figure 3.7). The commune has a total of 1,197.0 ha of natural land, of which there are 957.6 ha of rice land, 80.2 ha of long-term trees and 18.3 ha of aquaculture land surface. The commune is divided into five hamlets: Thanh Loc 1 (239.8 ha), Thanh Loc 2 (238.4 ha), Thanh Loi (161.0 ha), Thanh Loi 1 (292.1 ha), Thanh Loi 2 (117.2 ha). Residing within the commune, there are 2,362 households, of which there are 119 poor households which have the 'poor certificate' (5.0 per cent), 54 households identified as near-poor[26] (2.2 per cent) and 19 policy related-households[27] in 2009 (Trung An People's Committee 2009). Compared to the other two communes, the official poverty rate is relatively low in this commune.

This commune is located in the lower part of the Vietnamese floodplain delta (Figure 3.14). The natural flood starts in July, gradually reaches its peak in September and recedes in October. The duration of the annual flood is shorter than that of the high and moderate-flooded areas. The flood peak is also lower than that of the moderate and high-flooded areas (just above 1.0 m in depth). The flood is less severe in this area than in the other two communes.

[26] Near-poor households are those whose household's member income exceeds VND 250,000 per month, but less than VND 500,000 per month.

[27] Policy related households are those who have veterans or people who died during the war. Government gives priority to those households to access public welfare.

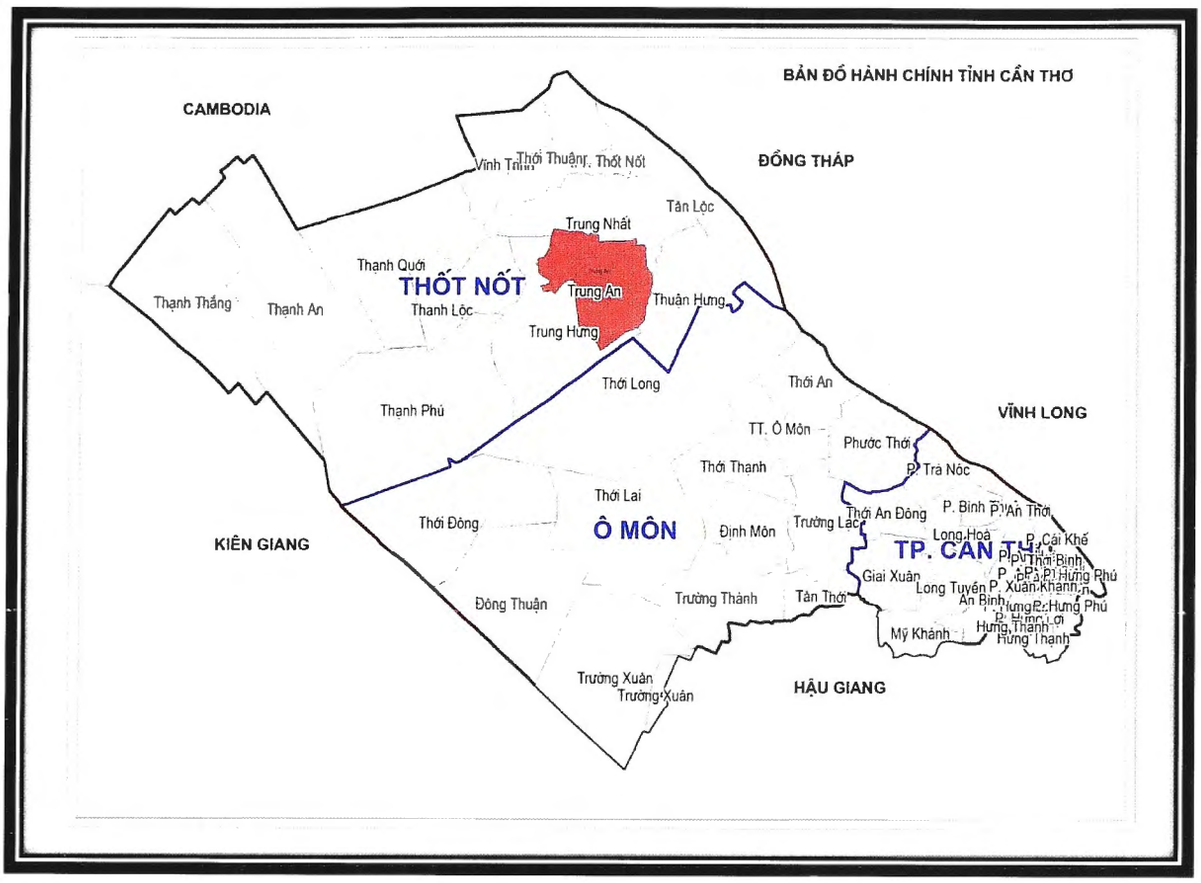

Figure 3. 14: Map of Trung An commune (red area), Co Do district, Can Tho City

Source: Pham Duy Tien (2012)

The livelihoods of local people are diversified across agriculture, small industry (rice processing and storage), small business, off farm agricultural and industrial labour. Compared to the moderate and high-flooded areas, small local industries and services are more likely to develop in this area, and will attract many local labourers in both flood and dry seasons. In particular, 22 rice mills and rice storage facilities are located in this commune, which create about 1,620 jobs for local labourers annually (Trung An People's Committee 2009). In addition, there are 161 small businesses such as textile shops, coffee shops, groceries and other types of small businesses in this commune. The local infrastructure is more likely to develop in this area so transportation is convenient for local people. The communal strategy for coping with flood is to construct dikes to hold back floodwaters in July, in order to protect the summer rice crop and allow flooding afterward to exploit the natural benefits from floods.

3.8 Conclusion

The MRD is a diverse ecological region. While the western part of the delta is annually affected by a half-year of flooding, the southern and the eastern part of the delta faces

the saline intrusion during the dry months. The flood in the MRD is classified as the riverine flood, which is scientifically measured by the alarm[28] water levels at Tan Chau and Chau Doc Gauging Station. Although the local people have a long tradition of living with floods, they have experienced severe damage and losses in extreme flood events. The damage and losses include fatalities, crop losses, house damage and public infrastructure disruption, and anxiety during the flood season. However, the annual flood also provides significant benefits to rural livelihoods by developing flood-based livelihoods as well as off-farm fishing activities. The 'living with flood' policies have addressed the importance of structural measures, but have largely ignored non-structural measures for living with floods. The 'living with floods' policies have shifted from total adaptation during the 19th century, to semi-structural adaptation, and total control in the form of dikes and polders. Dike strengthening and canal development were the key measures for living with floods during the 1980s. Recently, a resettlement project has been implemented by the central government to relocate thousands of poor households into 'residential clusters'. This project aims to reduce vulnerability to flooding. At the same time, the local government policies of some flood-prone provinces attempt to balance between the structural measures in the form of dike development and developing innovative flood-based farming practices. These policies have significant effects on reducing the vulnerability of some social groups, but increase the vulnerability of others.

The next chapter will discuss the in-depth perceptions of and coping with floods by different socio-economic groups in the MRD, from local to state government.

[28] The local radio and TV stations will base on the alarm water level to warn people the severity of the floods.

Chapter 4

Perceptions of and coping with annual flood events in the Mekong River Delta[29]

> I have lived in the MRD for many years where I see the flood or water season occurs from July to November each year. I use the term 'flood' or 'rising water season', but others call it the 'flood season'. The flood peak level varies by years and by geographical regions. I also have heard local people use different terms to discuss the water events. Some people use a pronoun referring to it as 'he' *(ổng)*. In particular, they say *(ổng về)* "he returns".
>
> I have also learnt that rural households in the flood-prone areas have adapted in different ways to cope with the flood season. In particular, most people reinforce their homes before the flood event; stay at home to look after their children, pray for safety from the floods, evacuate to their neighbours' homes, high ground or a safe place, reduce the normal meals, borrow money and rice from neighbours or informal and formal credit providers, wait for public relief and visit the local religious sites to pray for peace (personal experiences of the researcher).

4.1 Introduction

What do we know about the perceptions of flooding held by different actors in the MRD? Although, the flood occurs every year and is embedded in the life history of the people in the delta, there is a variety of perceptions of floods by different social groups and occupations. This chapter explores the perceptions of floods of different social groups in different flood-prone regions using evidence from the field, archived information from local and national newspapers, academic publications and a household survey in 2010. The term 'flood' often means an 'abnormality' in the English language. Many researchers have seen 'flood' as adversity or a cost to human society (White 1945, 1964, 1974b). Human perceptions and adjustments to floods have been studied by natural hazard researchers in the United States from the 1940s to 1970s (White 1945, White 1964, Kates 1962, Kates 1971, White 1974a, Islam 1974, Harding and Parker 1974, Kates 1963). Among these researchers, the perception of flood was first studied by White (1945) who examined factors affecting human adjustments to floods.

[29] An early draft of this chapter was presented at the Vietnamese Update on 17th – 18th November 2011 with the title "*Floods in the Mekong Delta: Local Perceptions, Impacts and Resilience*" at the link http://ips.cap.anu.edu.au/psc/Vietnam/2011/?tab=program. This chapter will be published as Nguyen Van Kien (forthcoming) 'Farmers' perceptions and responses to annual flood events in the Vietnamese Mekong River Delta: Adapting to Climate Change Impacts' in Lopez-Gunn, E., Stefano, L. D. and Stucker, D., eds., *Adaptation to Climate Change through Water Resources Management: Capacity, Equity, and Sustainability*, London: Earthscan.

However, the knowledge of flood perception was still focusing physical conditions such as the frequency and magnitude of flood occurrence, and flood damage. During the 1970s, White and his colleagues produced a series of research papers on perceptions of floods. The term 'perception' is defined as "the individual organization of stimuli relating to an extreme event or a human adjustment" (White 1974b: 4). This concept attempts to understand "how people talk and view the occurrence of extreme events and their coping strategies with such events" (White 1974a). However, this concept is presented in a narrow, extreme context and the negative effects of such events are paramount. In Bangladesh, Paul (1984) describes the characteristics of floods in terms of time (early, usual, late), magnitude (below, normal, abnormal), and duration (shorter, normal, longer than normal). Regarding the annual occurrence of flood events in the MRD, this chapter explores the perceptions of different stakeholders of the flood events and examines their coping behaviours as a result of the floods.

4.2 'Flood' or the 'rising water season' from national to local perspectives

Over time, the term flood *(lũ)* has been commonly used in the newspapers for the big water event, while it is termed the 'rising water season' *(mùa nước nổi)* for moderate or small flood events. In the 1990s, the *An Giang* newspaper used a variety of terms to describe the water event such as 'flood' *(lũ)* or 'dangerous floods' *(lũ giữ)* or 'big flooding' *(lũ lụt lớn)*, 'flood season' *(mùa lũ)* to talk about the annual water events. However, the term 'rising water season' rarely appeared in the newspapers to describe the big water event. An article in the *An Giang* newspaper number 1270 issued on 12-10-1996 called the 1996 flood a 'dangerous flood' *(con lũ dữ)* (Figure 4.1 (right)) (Minh Duc 1996). Very few articles used the term 'returning floods' *(lũ về)* to express the local interest in the flood events for maintaining household income (Nguyen Nham 1997).

Until 2008, it was still very common for newspapers to refer to the 'flood season' using 'military language', implying the floods were perceived as an enemy or a threat. They saw the flood as the 'enemy', so 'fighting the flood as fighting an enemy' was presented in An Giang local newspaper (Figure 4.1 (left)). Especially, the term 'flood' was mostly used in local news before the historic flood in 2000. The term 'flood' was subsequently changed into 'rising water season' in provincial government policy.

Figure 4. 1: Fighting the flood, as fighting the 'enemy' in the MRD (left); An Giang is fighting against a 'dangerous flood' (right)

Source: Minh Duc (1996) and Minh Duc (2008)

Similarly, both local researchers and government use the term 'flood' in scientific reports as well as in government documents (Đặng Quang Tính and Phạm Thanh Hằng 2003, Đào Công Tiến 2001b, Ngô Trọng Thuận 1995, Nguyễn Hồng Bỉnh 1995, Nguyễn Như Khuê 1995, Ministry of Agriculture and Rural Development (MARD) 2004, Southern Institute of Water Resource Planning Management (SIWRPM) 2000). Whether local people call the water season the 'flood season' or the 'rising water season', the term 'flood' is a key term used throughout this thesis for the sake of simplicity. However, it does not imply that the flood is dangerous to any extent. Various local terms that describe the water events are used by different social groups and in different regions, as discussed in this chapter.

Local government staff and media often employed the term 'flood' in the past because they did not acknowledge the benefits of floods. Mr Bieu, a flood-based prawn farmer in Thanh My Tay commune said that government staff often use the term 'flood', but people in his village call it the 'water season' [in-depth interview with Mr Bieu on 15th September 2010]. However, there has been a shift in perceptions of water events by local government authorities. The term 'rising water season' means that the water season is a 'friend of humans'. It is not a 'disaster'. It implies that the water season brings resources that maintain rural livelihoods. Local governments in An Giang province recognize the benefits of the water season so they have began to develop

policies and programs[30] to empower farmers to exploit the natural benefits of the water season. In particular, many farmers in Thanh My Tay commune of Chau Phu district have engaged in flood-based farming as they have identified the significant benefits of the floodwater.

> Mr Niem, a deputy vice president of Trung An commune, asserts that the water season is very good for rice farming and for the poor to catch fish. He said that if there is no water, there is no life in this commune. So the commune strategies are to adapt to the 'water season', not to control the waters [in-depth interview with Mr Niem on 20th October 2010].

The local perception of the water event is to some extent not consistent with the perception of floods in newspapers. Local people in the three study sites use several local terms to describe the water event in the MRD. Some people call it the 'rising water season' *(mùa nước nổi)*, while other people refer to it as the 'water season' or *(mùa nước)* in the three study sites. Alternatively, some respondents use the term 'flood season' *(mùa lũ)* to express their experience of the water event. The term 'rising water season' is positive, while the term 'flood season' is usually negative to rural livelihoods. In particular, farmers wait for the 'rising water season' in order to capture fish, raise prawns and fish and grow vegetables *(Neptunia prostrate)* to maintain their income during the flood season. Therefore, it appears that when people talk about the benefits of the water event, they use the term 'rising water season', but when it causes damage or loss, they use the term 'flooding' *(lũ lụt)*.

Most local participants in the three study sites have experienced the annual flood event and believe that the 'flood' or 'water' season has been a natural part of their lives for years. They know that the 'flood season' frequently occurs at the same time each year. All female and male participants in focus group discussions in the three communes showed an understanding of the occurrence and magnitude of the flood or water season. Usually, they refer to the moderate flood as the most 'beautiful' water season. However, a big or small flood may occur once in several years and disrupts rural livelihoods in certain ways. In particular, the flood events in 1978 and 2000 were described as the most unforgettable events because they submerged and destroyed many houses in the villages, killed livestock, and drowned many fishermen and children. The following

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[30] An Giang People's Committee (2006) *Chương trình: khai thác lợi thế mùa nước nổi tỉnh An Giang giai đoạn 2002-2010 (Programs: exploitation of the benefits of the 'rising water season' of An Giang province from 2002 to 2010*, Long Xuyen: Office of An Giang People's Committee.

comment by one participant illustrates the typical local understanding about the flood events in the three selected study sites.

> Every year local people say the 'flood returns' *(lũ về)*. The flood returns in June (lunar calendar), slowly claims the harvested rice fields in July and reaches its peak from 15 August to 25 September and will slowly recede in October or November. The flood peak *(phân đồng)* often stays for a month [Mr Moi, aged 65, a better-off rice farmer in Phu Xuan Hamlet, Phu Duc Commune in FGD_PD1].

4.3 Talking about the water events by local people from region to region, by gender, by time of occurrence and in the mythology

4.3.1 Different terminologies for the flood event used region by region

People in different regions use different terminologies to discuss water events in the MRD. People in the moderate flood region use different names for the water event from those in the highest flood prone region, where most participants use the term 'flood season'. In comparison, very few respondents refer to a 'flood season' in the low inundated region. Mr Nhat, aged 25, a university student, argues in a focus group discussion that the flood often occurs suddenly so there is actually no 'flood season' in this region. Nhat explains that while local residents call it 'flood season' in this area, in reality it is 'rising water season' [in-depth interview with Mr Nhat on 20th September 2010].

However, there is a mixed use of the terms 'water season' or 'flood season', in the moderate flood-prone region. In contrast to people in the highest flood prone region, most people in Thanh My Tay commune call it the 'water season'. According to local people, the meaning of water season is the flood season. When people refer to it as the 'water season', it is likely to be less disastrous than the term 'flooding'.

> The water season *(mùa nước)* returns to this area every year. According to different years, there is a big water *(nước lớn)* or small water *(nước nhỏ)* or moderate water *(nước vừa)* [all male participants in FGD_TMT01 on 7th 2010].

> Each year the flood rises above the ground floor or nearly up to the house floor. Rice fields are inundated each year. People here call it the 'rising water season' *(mùa nước nổi)* or the 'flood returns' *(lũ về)*. The water starts to rise in June or July (lunar calendar), and gradually submerges the rice fields in mid July. In August, the water level is highest *(phân đồng)* until September, and the water starts to recede in October or November. In some years the water is big *(nước lớn)* or small *(nước nhỏ)*. The water level is about 2.0 metres above the rice fields during a small flood while it reaches

> up to 2.5 metres in a big flood in this area [Mrs Lan, aged 40, a poor female in My Binh hamlet in FGD_TMT04 on 7th 2010].

Few words for 'flood' or 'flood season' were used by people in focus group discussions in the low inundated areas of Trung An commune. Most people in Trung An commune claim that they have never seen a flood in their lives. They said that the term 'flood' should be used in An Giang and Dong Thap provinces or in Central Vietnam but not in their community.

> Every year, there is a 'water season' *(mùa nước)*, not a 'flood'. From the water rising period to water receding period is about three months. The water reaches a peak in about 15 days. The water season does not cause any damage or submerge houses, so people here call it the 'water season' [Mrs Thoa, aged 36, a poor female in Thanh Loc 2 hamlet in FGD_TA03 on 30th December 2009].

4.3.2 Different terminologies about the flood event by gender

Besides the differences in terminology for 'flood' used in the different regions, there is a difference in perception of the flood event by gender. Importantly, men are more likely to use the term, 'water season', while women use the term, 'flood season'. This implies that daily livelihood activities of males are directly related to the water event so they are aware of the water season. Interestingly, many men in the study sites often call the water season the 'income season'[31] because they can catch fish for sale during the water season. On the other hand, women often use the term 'flood season' because they become unemployed during the flood season. Through my own observation for many years living in the flood-prone region, I have seen that most women stay at home, while their husbands go out fishing in the fields. Although there are women participating in off-farm activities, this number is quite limited.

4.3.3 Different terminologies used to discuss the occurrence of the floods

The timing of flood occurrence is another aspect of the flood discourse. It is often referred to as the early or late floods *(lũ sớm hoặc lũ muộn)*. The term 'early' or 'late' flood was also discussed in the local newspapers during the 1990s (Figure 4.2). This typology is relevant to local perceptions of flood events. Especially, participants recalled that the 1978 and 2000 floods occurred earlier than the usual flood event by about two weeks. The water in the rivers or canals usually starts to reverse *(xoay nước)* in the river about 5th May (lunar calendar), slowly rises and claims the rice fields in

[31] 'Income season' means that the flood season is not totally disadvantageous, but provides opportunities for improving income.

early July (lunar calendar), reaches a peak in the second week of August, stays at peak for approximately three weeks or one month, then gradually recedes on 25 September.

Farmers in the three study sites use their traditional knowledge to adjust their rice-farming calendar in order to harvest their crop before the massive inundation in August. For example, farmers in Tam Nong district harvest the summer rice crop in early July to avoid inundation in the August flood *(lũ tháng tám)*.

> According to a local resident living in the high flood prone region, the flood in 2000 occurred fifteen days earlier than the usual occurrence; so many rice crop areas were submerged in Phu Duc and Thanh My Tay communes [in-depth interview with Mr Moi, aged 62, living in Phu Duc commune on 12th September 2010].

Similarly, the flood also returns later in other years, affecting the livelihoods of many poor people in the flood-prone regions. The flood in 2010 was seen as a 'late flood', because the floodwater claimed the rice fields one month later than the usual flood occurrence.

> According to Mr Bong, a leader of K9 hamlet, Phu Duc commune, Tam Nong district, the flood in 2010 came very late in comparison to the normal flood event, but he did not know the reason for this abnormality. Usually, the flood level is up to ones' head[32] on 15th September, but this year the flood level was only as high as the rice straw[33] on this day [in-depth interview with Mr Bong on 15th September 2010].

Figure 4. 2: An early flood in the west of the MRD (left); a late flood in the Plain of Reeds, Dong Thap province (right)

Source: Nguyen Hong (1997) and photo taken by Nguyen Van Kien on 15th September 2010 at Phu Xuan Hamlet, Phu Duc commune, Tam Nong district, Dong Thap province

[32] Head of male adults is referred here. An average Vietnamese male adults' height is 1.6 m.
[33] A rice straw is about 0.5 m in height.

4.3.4 Using the myth of the Water Genie and Mountain Genie to infer the water event

Local people mentioned the "myth of the Water Genie and Mountain Genie"[34] when they talked about the flood event (see the myth in Vietnamese and summary of English translation in Appendix 4.1). Most people both young and old, men and women in the Phu Duc village are aware of the myth.

> A male participant in a focus group discussion at K9 hamlet, Phu Duc district, and Tam Nong commune recalled the local proverb that "men do not forgive and women do not forgive, they fight against each other on 13 October each year" *(Ông không tha, bà không tha, đánh một trận mười ba tháng mười)*. Everyone knows about this myth because it impacts on their livelihoods every year [in-depth interview with Mr Canh, aged 45, a primary teacher in Phu Duc commune].

The saying does not mention the actual day, but people in the study site did use the date 13th of October *(mười ba tháng mười)*. I asked why they talked about the 13th of October. They told me that the 13th of October (lunar calendar) was the most dangerous day of the flood season because that is when the floodwater peaks and the storms often occur. They also said that the word 13th *(mười ba)* rhymes with the word *(tha)* in the myth *(ông không tha, bà không tha),* which is recited in rhyming couplets.

This story indicates that the water event is closely linked to the memory of local people, reminds people about the 'dangerous period' and the need to be prepared. Such proverbs can significantly assist local people to remember to be aware of the storms and prepare to cope with them.

4.4 Perceptions of flood severity by local people

4.4.1 Perceptions of local indicators of flood severity

It is important for different actors to understand the indicators of flood severity for developing coping strategies during and after the flood event. Local flood severity indicators were developed from the FGDs in three study sites. Most participants reached a consensus that there are four key indicators of flood severity: (1) duration of the flood; (2) depth of the flood; (3) flood when accompanied by strong winds; (4) suddenness of water rising (Figure 4.3). This implies that the duration of the flood event is not a

[34] This myth was printed in a literacy school book for year six of the Vietnamese Education System. The story recounts a fight between the Water Genie and Mountain Genie who were competing for marrying a princess. It is about the non-stop conflict between the Water and the Mountain. Sometime, the Water wins, the Mountain fails. But in the end, the Mountain wins and marries the princess.

serious indicator of the flood; however, flood depth, flood accompanied by strong winds and suddenness of rising water are the most serious indicators of severity during the flood season.

This ranking was further confirmed by the results of the household survey which indicated that the third indicator (flood accompanied by strong winds) was perceived as the most serious (88.2 per cent). Respondents were aware that the strong winds which occur during the flood season are most dangerous because they often cause house damage or disrupt fishing activities. The depth of the flood is perceived as the second most dangerous indicator of flood severity (61.2 per cent). Respondents in Phu Duc commune explained that the flood depth is not so dangerous if there is no strong wind during the flood season. The suddenness of water rising is also perceived as a serious danger indicator (23.1 per cent).

Most participants in the FGDs held in Thanh My Tay commune recalled that the most unforgettable extreme flood events occurred in 1978 and 2000 because the water rose very quickly, and people were not well prepared to cope with the sudden extreme situation. Consequently, their houses were submerged, collapsed and even swept away during those two flood events. Their floating rice crop *(lúa mùa nổi)* was completely destroyed by the flood in 1978, which forced them to evacuate for temporary survival during and after the flood event. The duration of the flood season is perceived as the least dangerous element (9.4 per cent) because people have long experience of living with the flood season.

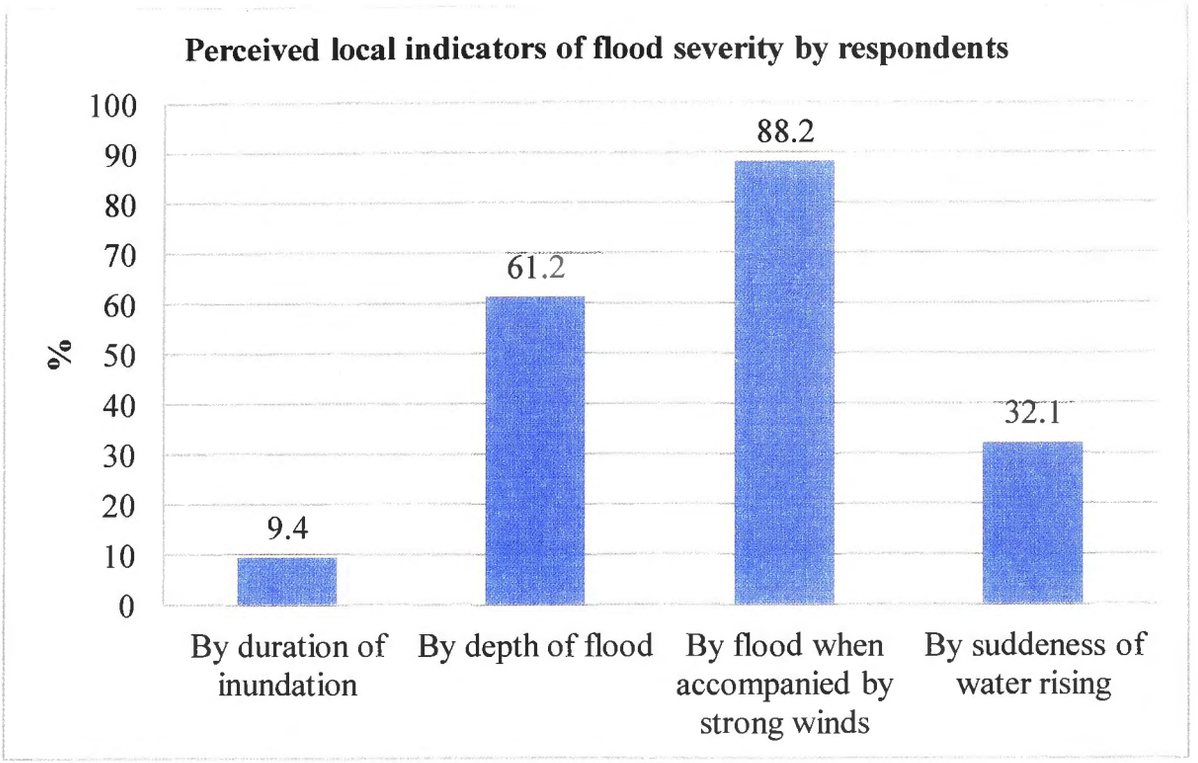

Figure 4. 3: Perceived local indicators of flood severity by respondents (N=459)

4.4.2 Perceptions of local flood severity by different region

The flood depth is perceived as one of the most serious flood indicators of severity. However, the perception of peak flood depth varies in different geographical locations. Respondents in the highest flood-prone region perceived that the depth of peak big floods ranges from 3.0 to 3.5 m above the surface of the rice fields. People in the rural areas use various indicators to measure the depth of floodwater. The most accurate measurement is observing the flood depth through the concrete stilts where the most recent floodwater level is marked on the stilt (Figure 4.4). Alternatively, farmers estimate the flood depth by comparing its height in the rice fields: in this way they can estimate very accurately the depth of the flood. In this context, the depth may reach over 3.5 m in some of the lowest swamps, but it is usually about 3.0 m in depth in a big flood year. The depth of a moderate flood is about 2.5 m above the surface of the rice fields, whereas the peak of small flood is less than 2.0 m above the rice fields. The following discourses about flood depth were recorded in FGDs in the highest flood-prone region.

> This year (2010) the flood was smaller than the 2000 flood. In 2000, the floodwater *(nước lũ)* was so high...about 3.0-3.5 m above the surface of the rice fields. It was over my head...The usual flood level is just about 2.5 m in depth. This year (2010), the flood level is low [in-depth interview with Mr Hong, aged 61, a poor landless farmer, in Phu Xuan hamlet, Phu Duc commune on 13th September 2010].

Figure 4. 4: The (left) photo (a mark on concrete stilt) indicates the difference in highest floodwater level between the 2000 flood and the usual flood year. The (right) photo shows the flood level in 2009 (a mark on electricity pole)

Source: Photo taken by Nguyen Van Kien (2010)

The peak depth of the big flood was perceived as lower in the Thanh My Tay and Trung An communes compared to the Phu Duc commune. This perception reflects the appropriate selection of study sites to represent the differences in levels of flooding in the MRD. The following perception of flood depth is presented by a participant in a FGD at Thanh My Tay Hamlet, Chau Phu district, An Giang province.

> In 1968 the flood was the biggest. The floods in 1978 and 1979 were just a little smaller than that of the 1968 flood. The peak of the big flood in 1978 reached over my head. It would range from 2.5 to 3.0 m in depth. The water season was normal, just from 1.8 to 2.0 m above the rice fields in 2009. In this year (2010), the water is too small. The water in 2008 was just a little bigger than that of the 2009 flood. You can see at this time the water only claims the rice fields. Normally, in previous years it was up to my knees at this point [Mr Tuan, aged 62, a poor man, living in Ba Xua hamlet in FGD_TMT01 on 7th January 2010].
>
> The peak of the 'water season' is just from 1.0 to 1.2 m above the rice fields in Trung An commune. It is not comparable to the peak of the flood in An Giang or Đồng Tháp province [All female participants in FGD_TA04 in Thanh Loc 2 hamlet on 31st December 2009].

These impressions were further confirmed by the perceptions of the respondents in the household survey. An F-test was used to compare the mean depth of three flood types (big, moderate and small) by the three selected natural inundated regions (high, moderate, and low inundated regions). The results from the F-test show a statistically significant difference ($p<0.001$) in mean depth of the three common flood types in the

three flood-prone regions. Findings (Table 4.1) confirmed that the mean perceived flood peak[35] of a big flood is 3.0 m in the highest flood-prone region, while it is only 2.9 m in the moderate inundated region, and 1.4 m in the low flood-prone region. The mean of a moderate flood peak is perceived from 2.0 to 2.2 in the highest and moderate flood-prone regions, while it is only 0.9 m in the low flood-prone region. A small flood peak is perceived to be about 1.1 to 1.5 m in the moderate and highest flood prone regions, whereas it is about 0.6 m in the lowest flood prone region.

Table 4. 1: Perceptions of mean depth in metres (m) of different flood types by region (N=459)

Flood prone region	**Big flood event**			**Moderate flood event**			**Small flood event**		
	Mean**	n	Std.	Mean**	n	Std.	Mean**	n	Std.
Phu Duc	3.06	147	0.57	2.09	148	0.49	1.11	130	0.430
Thanh My Tay	2.92	143	0.64	2.22	154	0.53	1.59	131	0.493
Trung An	1.44	116	0.41	0.97	147	0.27	0.62	60	0.327
Total	2.55	406	0.90	1.77	449	0.72	1.21	321	0.567

Note: Test of significant difference is based on F-test, ***p<0.001, ** p<0.01 per cent; *p<0.05

4.4.3 Perceptions of local flood severity by socio-economic group

There is a statistically significant difference in the perceived mean of flood peak by socio-economic group of respondents (Table 4.2). Poor households are more likely to perceive the mean big flood depth as higher than that presented by the medium and better off households (p<0.001). Similarly, poor people see the mean peak of moderate and small floods as higher than that of the medium and better off households (p<0.05). This can be interpreted to mean that poor people, who are more likely to pursue their livelihoods in the floodplain during the flood season, tend to perceive the floods as higher than members of the better-off social groups.

[35] The flood water level was measured using local knowledge, as water level above the rice field surface, not as a scientific measure of the water level above mean sea level.

Table 4. 2: Perceptions of mean depth in metres (m) of different flood types by socio-economic group (N=459)

Socio-economic group	Big flood			Moderate flood			Small flood		
	Mean***	n	Std.	Mean**	n	Std.	Mean**	n	Std.
Poor	2.73	159	0.90	1.89	175	0.78	1.32	130	0.64
Medium	2.46	120	0.89	1.72	131	0.69	1.19	93	0.53
Better off	2.41	127	0.88	1.66	143	0.65	1.10	98	0.47
Total	2.55	406	0.90	1.77	449	0.72	1.21	321	0.57

Note: Test of significant difference is based on F-test, ***p<0.001, ** p<0.01 per cent; *p<0.05

4.4.4 Perceptions of local flood severity by gender

The perceived flood peak depth showed a statistically significant difference between genders (Table 4.3). In general, the average peak of the big flood in the three regions was perceived as 2.4 m by males but 2.7 m for females (p<0.05). Similarly, females are more likely to perceive that the depth of moderate and small flood is higher than that of the males' perception. However, there is no statistically significant difference in perception of flood depth by different age groups, except for the small flood years (p<0.05). I could not determine the reasons for this difference. I did observe that women express nervousness about the floods. It is possible that fear of floods affects the perception of the height. However, I lack evidence to support this argument.

Table 4. 3: Perceptions of mean depth in (m) of different flood types by gender (N=459)

Gender	Big flood			Moderate flood			Small flood		
	Mean**	n	Std.	Mean**	n	Std.	Mean**	n	Std.
Males	2.48	296	0.86	1.72	327	0.66	1.16	235	.515
Females	2.72	110	0.99	1.90	122	0.84	1.37	86	.670
Total	2.55	406	0.90	1.77	449	0.72	1.21	321	.567

Note: Test of significant difference is based on t-test, ***p<0.001, ** p<0.01 per cent; *p<0.05

4.4.5 Perceptions of local flood severity by months of flood occurrence

The flood severity indicators can tell us about the indication of flood severity; however, these indicators do not show the time dimension of flood severity. Results from household interviews further confirmed that the flood becomes serious only in August and September (of the lunar calendar) each year. Houses were mostly affected in those two months, so strategies to cope with annual flood events should be focused on those months (Figure 4.5). The risk communication about the negative impacts of flood events should also focus on this period.

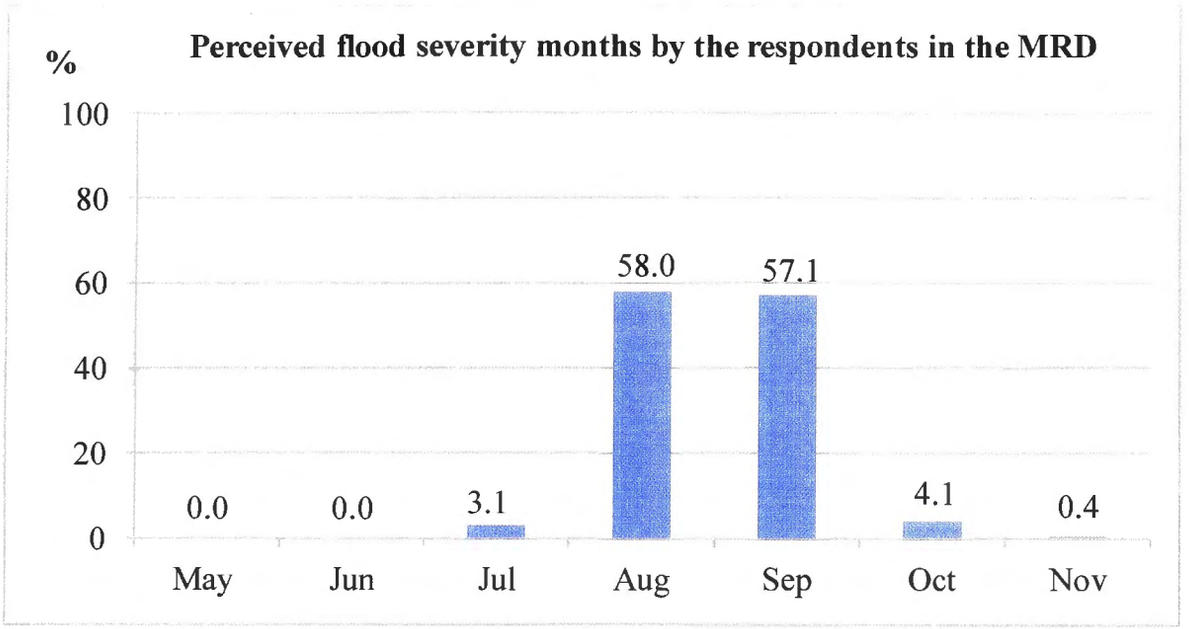

Figure 4. 5: Perceived flood severity months by the respondents in the MRD (N=459)

Although the flood was perceived as most severe in August and September, the different regions perceived the serious periods differently. Pearson Chi-square test was used to examine the relationship between flood regions (high, moderate and low) and perceptions of the serious months (August and September). The results show that the respondents in the highest flood region (Phu Duc commune) are more likely to perceive August to be the most serious month, while September is perceived as the most serious flood month in the moderate and low-flood regions (Table 4.4). It is true that the flood often comes earlier in Phu Duc commune than the other communes. This implies that preparedness activities should be undertaken before August in the highest flood prone region and before September in the moderate and lowest flood-prone regions.

Table 4. 4: Perception of most seriously flooded months by respondents in three flood-prone regions

Serious months		**Flood region**		
		High (n=150)	Moderate (n=159)	Low (n=150)
August***	Yes (%)	72.0	66.0	35.3
September***	Yes (%)	49.3	47.2	75.3

Note: Test of significant difference is based on chi-square, ***p<0.001, ** p<0.01 per cent; *p<0.05; ns is not significant

The content analysis from archived newspapers shows that media commentary on the annual flood event is more likely to appear during big flood events and in the peak flood months than in the small or moderate flood events and at the beginning or receding flood months. In particular, the floods in 1978, 1996, 2000 and 2011 were seen as a 'big flood' or 'disaster' which was described by the local *An Giang* newspaper, the regional

Can Tho newspaper, and the national *Tuoi Tre* newspaper. Most of the news was published in the high intensity of flood months such as in September, October and November. For example, there were two articles on flooding news in September, 11 articles in October, and two articles in November presented in the *An Giang* newspaper in 1996. After the 1996 flood, there were 12 articles giving flood news during the flood season in the *An Giang* newspaper in 1997. Very little flood news was presented about the small flood in 1998. This means that the local and national media are more likely to present the disastrous events in the big flood years than in the moderate flood years. While there is other information available about positive flood events, it is less likely to be communicated by the media. For example, very few articles discussed the beneficial sides of flood events. This creates misunderstandings about water events in the MRD, and leads to valuable information about the benefits of the water event being missed by current flood risk communication.

The local and national media similarly carried little news of the small flood events. For example, little news about the flood was published in the *An Giang* newspaper in 2010, but many news items were published about the extreme flood of 2011. Much local news discussed the anxiety about the small flood event as this also threatens local livelihoods, but in different ways. Fishermen worry about losing their fishing benefits in the small flood years because there are fewer fish to catch. Rice farmers worry about too many weeds in the rice fields, so they have more costs to bear for the winter-spring rice crop. The photos in Figure 4.6 were presented in the *Can Tho* newspaper, dealing with the small flood.

Figure 4. 6: The impacts of small flood occurrence in the MRD

Source: Taken by Nguyen Van Thai (2010)

4.5 Household coping behaviours during different flood events in the MRD

4.5.1 Household coping behaviours during big flood events

Household adaptation to big flood events is very diverse, from livelihood protection to evacuation, child protection, relief, spiritual relief, and preparedness (Figure 4.7). Data from a household survey confirms that among 15 coping behaviours undertaken by local people during the big flood event, the majority of people stay at home to look after children (59.2 per cent), reinforce the house before the flood (56.4 per cent), elevate the house floor above the annual flood level (55.1 per cent), and pray at home (54.2 per cent). Some 49.2 per cent and 43.3 per cent do not go fishing, and borrow money and rice from neighbours, respectively. Less than a third (29.8 per cent) reduce the number of normal meals; 24.1 per cent borrow money from informal credit providers. Less than a quarter go to religious sites to pray (18.3 per cent); seasonally migrate (16.8 per cent); wait for public relief (16.7 per cent); borrow money from formal credit providers (15.9 per cent); move to higher ground to avoid the flood (13.3 per cent); elevate the floor of domestic animal pens (12.4 per cent); and send children to mobile kindergartens (2.8 per cent).

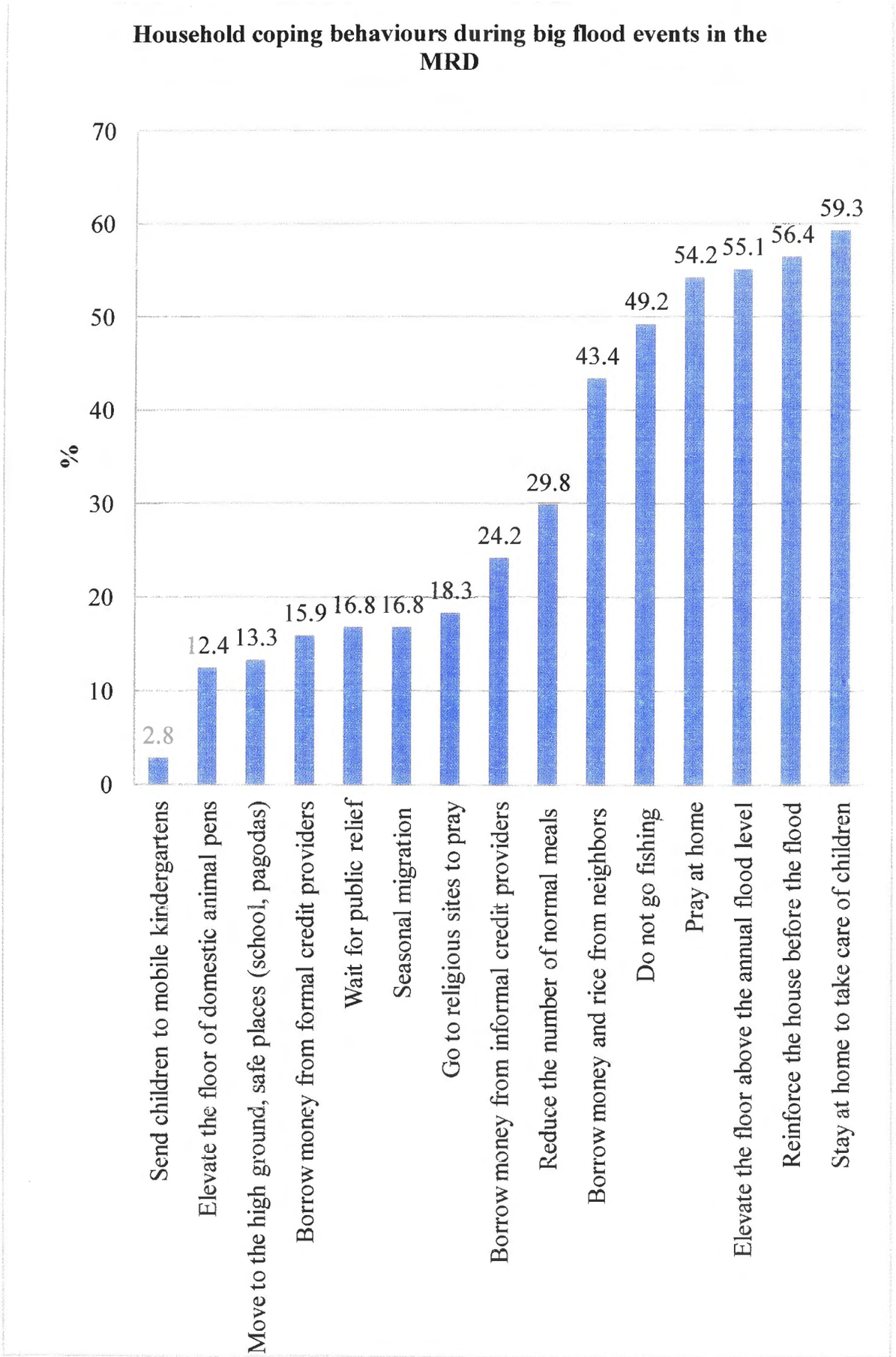

Figure 4. 7: Household coping behaviours during big flood events in the MRD (N=459)

Household adaptation varies among the different socio-economic groups (Table 4.5). Poor people are more likely to move to higher ground to avoid the flood ($p<0.05$); borrow money and rice from neighbours ($p<0.001$); borrow money from informal credit providers ($p<0.01$); wait for public relief ($p<0.001$); reduce the number of normal meal ($p<0.001$); seasonally migrate ($p<0.001$); pray at home ($p<0.05$); reinforce houses before the flood ($p<0.001$); and elevate the house floor above flood level than the medium and better-off households.

Table 4. 5: Household coping behaviours during big flood events by socio-economic group (N=459)

Coping behaviours (%)	**Socio-economic group**			**Total**
	Poor	**Medium**	**Better-off**	
N	181	132	146	
Move to the high ground, safe places (school, pagodas)*	18.78	10.61	8.90	13.29
Do not go fishing (ns)	53.59	46.97	45.89	49.24
Stay at home to take care of children (ns)	53.04	63.64	63.01	59.26
Send children to mobile kindergartens (ns)	3.87	3.03	1.37	2.83
Borrow money and rice from neighbours***	71.82	32.58	17.81	43.36
Borrow money from informal credit providers**	34.81	19.70	15.07	24.18
Borrow money from formal credit providers**	7.18	18.94	23.97	15.90
Wait for public relief***	32.60	6.82	6.16	16.78
Reduce the number of normal meals***	50.83	18.18	14.38	29.85
Seasonal migration***	32.04	6.82	6.21	16.59
Go to religious sites to pray (ns)	19.89	15.91	18.49	18.30
Pray at home*	64.09	49.24	46.58	54.25
Strengthen the house before the flood***	66.30	59.09	41.78	56.43
Elevate the floor above the annual flood level**	62.98	57.58	43.15	55.12

Note: Test of significant difference is based on chi-square, ***$p<0.001$, ** $p<0.01$ per cent; *$p<0.05$; ns is not significant

4.5.2 Household coping behaviours during moderate flood events

During moderate floods, the majority of households stay at home to pray and care for children (Figure 4.8). In particular, 55.3 per cent of households stay at home to pray. This may be due to the fact that most of the respondents belong to Hoa Hao Buddhism, so they are more likely to pray for safety in either the big or moderate flood season. Some 44.4 per cent and 42.0 per cent do not go fishing and strengthen their homes before the flood season. In terms of coping with flood insecurity, 33.8 per cent borrow

rice and money from neighbours; 21.8 per cent reduce the normal meals; 19.4 per cent borrow money from informal credit providers; 19.2 per cent upgrade the house floor above the flood level; 18.5 per cent go to religious sites to pray; 15.7 per cent borrow money from formal credit providers; 14.4 per cent seasonally migrate to the non-flood areas to seek jobs. Some 10.9 per cent of the respondents still wait for public relief, while a few lift up the house floor (4.1 per cent), and secure domestic animal shelters (3.5 per cent), and send the children to kindergartens during moderate flood events (2.0 per cent).

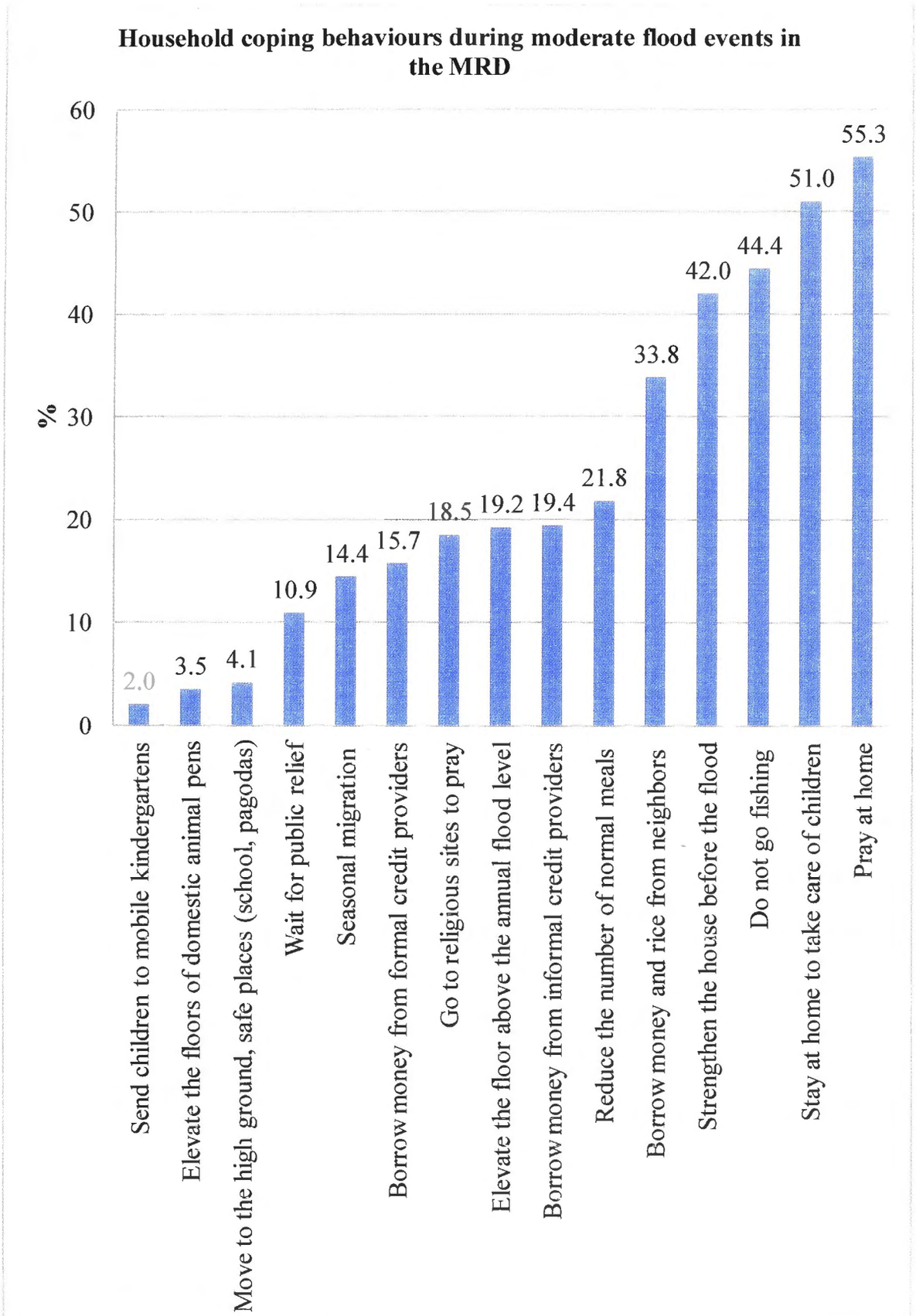

Figure 4. 8: Household coping behaviours during moderate flood events in the MRD (N=459)

There is a statistically significant difference in household coping behaviours during the moderate floods among different socio-economic groups (Table 4.6). In particular, poor people are more likely to move to higher ground or safer places ($p<0.05$); wait for public relief ($p<0.001$); seasonally migrate ($p<0.001$); borrow money from informal credit providers ($p<0.001$); reduce the number of normal meals ($p<0.001$); borrow money and rice from neighbours ($p<0.001$); pray at home ($p<0.001$); elevate the house floor above the annual flood level ($p<0.001$); and strengthen the house before the flood ($p<0.001$).

Table 4. 6: Household coping behaviours during moderate flood events by socio-economic group (N=459)

Coping behaviours (%)	**Socio-economic group**			**Total**
	Poor	**Medium**	**Better-off**	
N	181	132	146	
Send children to mobile kindergarten (ns)	3.31	0.76	1.37	1.96
Elevate the floor of domestic animal pens (ns)	3.31	1.52	5.48	3.49
Move to the high ground, safe places (school, pagodas)*	6.63	1.52	3.42	4.14
Borrow money from formal credit providers***	7.18	17.42	24.66	15.69
Wait for public relief***	26.52	0.76	0.68	10.89
Seasonal migration***	30.94	3.03	4.11	14.38
Go to religious sites to pray (ns)	20.99	15.91	17.81	18.52
Borrow money from informal credit providers***	33.70	12.88	7.53	19.39
Reduce the number of normal meals***	44.75	6.06	7.53	21.79
Borrow money and rice from neighbours***	67.96	14.39	8.90	33.77
Do not go fishing (ns)	49.72	43.18	39.04	44.44
Pray at home***	66.30	51.52	45.21	55.34
Elevate the floor above the annual flood level***	28.73	12.12	13.70	19.17
Strengthen the house before the flood***	58.01	41.67	22.60	42.05
Stay at home to take care children (ns)	47.51	53.03	53.42	50.98

Note: Test of significant difference is based on chi-square, ***$p<0.001$, ** $p<0.01$ per cent; *$p<0.05$; ns is not significant

4.5.3 Household adaptation during small flood events

In small flood events, coping behaviours are quite different between the big and the moderate floods (Figure 4.9). In particular, only 39.2 per cent of respondents said they pray; 31.3 per cent stay at home to take care of children; 25.0 per cent do not go fishing. Although a smaller proportion of people do not go fishing during the small flood, the majority of them go to HCM city to seek other non-farm jobs. This does not mean that

more people engage in fishing activity. Some 21.7 per cent reinforce their homes before the flood; 19.8 per cent borrow money and rice from neighbours; 12.2 per cent reduce the normal meal. Just about 11.9 per cent and 10.8 per cent borrow money from informal and formal credit providers. Notably, fewer people go to religious sites to pray as the result of the small flood (10.2 per cent). It is true that if people are worried about a big flood event, they are more likely to pray for safety to reduce the harmful effects. Very few people migrate seasonally, wait for public relief, evacuate to the high ground, send children to kindergartens or elevate the floor of domestic animal pens.

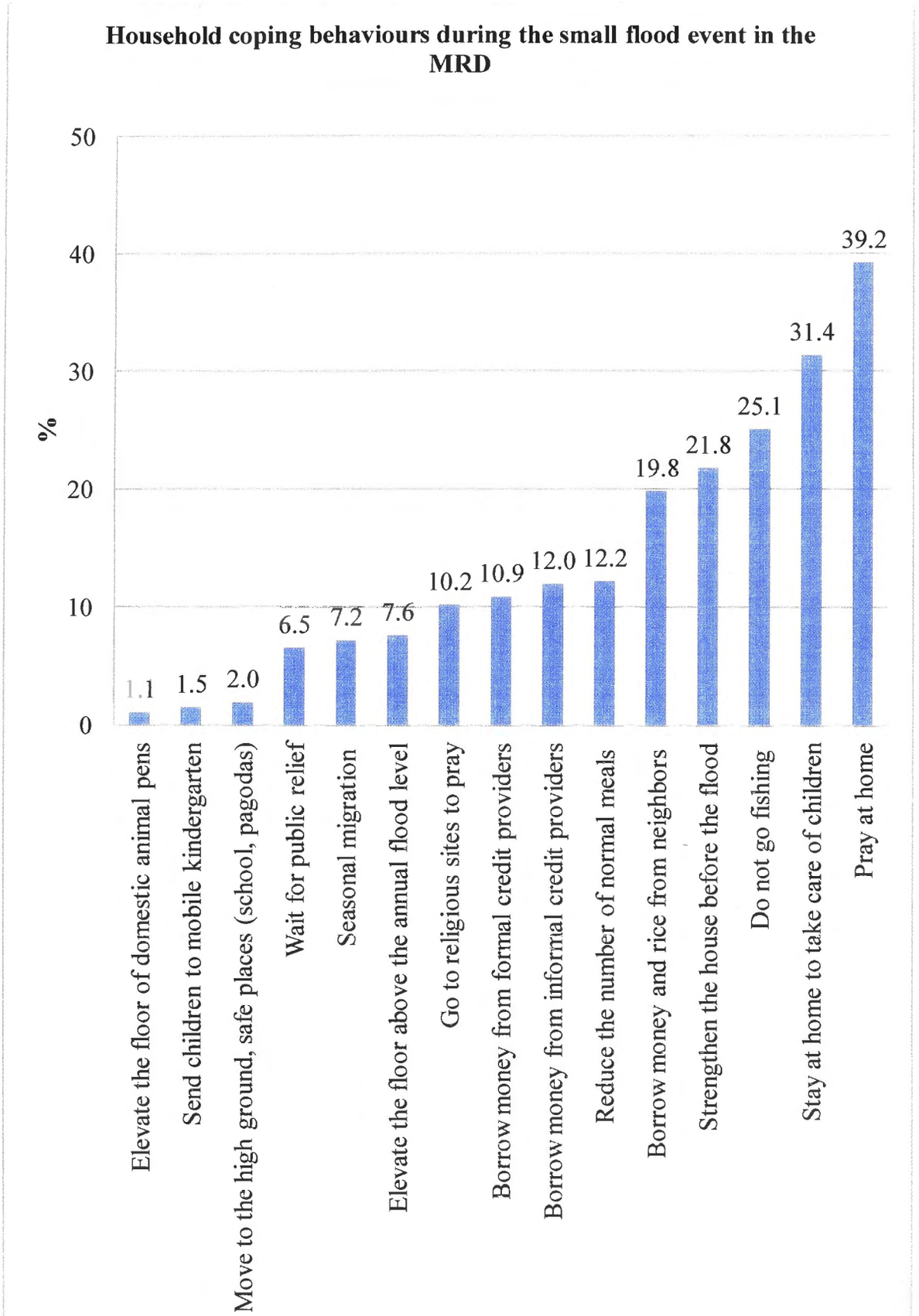

Figure 4. 9: Household coping behaviours during small flood events in the MRD (N=459)

While better-off and medium level families are more likely to borrow money from formal credit providers, poor households borrow from informal credit providers at a higher interest rate and from their neighbours, even during small flood events (Table 4.7). Poor households are more likely to wait for public relief, migrate seasonally, and reduce normal meals even during small flood events. Poor households are more likely to pray for good luck during small flood events. Even during small flood events, poor households are more likely to strengthen their homes before the flood, because their houses are simple and more vulnerable to storms and floods. In contrast, rich households build their homes on concrete stilts or foundations, so they are less likely to have to reinforce their homes before the floods.

Table 4. 7: Household coping behaviours during small flood events by socio-economic group (N=459)

Coping behaviours	**Socio-economic group**			**Total**
	Poor	**Medium**	**Better-off**	
N	181	132	148	
Send children to mobile kindergarten	1.66	0.76	2.05	1.53
Elevate the floor of domestic animal pens (ns)	1.10	0.00	2.05	1.09
Move to the high ground, safe places (school, pagodas) (ns)	2.76	0.76	2.05	1.96
Borrow money from formal credit providers**	3.87	14.39	16.44	10.89
Wait for public relief***	15.47	0.76	0.68	6.54
Seasonal migration ***	17.22	0.00	0.68	6.99
Go to religious sites to pray (ns)	13.81	8.33	6.90	10.04
Borrow money from informal credit providers***	21.55	7.58	4.11	11.98
Reduce the number of normal meals***	25.97	1.52	4.79	12.20
Borrow money and rice from neighbours***	41.99	5.30	5.48	19.83
Do not go fishing (ns)	27.62	27.27	19.86	25.05
Pray at home***	49.17	38.64	27.40	39.22
Elevate the floor above the annual flood level (ns)	10.50	3.79	7.53	7.63
Strengthen the house before the flood*	28.73	21.21	13.70	21.79
Stay at home to take care children (ns)	30.94	34.85	28.77	31.37

Note: Test of significant difference is based on chi-square, ***p<0.001, ** p<0.01 per cent; *p<0.05, ns is not significant

4.6 A comparison of household coping behaviours during three most common flood events

Household adaptation to floods is very diverse, from livelihood to evacuation, child protection, relief, seeking spiritual relief, and preparedness for different flood levels

(Table 4.8). However, households are more likely to respond to big floods than to moderate and small flood events. In particular, some 13.3 per cent of respondents move to the high ground or safer places to cope with floods, while only 4.1 per cent and 1.9 per cent do this in moderate or small floods. This is because medium and small floods are less likely to affect their homes, and their evacuation is less likely to occur in small and moderate flood events. Similarly, 49.3 per cent do not go fishing during the big flood, while 44.4 per cent and 25.0 per cent do not go fishing during moderate and small floods. In this situation, a low proportion of respondents do not go fishing during small flood events because there is less fish to catch. Therefore, they are likely to migrate to other non-flood areas to seek jobs.

Taking care of children is very important during the flood season. As discussed in the first chapter, most fatalities are children due to drowning. So, more respondents stay at home to look after the children during big floods (59.3 per cent) than during moderate floods (51.0 per cent) or small floods (31.3 per cent). This indicates that households are more prepared to protect children in big flood events.

More people borrow money and rice from neighbours and borrow from informal and formal credit providers in big floods than in moderate and small floods. In particular, 43.3 per cent of respondents stated that they have borrowed rice from neighbours during big flood events, while only 33.8 per cent and 19.8 per cent do so for moderate and small flood events respectively. Some 24.1 per cent of the respondents said they used informal credit in big flood events, whereas this is only 19.4 per cent and 11.9 per cent for moderate and small floods respectively.

In particular, more respondents wait for public relief, reduce normal meals and migrate seasonally, go to nearby religious sites to pray, reinforce the house before the flood season, and elevate the floor above the flood level in big flood events than in moderate and small flood events (Table 4.5).

Table 4. 8: A comparison of household coping behaviours by different flood events

Household coping behaviours (%)	Different flood events		
	Big flood	Moderate flood	Small flood
N	459	459	459
Move to the high ground, safe places (school, pagodas)	13.29	4.14	1.96
Do not go fishing	49.24	44.44	25.05
Stay at home to take care of children	59.26	51.00	31.37
Send children to mobile kindergartens	2.83	2.00	1.53
Borrow money and rice from neighbours	43.36	33.80	19.83
Borrow money from informal credit providers	24.18	19.40	11.98
Borrow money from formal credit providers	15.90	15.70	10.89
Wait for public relief	16.78	10.90	6.54
Reduce the number of normal meals	29.85	21.80	12.20
Seasonal migration	16.80	14.40	7.20
Go to nearby pagodas or religious sites to pray or worship	18.30	18.50	10.20
Pray at home	54.25	55.30	39.22
Strengthen the house before the flood season	56.43	42.00	21.79
Elevate the floor above the flood level after the flood season	55.12	19.20	7.63
Elevate the floor of domestic animal pens	12.42	3.50	1.09

4.7 Conclusion

Although people have lived in the flood prone regions in the MRD for many years, the existing knowledge about the perceptions of, and adaptation to, flood events is neglected in the existing literature. The findings of this study identify that people use various terms to talk about the water events in the MRD. Local people often call it the 'rising water season' or 'flood season' or 'water season'. The term 'rising water season' refers to the water season in the MRD and this is perceived as 'gentle', while the term 'flood' refers to a disastrous and disadvantageous event for rural livelihoods.

Additionally, local authorities and media are more likely to use the term 'flood' in government reports, and newspapers whereas most local people use the term 'water season'. This indicates that there exists a gap in the perceptions about the term 'flood' or 'water season' in the MRD. Such a misconception about water events may lead to the misuse of the floodplain resources.

Flood events can also be classified as 'early' or 'late' floods. This perception is relevant to people's perception of floods elsewhere, for example in Bangladesh (Paul 1984). A late or early flood is perceived to affect the local livelihoods differently. Both early and late floods are perceived to be 'not good' for local people because they affect livelihoods in various ways. An early flood may destroy the rice crop as farmers are less prepared for the flood. In 2000, the flood occurred two weeks earlier than usual (moderate), so many rice crop areas in An Giang and Dong Thap province were completely inundated and destroyed.

Local indicators of flood severity were obtained from local people. In contrast to the traditional perception of flood severity as magnitude and duration of the flood event, this study found that a flood which accompanies storms and high winds was perceived as the most severe. People worry about the occurrence of storms during the flood season that destroy their homes and disrupt their flood-based livelihoods. Importantly, this study found that the months of August and September were thought to be the most serious period for floods. This result confirms that preparedness activities should be undertaken before August and September. However, people in the heavy flood-prone region are more likely to experience serious floods in August, while they are perceived to be serious in September in the moderate flood-prone region. This indicates that people in the heaviest flood region may prepare for floods before August, but they do this before September in the moderate and low flood-prone regions.

The perception of flood depth also varies according to region, socio-economic group and gender. The depth of the flood is perceived to be larger in the heavy flood-prone area, and smaller in the moderate and low flood-prone regions. This information was relevant to the natural conditions of flood provided in scientific reports. However, poor people are more likely to see the flood depth as higher than in the medium and better-off groups. Females also see the flood depth as higher than male respondents.

Generally, local people use three common terms to express the magnitude of a water event: 'small flood or water season', 'moderate flood or water season' and 'big flood or water season'. This perception of three common flood regimes in the MRD leads to different coping behaviours by rural households.

Households use a wide range of coping behaviours to adapt to the different levels of the floods. In a big flood season, households are more likely to stay at home to take care of

children, reinforce the home, upgrade the house floor, and pray at home. However, poor households are more likely to evacuate to high ground, borrow money from neighbours and informal credit providers, wait for public relief, reduce meals, seasonally migrate, pray at home and reinforce their homes than other socio-economic groups in a big flood. These coping patterns are quite similar for the moderate flood events among these socio-economic groups. Importantly, poor households wait for public relief, migrate seasonally, and reduce their meals even during the small flood events.

Chapter 5

Socio-economic variations of flood impacts in the Mekong River Delta

"Nước nhỏ thì lo, nước vừa thì đẹp, nước nhiều thì khổ"

"A small flood is a worry; a moderate flood is beautiful, a big flood is miserable"

(Common saying in the MRD)

Mrs Nuoc, a poor landless woman living in Phu Xuan hamlet of Phu Duc commune, Tam Nong district, Dong Thap province, stayed several days in the roof of her simple house during the big flood in 2000. She reported that the flood season returns to this area every year. A big flood occurs once in several years, and it submerged her house, caused the deaths of children, killed animals in the community and forced her family and neighbours to evacuate urgently to higher ground *(gò Cao)*. She calls the big water event the 'big flood' because it brings hardship to her household and neighbours. She said that her husband could not catch fish during the high flood peak period because the high floodwater together with strong winds created risky waves that threatened fishermen's lives. Therefore, it was very dangerous to go fishing in the floodplain during the peak flood period because the strong wind may sink the tiny boat at any time, and would drown the fishermen. According to Mrs Nuoc, the peak of a moderate flood only inundates the harvested rice fields about 2.0 m which was less likely to submerge houses or disrupt rural livelihoods. So the moderate flood season is called the 'beautiful flood' because it brings more benefits than hardship to her household. Her husband can catch some fish to survive. However, the small flood season is also seen as an abnormal flood event because it affects rural households in different ways. Unlike the big flood events, the small flood does not threaten human lives or submerge or destroy houses, but it often causes loss of well-being for some social groups. Poor households worry that there would be no fish to catch for survival, but they are less likely to worry about damage to their houses during the small flood season. Better-off rice growers will be worse off because they have to pay more input costs for the winter-spring rice crop after the small flood, while gaining low rice yields (in-depth interview with Mrs Nuoc on 15th September 2010).

5.1 Introduction

Although the flood is seen as an annual event which is embedded in the social and ecological systems of the MRD, both a 'big flood' *(lũ lớn)* and a 'small flood' *(lũ nhỏ)*

are perceived as a 'shock' or 'stress' to some social groups in the flood-prone areas of the MRD. The extreme big flood events cause human losses (especially of children), house damage and crop losses, and force many families to evacuate temporarily during the flood months. I also have seen that a big flood brings fertile sediment that fertilizes the soil and as a result, farmers gain high yields from the winter-spring rice crop *(vụ lúa đông xuân)*. I also have seen that the small flood is not very useful for rice farmers and fishermen. In particular, the small flood brings less fish and sediment, lessening the opportunity for maintaining rural livelihoods during the flood months. Many poor households whose livelihoods rely on off-farm fishing during the flood months have to migrate out to other non-flood areas to seek new livelihoods in the small flood years. Interestingly, the moderate flood *(lũ vừa)* is perceived as the most beneficial one because it brings less harmful effects, but provides more benefits to rural populations.

People in the MRD have learnt to live with the floods for hundreds of years. People living there exploited the natural foods such as wild floating rice and fish from 17th to early 20th Centuries (Biggs 2003, Biggs et al. 2009, Võ Tòng Xuân and Matsui 1998). Floods also bring millions of tons of fertile sediment and wash away acid sulphate from the soils each year (MRC 2005). Recently, farmers have been able to use floodwaters for developing flood-based farming in the Plain of Reeds and Long Xuyên Quadrangle of the delta (Nguyen Van Kien 2008). However, misconceptions about living with floods have long existed at different social levels: at central government level, among local authorities, and local communities. In particular, central government and some local authorities underestimate the value of flood resources, so their policy response to the flood is to control it for agricultural development rather than adaptation. In particular, the government policies towards dike strengthening to control floodwater, implemented since 1996, changed the natural conditions of the delta by artificial canals and dikes (Biggs et al. 2009). Recently, the government issued a policy to expand 100,000 ha of the 'third rice crop'[36] during the flood season in the MRD (Thủ Tướng Chính Phủ (Prime Minister) 2011). This means that the areas with high dikes for controlling flooding have been expanding rapidly in the delta. In contrast, some local people perceive the floodwaters as resources for maintaining rural livelihoods. Floodwaters can be used for growing vegetables and raising fish and prawns to improve household income during the flood months.

[36] Usually, farmers grow the first rice crop from November to March, the second crop from July to August and the third crop from August to end of October.

Therefore, floods can be seen as a natural hazard or a natural resource depending on the flood characteristics and socio-economic conditions of the social system. In particular, the flood was often perceived as a natural disaster which caused loss of lives, animals, agriculture and properties (White 1945, 1964, 1974b, 1974a, Kates 1962, Mohapatra and Singh 2003). In Asia, many countries experience flood events annually. In India, millions of hectares of land and millions of people are affected by floods annually (Mohapatra and Singh 2003). Bangladesh is one of the most flood-prone countries in the world where flooding occurs every year (Chowdhury and Ward 2007). Brammer (1990: 164) found that the fertile silts can improve soil fertility by the fixation of nitrogen derived from the blue-green algae in the floodwater. The fertile silts deposited from floods assist productivity for agriculture (Brammer 1990, Cuny 1991, Paul 1984, Paul 1995, Paul 1997, Shaw 1989, Davar et al. 2001, Phóng Trần et al. 2008, Nguyễn Hữu Ninh et al. 2007). A normal flood *(barsha in Bengali)* is a resource for Bangladesh farmers, providing moisture for the fertile silt, and for fishing whereas an abnormal flood (*bonna Bengali)* which occurs once every few years and results from excessive rainfall. An abnormal flood is seen as a 'disaster', while a normal flood is considered to bring environmental and economic benefits (Blaikie et al. 1994).

Although floods are considered to bring both costs and benefits to societies, most research examines the negative impacts of the extreme flood events worldwide. In particular, the impacts of flood on human lives, housing, and agriculture are investigated (Lewis and Kelman 2009, Few and Pham Gia Tran 2010). Little is known about the socio-economic variations of the flood impacts of different flood regimes such as big, medium and small floods on a wide range of livelihood activities and assets by different socio-economic group and regional flood factors. Lebel et al. (2006: 3) argue that the impacts of catastrophic floods may be negative to most social groups, but different occupational groups may experience different impacts of normal flood regimes. Floods may be perceived as disastrous for the urban population, but they may provide benefits for rural people (Lebel et al. 2006). Recently, Phóng Trần et al. (2008:129) have argued that the poor are more likely than the well-off to lose houses and engage in livelihoods in risky conditions during the flood season. In the MRD, the flood is frequently a seasonal riverine flood event. The big or small floods often occur once every several years, while in most years the flood is 'moderate'. Different flood regimes have different effects on the livelihood activities and assets of different socio-economic groups and different flood-prone regions.

Regarding Mrs Nuoc's story at the beginning of this chapter, what are the impacts of floods on livelihood activities and assets of people living in flooded regions? What are the impacts of different levels of floods on different occupations, livelihood activities, different socio-economic groups, and in different flood-prone regions in the MRD? Using information obtained from the FGDs, in-depth interviews and a survey of 459 households in three flood-prone areas in the MRD, this chapter explores the complexity of flood impacts on the livelihoods of different socio-economic groups in the three most commonly-flooded regions (low, moderate and high) to argue that the impacts of floods vary by different livelihood activities and assets and the different socio-economic groups and regions.

In this chapter, firstly I will provide an in-depth discussion of the floods and socio-economic variations in flood impacts on household livelihood activities and assets. This chapter argues that the impacts are nuanced across different social groups. This chapter is divided into six parts. First, the general perception of flood impacts is reviewed, and presented in part two. The perceptions of the negative and positive impacts of big floods on household livelihoods are analysed and discussed in section three. Section four is about both the negative and positive impacts of moderate floods on household livelihoods. Section five is about the negative and positive effects of small floods on household livelihoods. The conclusion section is presented in section six.

5.2 Floods in the MRD: 'good' or 'bad' from livelihood perspectives?

The annual flood event in the MRD brings benefits on the one hand, but also creates disadvantages on the other hand, to rural communities and households. Different flood rhythms generate different impacts on households' livelihood activities and assets. The findings from the household survey indicate that respondents perceive both negative and positive impacts of the annual flood season, although some people have not experienced the big or the small floods. The finding confirms findings in the literature that the flood in the MRD has both costs and benefits (MRC 2005, Cuny 1991). However, the impacts are nuanced across various livelihood activities and assets of rural populations. The negative sides include the impacts on housing, health, property, crops, securing food and income during the flood season, job disruption, evacuation, interruption of education, and psychological effects such as anxiety. The flood also provides benefits to rice crops, off-farm fishing and other environmental services that support rural livelihoods. However, most people reported that big floods have greater negative

impacts, with fewer people experiencing negative impacts from moderate and small flooding. Interestingly, small levels of flooding were perceived to have slightly greater negative impacts on rural livelihoods than moderate flooding. It was found that 83.7 per cent of the respondents thought that big floods brought negative impacts, 55.7 per cent perceived the impacts of moderate flooding to be negative, whereas 58.3 per cent viewed small floods as having negative impacts (Figure 5.1). This finding indicates that a moderate flood is most favoured by local people and the community.

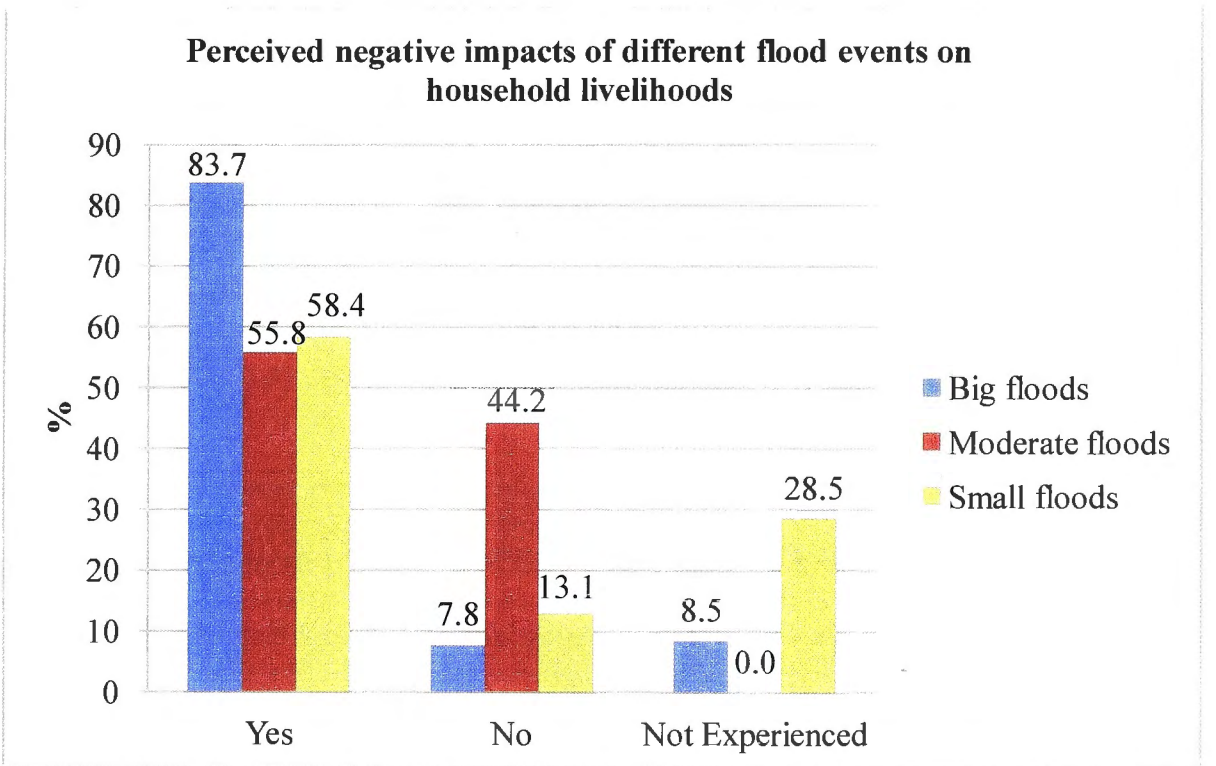

Figure 5. 1: Perceived negative impacts of different flood events on household livelihoods (N=459)

In contrast, annual flood events also provide benefits to rural livelihoods. The benefits of a big flood are distributed among various livelihood activities from rice farming to off-farm collecting and environmental services. In particular, 90.2 per cent of respondents perceived moderate floods to have benefits to their livelihoods; 84.7 per cent of respondents thought that big floods also provide benefits; while only 62.7 per cent of respondents pointed out the benefits of small floods (Figure 5.2). Significantly, the benefits of a small flood are slightly different from the big or moderate floods. The benefits of a small flood include more convenient local transportation, and less worry about house damage. In summary, moderate floods can be judged to be best for rural livelihoods because they bring more benefits and less harm to local people.

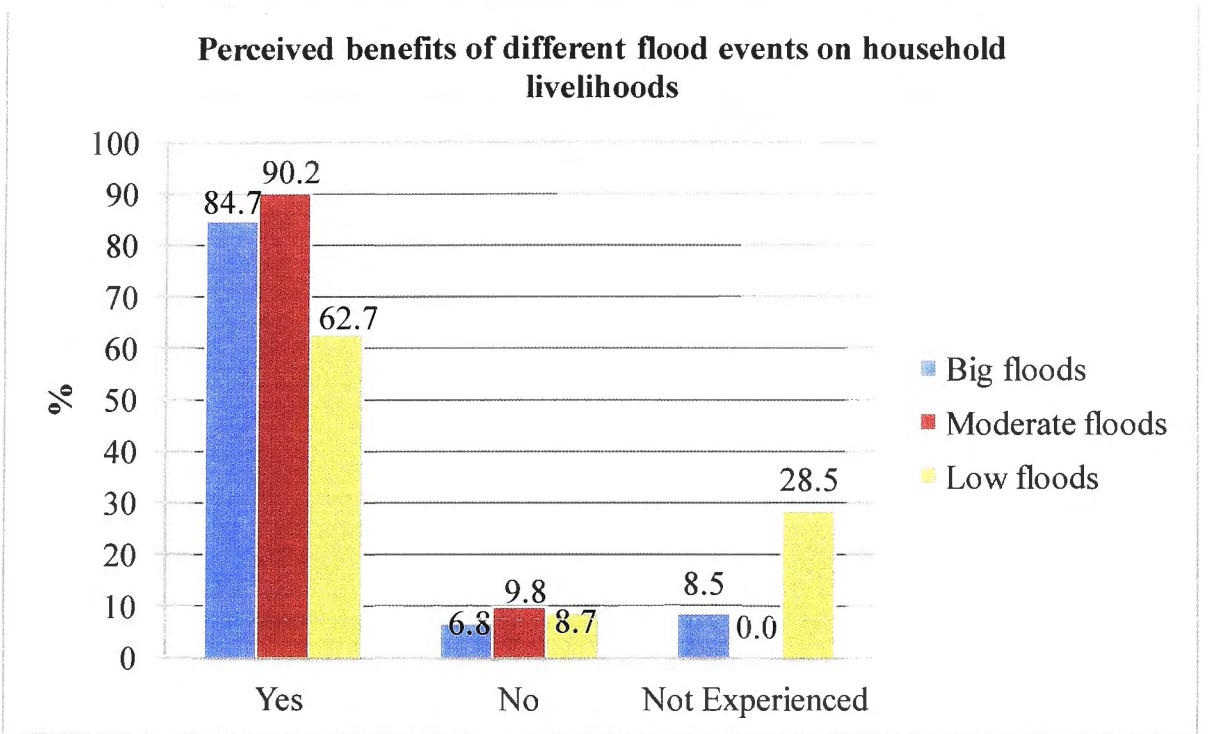

Figure 5. 2: Perceived benefits of different flood events on household livelihoods (N=459)

5.3 The perceived impacts of big flood events on households livelihoods

5.3.1 Perceived negative impacts of big flood events on household livelihoods

The negative impacts of big floods cover a wide range of livelihood activities and assets, from housing, food, income, anxiety, migration, and evacuation to education. However, more respondents experienced difficulties as a result of submerged houses, anxiety about flooding, a lack of rice to eat during the flood season, loss of jobs and destroyed houses. The results show 61.2 per cent of respondents reported that big floods submerge their homes; 60.5 per cent experienced anxiety; 46.4 per cent experienced a shortage of rice to eat during the flood season; 36.1 per cent lost their jobs; 28.5 per cent experienced the loss of their homes; 21.3 per cent experienced disruption to their education; 15.9 per cent lost crops; 15.4 per cent had to seek jobs in non-flooded areas; 13.7 per cent reported a reduced income from fishing in years with big floods; and 9.3 per cent had to evacuate during big floods. Around 5.0 per cent of respondents reported total destruction to their homes, deaths of animals, and adverse effects on prawn and fish farming from a big flood event (Figure 5.3).

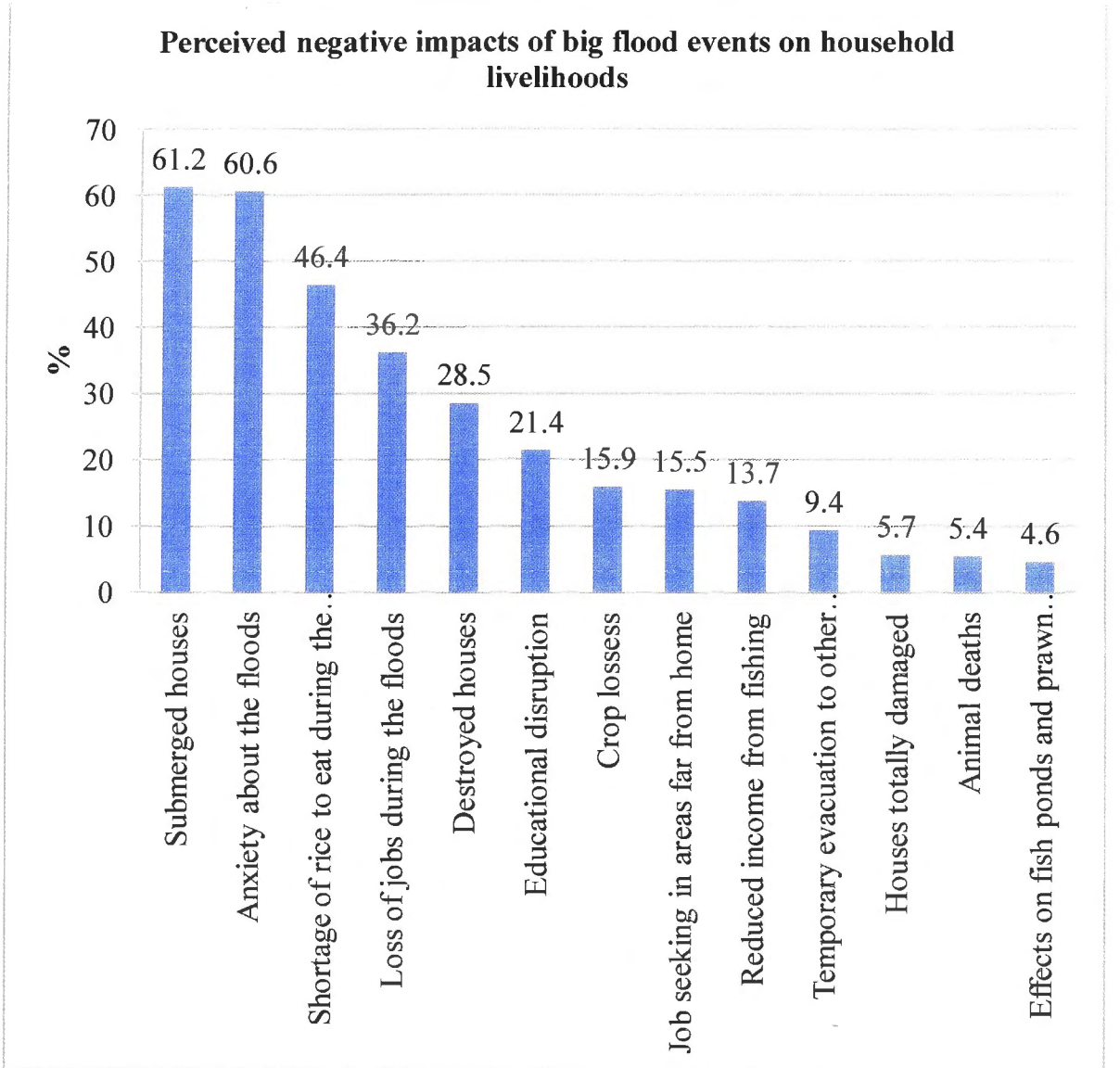

Figure 5. 3: Perceived negative impacts of big flood events on household livelihoods (N=459)

Qualitative data confirms that human health and safety during the flood season are the key concerns of most participants in twelve focus group discussions. The drowning of children is of critical concern for both male and female groups. Children were recognized as the most vulnerable group during the annual flood event, especially a big flood event (Nguyễn Hữu Ninh et al. 2007). Deaths of children were not directly caused by flood-related disease, but related to drowning due to lack of supervision from parents or carers. This issue was critically discussed by the local *An Giang* newspaper during the flood season in 1996. Many examples show that children drowned while their parents were doing housework, sleeping at night, and fishing on the floodplain (Figure 5.4).

TRẺ EM CHẾT VÌ LŨ - DO ĐÂU ?

Con lũ năm 1994 đã cuốn đi 188 sinh mạng (trong 134 trường hợp là trẻ em). Năm 1995, 71 sinh mạng (66 trẻ em) cũng đã ra đi cùng con lũ. Lũ lụt là năm nay, Thủ tướng Chính phủ, Chủ tịch UBND tỉnh đã chỉ đạo các địa phương không để xảy ra trường hợp trẻ em và người già chết vì nước lũ. Thế nhưng, đến ngày 14-10, đã có 26 người (với 23 trường hợp là trẻ em) bị thiệt mạng do nước lũ. Còn hơn tháng nữa mực nước trên các sông rạch, đồng ruộng mới trở lại mức bình thường. Sẽ có nhiều trẻ em thiệt mạng nếu bậc phụ huynh các em lơ là, thiếu cảnh giác.

Figure 5. 4: "Child mortality due to floods – why?"

Source: Article in An Giang Newspaper No 1272 on 19/10/1996

In focus group discussions conducted with residents of the three flood-prone localities, most children's deaths were reported during the highest and moderate flood events, while very few cases were identified for small flood events. Importantly, most people said that children's deaths were more likely to happen in households that are isolated in flood-prone fields. Most of them were poor as their parents had to work far from home to maintain household income and expenditure.

> Mr Canh, aged 41, a primary teacher, living in K9 hamlet, Phu Duc commune in FGD_PD02 said that children are the group most vulnerable to drowning during a big flood season. For example, in 2000, his house floor was submerged; he had to remove the wooden floor[37] to keep the house from being swept away by the flood waves. He, his wife and little son had to survive in the only bed. "We ate and slept, toileted ... on the bed". Suddenly, his little son fell into the floodwater underneath the floor. Luckily his father grabbed him in time. If he had not grabbed him, he would have been swept away by the strong waves.
>
> In the past many children drowned during the flood season. Because they lived in houses which were built on fragile stilts, even on the flood plain, without protective means, children easily drowned due to lack of supervision. For example, when parents cooked food, children played alone on the front balcony and they drowned accidentally. Children even drowned during their sleep. When parents awoke they found their children gone [Mrs Tho, aged 36, a poor woman, in Phu Xuan hamlet in FGD_PD03 on 12 January 2010].

[37] The floor is made of wooden boards. One board is 30 cm in width and 4.0 to 5.0 m in length.

> Drowning also occurs during fishing time. Last year, a couple went fishing, and placed their little son in the rear of the tiny boat. While they were absorbed in fishing, their son fell into the floodwater and drowned. After they noticed their son was gone, they could not find where he was. Three days later, people in K10 cannel found the dead body [Mr Phong, aged 35, a poor fisherman in Thanh Hoa hamlet in FGD_TMT02 on 8th January 2010].

The impact of big floods on housing is variable according to socio-economic group. A house is the most important livelihood asset of rural people. Vietnamese have a common proverb *(an cư lạc nghiệp)*: 'have a stable house to stabilize careers'. This proverb implies that if the house is not stable, the livelihood is unstable too. However, poor people are more likely to experience submerged homes ($p<0.05$), destroyed houses ($p<0.001$), and total house damage ($p<0.05$) than the medium and better-off households during big floods (Table 5.1). Of the 61.2 per cent of respondents who experienced submerged homes during a big flood, 71.8 per cent were poor households, 58.3 per cent were medium households and 50.6 per cent were better-off households. Similarly, of the 28.5 per cent of respondents who experienced destroyed houses, 45.3 per cent were poor households, 19.7 per cent were medium households, and 15.7 per cent were better-off households. Only 5.6 per cent of the respondents experienced complete house damage during the big floods; of these, 9.9 per cent were poor households, 5.3 per cent were medium households and just less than 1.0 per cent were better-off households.

Table 5. 1: Perceived negative impacts of big flood events on household livelihoods by socio-economic group

Negative impacts of big flood events (%)	**Socio-economic group**		
	Poor	**Medium**	**Better-off**
N	181	132	146
Submerged houses **	71.82	58.33	50.68
Anxiety about the floods (*ns*)	65.19	58.33	56.85
Shortage of rice to eat during the floods***	71.27	40.15	21.23
Loss of jobs during the floods**	46.96	28.03	30.14
Destroyed houses***	45.3	19.7	15.75
Educational disruption (*ns*)	23.2	18.18	21.92
Crop losses**	8.29	16.67	24.66
Job seeking in areas far from home***	25.97	8.33	8.9
Reduced income from fishing**	21.55	7.58	9.59
Temporary evacuation to other places**	16.02	4.55	5.48
Total house damage*	9.94	5.3	0.68
Animal deaths (*ns*)	3.87	6.06	6.85
Adversely affected fish pond and prawn farms (*ns*)	6.08	3.03	4.11

Note: Test of significant difference is based on Chi-Square, ***$p<0.001$, ** $p<0.01$; *$p<0.05$; ns is not significant

Poor households are the most vulnerable group in respect of the impacts of big floods on housing. Typically, most poor households live in small and simple houses along the canals without protective trees surrounding them, and they can easily be submerged, destroyed and swept away by strong flood waves, winds and storms (Figure 5.5). In contrast, most medium and better-off households have houses constructed on concrete stilts, which are less likely to be affected by big floods. In summary, housing is the factor most affected by big floods, but regarding this impact, poor households are the most vulnerable group.

Figure 5. 5: A simple[38] house of the poor (left) and a semi-concrete[39] house of the medium level households (right)

Source: Photo by Nguyen Van Kien (2010)

Information from focus group discussions shows that the impact of floods on houses varies among different social classes. Most of the respondents who experienced submerged and destroyed homes in the big flood of 2000 were poor. One female group in the moderate and high flood-prone regions reported that the floods of 1978 and 2000 destroyed many poor households in Phu Duc commune. Many houses were not completely destroyed, but they were submerged up to the floor or roof level. Whereas a big flood submerges the houses of the poor, it often destroys the structures and contents of the houses. People were worried about being in debt if they had to borrow credit for repairing their houses after a flood.

> Most houses in this village were submerged in the big flood in 2000. Most of the house walls were damaged. Because walls were made of simple materials such as water coconut leaves and melaleuca or eucalyptus wood, they were easily damaged in a big flood year. Many houses were washed from the other side of this canal to here in the 2000 flood [Mr Tien, aged 34,

[38] Simple houses are often built from local wood such as bamboos or eucalyptus trees.
[39] Semi-concrete houses are often built from both concrete and local wood.

> a poor man, president of youth union in Phu Xuan hamlet in FGD_PD01 on 12th January 2010].

However, housing was less likely to be vulnerable to the impacts of annual flood events if houses were moved to residential clusters[40]. People residing in residential clusters are confident that their homes would not be negatively affected by floods, as they were during the biggest flood in 2000.

> Now I have moved to a residential cluster so my house was not submerged by flood in recent years. In 2000, my house was located on the internal canal *(trong kênh nội đồng)*. When the flood submerged my house in 2000, I had to stay on the roof of the house *(cánh én)* for several days [Mrs Nuoc, aged 35, a poor woman, in Phu Xuan hamlet in FGD_PD03 on 12th January 2010].

Securing food during a big flood season is perceived as one of the most important indicators of coping with the flood. A big flood event often occurs over several months, which disrupts the income streams of some social and occupational groups. In total, 46.4 per cent of respondents experienced shortage of rice during the flood season, but the percentage were 71.2 per cent for poor households, 40.1 per cent for medium households, and 21.2 per cent for better off households ($p<0.001$) (Table 5.1). It is true that most poor households whose daily incomes rely on risky livelihoods (catching fish) during the flood season were more likely to experience food insecurity. If there are sudden strong winds or storms during the big flood season, their fishing activities may be disrupted for several weeks. This may lead to loss of income as a result of lacking money to purchase food for survival. However, the medium and better-off households are able to access food more easily as they have sufficient savings. Location within the flood zone also has a statistically significant impact on food insecurity. It is clear that respondents in the high flood zone were more likely to experience a shortage of rice to eat during the flood season. This can be explained by the fact that the flood lasts longer in the high flood region, so they experienced unemployment for a longer period than those in the moderate and low flood regions.

Anxiety during the floods is one of the psychological effects of flooding found in this study. People worried that their homes would be destroyed by the strong winds or giant

[40] A residential cluster is an artificially-built high ground area in which around 300 households reside. This is a part of the 'living with floods' program of the Vietnamese Government to relocate the poorest and most vulnerable households into the clusters permanently to avoid the impacts of annual flooding. Đặng Quang Tính and Phạm Thanh Hằng (2003) *Living with flood in the Mekong River Delta of Vietnam*, Hà Nội: Department of Dike Management, Flood and Storm Control, Ministry of Agriculture and Rural Development, Socialist Republic of Vietnam.

flood waves during a big flood season. Up to 60.5 per cent of the respondents reported experiencing anxiety during the flood season. However, there is no statistically significant difference between the different socio-economic groups. This shows that when a big flood occurs, both poor and non-poor households worry about the risk of inundation. In particular, they often worried that their houses would collapse due to the strong winds and flood waves, or that their children would drown when parents went out to work or even during sleeping time. The following quote from an in-depth interview with a key informant in the high flood prone region illustrates such feelings about big floods.

> When the big flood season comes, my family members and I cannot sleep well during the peak flood period. We worry that our house could be destroyed any time during the flood season [Mrs Lien, aged 25, a poor woman in Phu Xuan hamlet in FGD_PD03 on 12th January 2010].

In the natural hazard literature review in section 5.1, the agricultural sector was considered as most sensitive to flood risk. In this context very few respondents (15.9 per cent) experienced crop losses due to a big flood in the past 20 years. However, there is a statistically significant difference in experience of crop losses by socio-economic group ($p<0.05$) (Table 5.1). In particular, 24.6 per cent of better-off households experienced rice crop losses, while 16.6 per cent of medium households and only 8.2 per cent of the poor experienced such losses. The reason for this difference is that most poor households are landless or own little land, so a very low proportion of them experienced the impacts of big floods on the summer-autumn rice crop. When big floods occur over a long period of time, poor people are the most vulnerable group due to the extent of damage to their homes and the loss of income they suffer. Additionally, more poor households experienced loss of income from fishing and agricultural labour than medium and better-off households in a big flood year ($p<0.001$) (Table 5.1). Around 5.0 per cent of respondents experienced animal deaths or adverse effects on fish farming due to big floods; however, there is no statistically significant difference in animal deaths and adversely affected fish and prawn farming by different socio-economic groups.

Evacuation and seasonal migration during the big flood season are moderate concerns of the respondents. However, poor people were more likely to experience temporary evacuation and seasonal migration during the floods compared with the medium and better-off households (Figure 5.4). The livelihoods of the poor are totally dependent on

daily agricultural wage labour and off-farm fishing, which are sensitive to the impacts of the big floods. Educational disruption is one of the biggest concerns for people in the flood prone areas; however, there was no statistically significant difference between different social groups. The explanation for this is that when a big flood submerged roads and schools, all children had to stop studying for a while. The educational disruption in this context refers to short-term seasonal disruption rather than long-term effects of flooding on school drop-outs between the different socio-economic groups.

Regional flood characteristics are one of the important determinants of flood impacts. As Neto (2001: 285) states, the environmental characteristics of the flooded area are one of the determinants of vulnerability to floods. The impact of big floods on housing is significant among different regions (Table 5.2). In particular, respondents who live in a high flood-prone region are more likely to experience submerged houses ($p<0.001$); destroyed houses ($p<0.001$), and total house damage ($p<0.001$). Qualitative information also confirms that the impacts of big floods vary among different flood-prone regions. The impact of big floods on housing was perceived as being more serious in the high and moderate flood-prone regions than in the low flood-prone area. The flood in 2000 submerged and destroyed many houses in Phu Duc and Thanh My Tay communes, whereas it just inundated house floors by several centimetres (cm) in the Trung An commune for several days. The damage caused by the 2000 flood on the housing sector in Phu Duc and Thanh My Tay communes was significantly greater than that in the Trung An commune. The following story illustrates the impacts of the big flood on housing by a key informant in the low flood-prone region.

> The water season in 2000 was big, but just submerged the school floor and some houses in the Trung An commune. The water level was lower than the road [Mr Binh, aged 24, a better-off male farmer living in Thanh Loc 2 hamlet in FGD_TA02 on 31st December 2009].

> The big flood in 2000 caused severe damage to houses located along the river bank. Some houses were submerged up to the roof. Rural people here had to move to the front road as a shelter for evacuation. We ate and toileted in the same place [Ms Vet, aged 44, a poor female farmer living in K9 Hamlet in FGD_PD04 on 11th January 2010].

Table 5. 2: Perceived negative impacts of big flood events on household livelihoods by region

Negative impacts of big flood events (%)	Flood region		
	High	Moderate	Low
N	150	159	150
Submerged houses***	78.67	57.86	47.33
Anxiety about floods***	73.33	65.41	42.67
Shortage of rice to eat during the floods***	64.67	42.77	32.00
Loss of jobs during the floods***	45.33	32.08	31.33
Destroyed houses***	47.33	22.64	16.00
Educational disruption***	24.00	20.75	19.33
Crop losses***	20.00	22.01	5.33
Seeking jobs in other areas far from home***	16.67	22.64	6.67
Reducing income from fishing***	16.67	18.87	5.33
Evacuating temporarily to other places***	18.67	5.66	4.00
Completed house damage***	10.67	5.03	1.33
Animal deaths***	8.00	3.77	4.67
Affected fish pond and prawn farms***	10.67	2.52	0.67

Note: Test of significant difference is based on Chi-Square, ***p<0.001, ** p<0.01; *p<0.05; ns is not significant

5.3.2 Perceived benefits from big flood events to household livelihoods

Big floods also bring several benefits to rural households in the MRD (Figure 5.6). A high percentage of respondents (84.7 per cent) reported benefits as a result of big flood events. Of them, 69.5 per cent thought that big floods kill rats and mosquitoes. Rats are pests for rice farmers: the rice damage due to rats was sometimes perceived as more serious than the losses due to the flood impacts. Rice farmers also reported that they gained good yields after each big flood season (51.6 per cent). Nearly half of respondents asserted that a big flood event helped them to reduce input costs for the winter-spring rice crop (46.4 per cent). As a big flood often brings fertile sediments and fresh water to replenish the soil, and kills pests, so farmers perceived that they gained good yields after each big flood thanks to those free environmental services from the floodwaters. One benefit of a big flood is to improve fish yields from off-farm collecting during the big flood season (42.2 per cent); it allows them to take leisure time during the flood season (41.3 per cent). Although it was difficult to catch fish during the big flood peak period, there were more fish to catch afterwards. Very few respondents mentioned the benefits of a big flood with regards to collecting snails and crabs (10.0 per cent), or farming fish and prawns (5.0 per cent) and ducks (4.7 per cent). Because the big flood often brings giant waves, it brings hardship to farming activities such as prawn or fish farming. So, fewer people perceived that it brings significant benefits to

them. Rice farming and off-farm fishing were perceived as benefitting them the most from a big flood event.

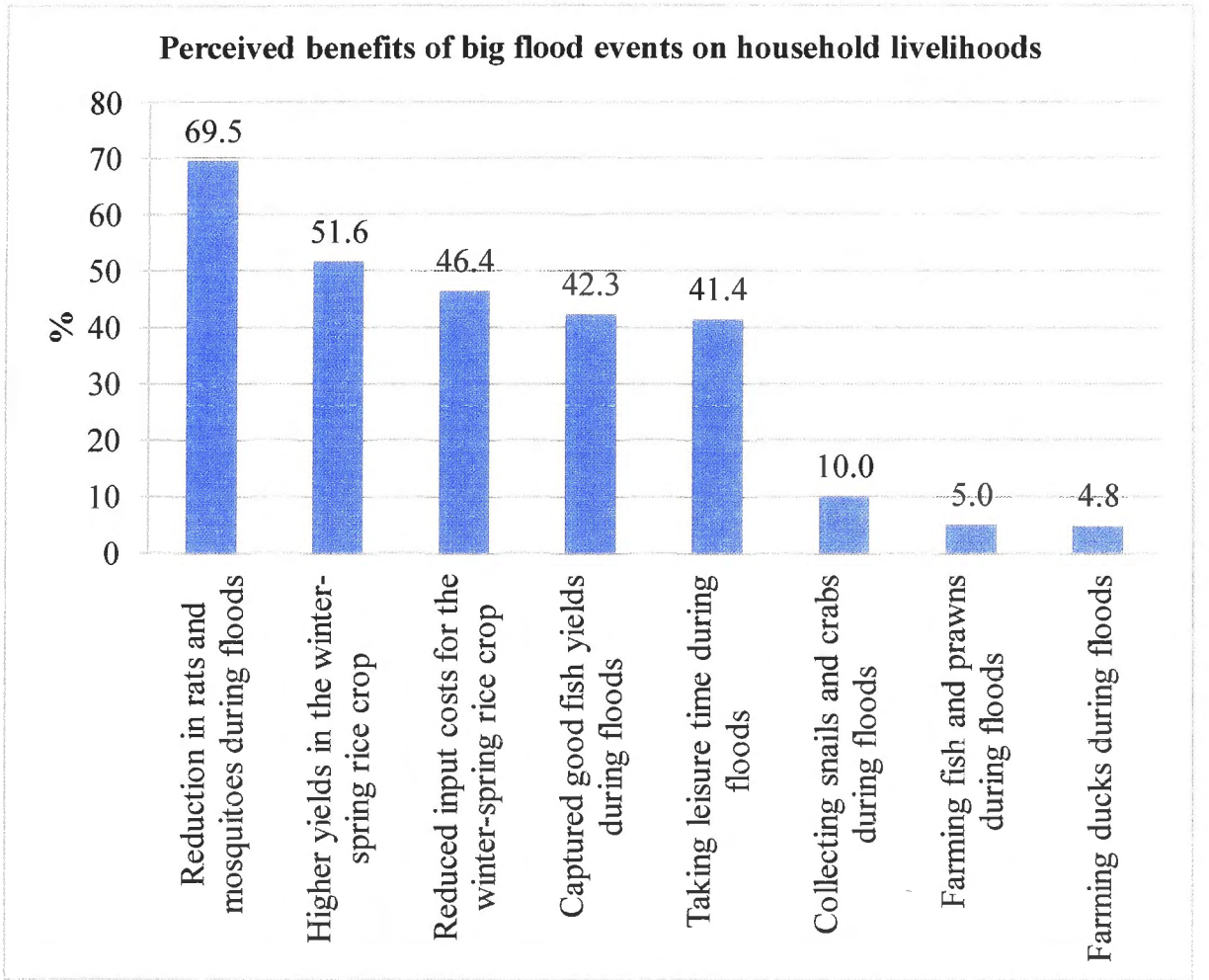

Figure 5. 6: Perceived benefits of big flood events to household livelihoods (N=459)

The benefits of a big flood event are variable among socio-economic groups (Table 5.3). Better-off households and medium households are more likely to benefit from a big flood than poor households in terms of improving rice yield as well as reducing the input costs for the winter crop, while poor households are more likely to benefit from off-farm collecting. The chi-square test shows that according to social class there is a statistically significant difference in the perceived benefits of a big flood on the following: gaining a high yield after a flood ($p<0.001$); reducing input costs for the winter-spring rice crop ($p<0.001$); taking leisure time during the flood ($p<0.001$); and reducing the number of rats and mosquitoes during the flood ($p<0.05$) (Table 5.3). For rice farmers, the big flood is perceived as 'good' because it brings fertile sediment, kills pests, weeds and rats which are 'beneficial' for the rice crop. Farmers can reduce inputs and costs by a large amount thanks to a reduction in application of fertilizer, pesticides

and insecticides to kill rats, pests and weeds. From field observations, in-depth interviews, and FGDs with local farmers, it was found that farmers often gain good rice yields in the big flood year. In contrast, poor households experienced more benefits of a big flood as 'good' for collecting crabs and snails than medium and better-off households ($p<0.05$). This means that poor households were more likely to engage in off-farm fishing and collecting activities, so they were more likely to perceive such benefits. Interestingly, better-off households were more likely to report that a big flood gave them the benefit of taking leisure time, while poor and medium households were busier during the flood season because they have to work harder in order to survive.

Table 5. 3: Perceived benefits of big flood events to household livelihoods by socio-economic group

Benefits of big flood events (%)	**Socio-economic group**		
	Poor	**Medium**	**Better-off**
N	181	132	146
Reduction in rats and mosquitoes during floods**	59.67	76.52	75.34
Higher yields in the winter-spring rice crop***	17.68	68.94	78.08
Reduced input costs for the winter-spring rice crop***	14.36	63.64	70.55
Good captured fish yield during the floods (ns)	44.75	42.42	39.04
Taking leisure time during floods***	28.73	40.91	57.53
Collecting snails and crabs during floods*	14.92	10.61	3.42
Farming fish and prawn during floods (ns)	6.08	4.55	4.11
Farming ducks during floods (ns)	4.97	6.82	2.74

Note: Test of significant difference is based on Chi-Square, ***$p<0.001$, ** $p<0.01$; *$p<0.05$; ns is not significant

In terms of regional flood factors, generally people in the high flood-prone region were more likely to gain benefits from big floods than those living in the moderate and low flood region although they also experienced greater negative impacts ($p<0.001$) (Table 5.4).

However, qualitative information confirms that a big flood may not be good for fishermen as it is often accompanied by strong winds and giant waves which disrupt fishing activities during the flood season. For example, there were two flood peaks in the flood of 2000. Each peak period lasted for twenty days, so fishermen just stayed at home. Those fishermen were poor, so the disruption of their income for several days was a huge burden for them.

> According to Mr Moi, rice farmers gain good yields after a big flood season. However, rural lives are too difficult because it is hard to make

money during the big flood season. The big flood has negative effects on animal rearing as well. In 2000, the flood water swept away his only 'mother pig' even though he had put her on land above the flood level. Many houses were swept away from the other side of the canal to here. It is miserable in such big flood years. If there were not big floods, local people would be happier in this area [a better off farmer in Phu Xuan hamlet in FGD_PD01 on 12th January 2010].

If there were big floods in this area, I would be happier. I would not worry about my house being destroyed by such floods. However, a big flood brings good yields for rice farmers [Mrs Thi, aged 38, a poor woman living in Phu Xuan hamlet in FGD_PD03 on 12 January 2010].

The big flood is not good. In 2000, many chickens and ducks were killed by the flood. A moderate flood is good, but we cannot do anything during the big flood. Big floods swept away the fishing nets. If fishermen are interested in fishing during storms, the giant flood waves may drown them any time and take the nets away [Mr Hoa, aged 54, a fisherman, living in Thanh Hoa hamlet in FGD_TMT02 on 8th January 2010].

Table 5. 4: Perceived benefits of big flood events to household livelihoods by region

Benefits of big flood events (%)	**Flood region**		
	High	**Moderate**	**Low**
N	150	159	150
Lessening rats and mosquitoes during the floods***	84.00	67.30	57.33
Gaining high yields in the winter-spring rice crop***	58.67	47.80	48.67
Reducing input costs for the winter-spring rice crop***	52.67	42.14	44.67
Good captured fish yield during the floods ***	62.00	32.08	33.33
Taking leisure time during the floods***	42.67	38.99	42.67
Collecting snails and crabs during the floods***	13.33	10.06	6.67
Farming fish and prawn during the floods***	8.67	3.77	2.67
Farming ducks during the floods***	6.67	4.40	3.33

Note: Test of significant difference is based on Chi-Square, ***p<0.001, ** p<0.01; *p<0.05; ns is not significant

5.4 The perceived impacts of moderate flood events on household livelihoods

A moderate flood is perceived as 'a beautiful flood' because it not only brings fish for fishermen to catch, but also brings fertile silt for rice farmers to assist them to gain good yields after each flood season. Moderate floods can submerge the rice straw and weeds, so there are no places for rats and insects to survive. Farmers can apply less fertilizer, pesticide and herbicide to the rice crop in the moderate flood years. The moderate floods bring fewer giant waves and strong winds during the peak periods, so fishermen can fish safely throughout the flood season.

> A moderate flood is good for landless poor households like mine because we can catch fish for survival during the flood season. Moderate floods are also good for rice farmers because weeds and pests can be swept away by such floods [Mrs Vet, aged 44, a poor woman living in Phu Xuan hamlet in FGD_PD04 on 11th January 2010].
>
> In the moderate flood years, I can catch fish and earn about 30 or 40,000 VND. During the flood season, a fisherman can earn money from fishing from August to October [Mr Hoa, aged 54, a fisherman, living in Thanh Hoa hamlet in FGD_TMT02 on 8th January 2010].
>
> The 'water season' is good for the poor people in this area. For poor people, the water season is considered as the 'income season' *(mùa thu nhập)*. Moderate water is good but too much water makes it too difficult to catch fish. If there is a low water season, poor households find it very difficult because there are no fish to catch. So they have to go to Binh Duong[41] province to seek temporary jobs for survival during the water season [Mr Nho, aged 37, a medium rice farmer living in Ba Xua hamlet in FGD_TMT1 on 7th January 2010].

5.4.1 Perceived negative impacts of moderate flood events on household livelihoods

Moderate flooding has fewer negative impacts on household livelihoods in general compared with high floods. However, worrying about a shortage of rice to eat, anxiety about floods, and job losses during the flood season were the most frequently stated negative effects perceived by respondents (Figure 5.7). Out of some 55.7 per cent who said they had experienced negative impacts of moderate floods in their lives, a total of 30.3 per cent had experienced a shortage of rice during flooding. An explanation for this high figure is that the flood season lasts for several months, so some households may experience joblessness. As a result, they lack the money to purchase rice to eat. Interestingly, fewer people had experienced anxiety (28.3 per cent). The most notable source of anxiety is worry about the house being affected by the floods, and daily income and job disruption. Up to 23.0 per cent of these people had suffered job loss and about 17.0 per cent had experienced disruption to fishing; 11.5 per cent experienced destroyed homes and 11.7 per cent had experienced submerged homes (Figure 5.7). Those are important livelihood assets and activities of rural people in the flood-prone areas. If any one of them is affected negatively by a flood event, their livelihood becomes difficult. Significantly, none of the respondents had experienced total house damage as a result of moderate flooding. Very few respondents (just under 5.0 per cent)

[41] Binh Duong Province is an industrial zone located to the Northeast of Ho Chi Minh city which attracts thousands of unskilled labourers. When people said they 'go to Binh Duong', they migrate to the industrial zones to look for work.

experienced crop losses, evacuation, animal deaths, seasonal migration or educational disruption during a moderate flood season.

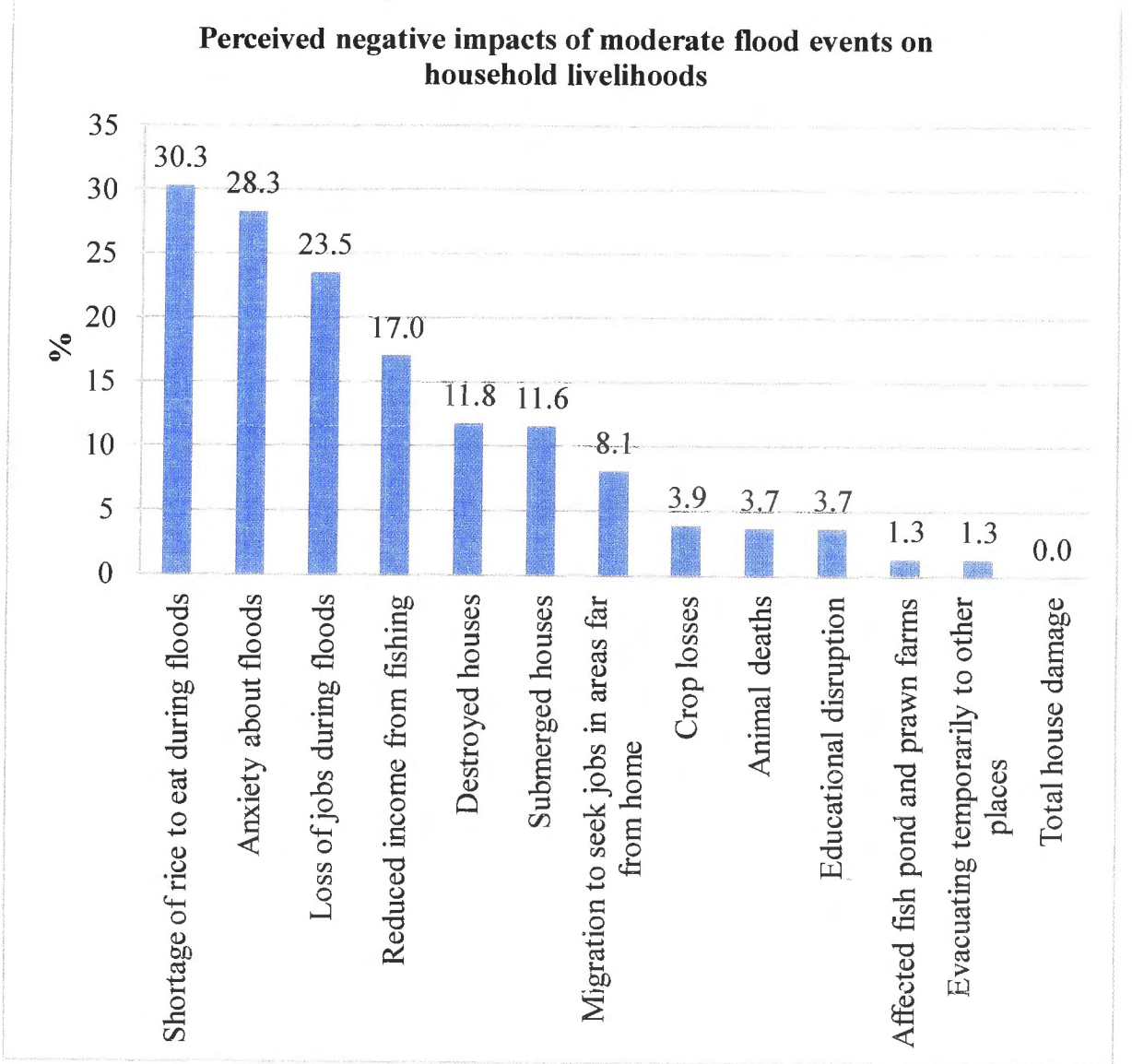

Figure 5. 7: Perceived negative impacts of moderate flood events on household livelihoods (N=459)

Although moderate flooding was perceived to have fewer negative impacts on rural households' livelihoods than a big flood event, poor households were still more likely to experience the following: a shortage of rice during the flood season ($p<0.001$); anxiety about floods ($p<0.001$); job losses ($p<0.001$); losses in fishing income ($p<0.05$); submerged houses ($p<0.001$); and destroyed homes ($p<0.001$) (Table 5.5). In particular, some 20.9 per cent and 21.5 per cent of the poor households experienced submerged houses and destroyed houses, respectively, while around 11.1 per cent to 17.0 per cent of medium and better-off households experienced such impacts on housing. None of the respondents experienced total house damage. There were no statistically significant crop

losses, animal deaths, or losses nor adversely affected fish ponds or prawn farming among the three social groups as a result of moderate flooding.

Table 5. 5: Perceived negative impacts of moderate flood events on household livelihoods by socio-economic group

Negative impacts of moderate flood events (%)	**Socio-economic group**		
	Poor	**Medium**	**Better-off**
N	181	132	146
Submerged houses***	20.99	4.55	6.16
Anxiety about floods***	44.20	18.94	17.12
Shortage of rice to eat during the floods***	64.64	12.12	4.11
Loss of jobs during the floods***	35.36	12.88	18.49
Destroyed houses***	21.55	6.82	4.11
Educational disruption**	6.08	0.00	4.11
Crop losses (ns)	2.76	2.27	6.85
Migration to seek jobs in areas far from home***	18.78	1.52	0.68
Reduced income from fishing**	24.86	9.85	13.70
Temporary evacuation to other places (ns)	2.76	0.00	0.68
Total house damage	0.00	0.00	0.00
Animal deaths (ns)	3.31	3.03	4.79
Effects on fish ponds and prawn farms (ns)	1.10	0.76	2.05

Note: Test of significant difference is based on Chi-Square, ***$p<0.001$, ** $p<0.01$; *$p<0.05$; ns is not significant

Again, people in the high flood-prone region were more likely to experience the negative impacts of moderate floods than those living in the moderate and low-flood regions in respect of most household livelihood activities and assets (Table 5.6).

Table 5. 6: Perceived negative impacts of moderate flood events on household livelihoods by region

Negative impacts of moderate flood events (%)	Flood region		
	High	**Moderate**	**Low**
N	150	159	150
Submerged houses***	20.00	8.81	6.00
Stress due to worried about floods***	42.00	24.53	18.67
Shortage of rice to eat during the floods**	40.67	22.01	28.67
Loss of jobs during the floods**	28.00	13.21	30.00
Destroyed houses***	20.67	9.43	5.33
Educational disruption (ns)	5.33	2.52	3.33
Crop losses**	5.33	6.29	0.00
Seeking jobs in other areas far from home**	10.67	11.32	2.00
Reducing income from fishing**	24.00	10.06	17.33
Evacuating temporarily to other places (ns)	2.00	1.26	0.67
Completed house damage	0.00	0.00	0.00
Animal deaths*	7.33	2.52	1.33
Effects on fish ponds and prawn farms (ns)	2.00	1.26	0.67

Note: Test of significant difference is based on Chi-Square, ***p<0.001, ** p<0.01; *p<0.05; ns is not significant

5.4.2 Perceived benefits of moderate flood events to household livelihoods

Moderate floods still bring fertile sediment and kill insects, providing a good environment for rice farming. Importantly, most respondents perceived fewer rats and mosquitoes (60.1 per cent). The second notable benefit from moderate floods was a gain in rice yields (51.4 per cent), followed by more leisure time (42.3 per cent), reduced input costs (41.6 per cent), increased yields from fishing during the floods (33.6 per cent), increased collecting of snails and crabs (12.4 per cent), better duck farming (7.6), and convenience for prawn and fish farming (6.1) (Figure 5.8).

Mosquitoes were perceived as a serious environmental health problem for rural people. However, a moderate flood can stop the breeding of mosquitoes which is good for rural people. Notably, a moderate flood is a good season for collecting fish since fishermen can catch fish all through the season. It is also a suitable time for farming fish and prawns as well. Some people also thought that the moderate flood is good for duck farming because ducks can eat the remaining rice as well as snails in the paddy fields. If the flood water is high, it is very hard for ducks to do this. Farmers consequently can reduce input costs for duck farming.

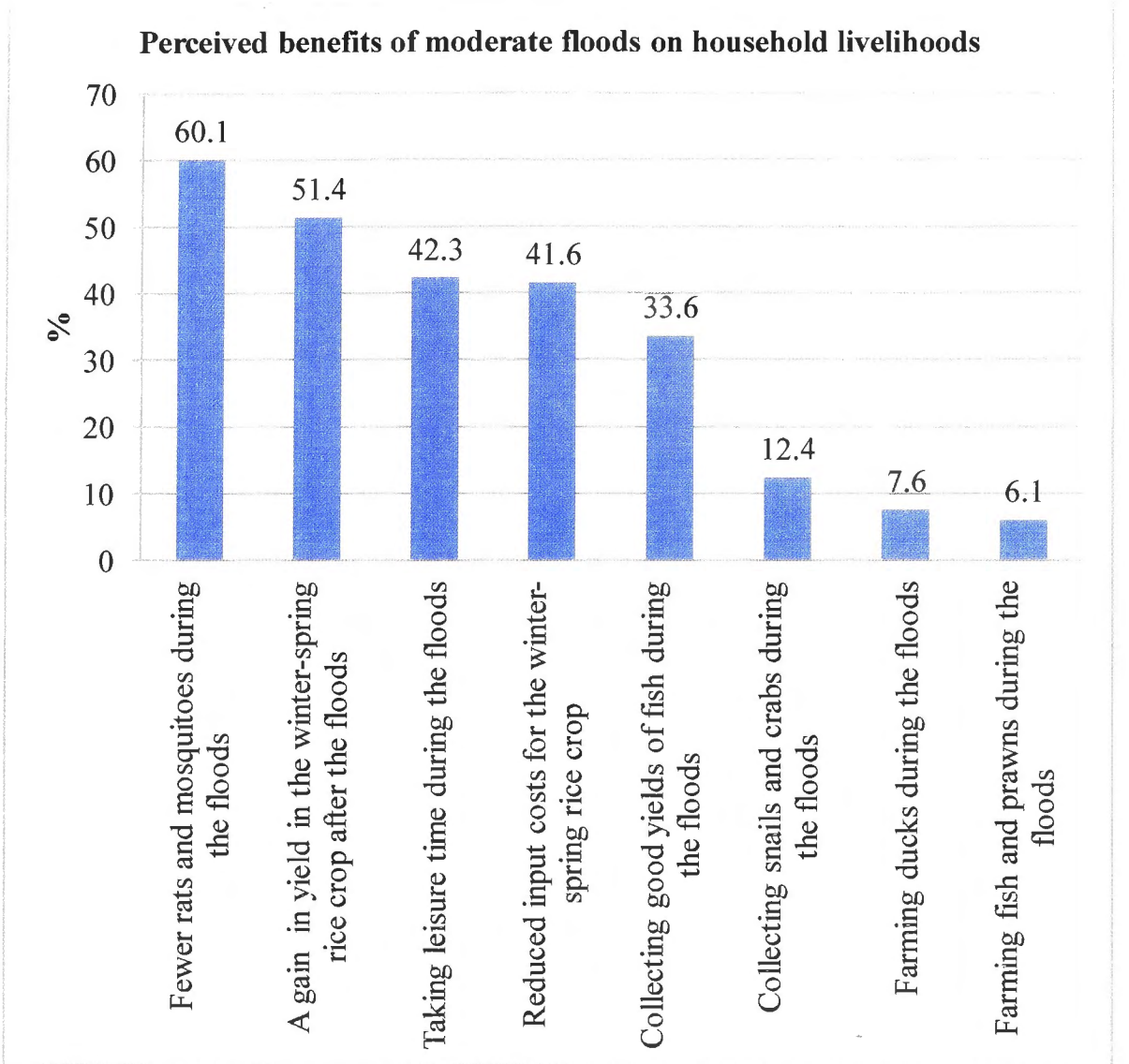

Figure 5. 8: Perceived benefits of moderate flood events to household livelihoods (N=459)

Similar to the benefits of big floods to household livelihoods, better-off households were more likely to benefit from these environmental advantages of moderate floods than medium and poor households (Table 5.7). In total 51.4 per cent of respondents perceived that moderate floods bring good yields for the winter-spring rice crop; 81.5 per cent for better-off households, 68.1 per cent for medium households and just 14.9 per cent for poor households ($p<0.001$). A higher proportion of better-off households reported that moderate floods reduced input costs compared with medium and poor households ($p<0.001$). Taking leisure time during the flood was more often perceived as a benefit by the better-off group (58.9 per cent), compared with medium households (40.9 per cent) and poor households (29.8 per cent) ($p<0.05$). However, more poor households engaged in catching fish, so they are more likely to experience such benefits than the medium and better-off households ($p<0.05$). It can be concluded that the poor

and medium households work harder than the better off households during the flood season. Qualitative data confirms that the moderate flood season is good for the poor because it enables them to earn money from off-farm fishing and collecting.

> Mr Nho, aged 37, 3 years in school living in Ba Xua hamlet, Thanh My Tay commune, Chau Phu district, said that rich people are less likely to go fishing during the water season while poor people need to work every day to earn money for surviving [In-depth interview with Mr Nho on 25th October 2010].

Table 5. 7: Perceived benefits of moderate flood events to household livelihoods by socio-economic group

Benefits of moderate flood events (%)	**Socio-economic group**		
	Poor	**Medium**	**Better-off**
N	181	132	146
Fewer rats and mosquitoes during the floods (ns)	54.70	67.42	60.27
A gain in yield in the winter-spring rice crop***	14.92	68.18	81.51
Reduced input costs for the winter-spring rice crop***	13.81	56.06	63.01
Collecting good yields of fish during the floods**	40.88	37.12	21.23
Taking leisure time during the floods***	29.83	40.91	58.90
Collecting snails and crabs during the floods*	17.13	12.88	6.16
Farming ducks during the floods (ns)	7.18	9.85	6.16
Farming fish and prawn during the floods (ns)	7.18	6.06	4.79

Note: Test of significant difference is based on Chi-Square, ***p<0.001, ** p<0.01; *p<0.05; ns is not significant

Among eight of recognised benefits for the moderate floods, five differ significantly between the different regional flood areas. In particular, more respondents in the high flood-prone region report that the moderate floods have the beneficial effect of lessening mosquitoes and rats ($p<0.005$). This shows that the moderate flood level in the high flood-prone region is still much higher than that in the moderate and low flood-prone region. Collecting good yields of fish is more frequently perceived as a benefit of moderate floods by people in the high flood-prone region. Since the moderate flood level is higher in the high flood-prone region than in the low and moderate ones, fishermen may catch more fish in that region. However, most people in the low flood-prone region enjoyed the flood season for resting rather than working in the fields ($p<0.05$) (Table 5.8). In contrast, more people in the high flood prone region benefit from collecting snails, crabs, and farming fish during moderate floods than those in the low and moderate flood-prone region ($p<0.05$).

Table 5. 8: Perceived benefits of moderate flood events to household livelihoods by region

Benefits of moderate flood events (%)	Flood region		
	High	Moderate	Low
N	150	159	150
Lessening rats and mosquitoes during the floods**	68.67	55.97	56.00
Gaining high yields in the winter-spring rice crop (ns)	51.33	51.57	51.33
Reducing input costs for the winter-spring rice crop (ns)	43.33	43.40	38.00
Collecting good yields of fish during the floods**	44.67	30.19	26.00
Taking leisure time during the floods**	37.33	38.36	51.33
Collecting snails and crabs during the floods**	16.67	13.21	7.33
Farming fish and prawns during the floods**	10.67	3.14	4.67
Farming ducks during the floods (ns)	6.67	10.69	5.33

Note: Test of significant difference is based on Chi-Square, ***p<0.001, ** p<0.01; *p<0.05; ns is not significant

5.5 The impacts of small flood events on household livelihoods

5.5.1 Perceived negative impacts of small flood events on household livelihoods

In contrast, a small flood is perceived as 'not good' for rice farmers because it does not bring enough fertile sediment into the rice fields. In such low flood years, the peak of floodwaters only submerges the rice straw and does not kill weeds, rats and pests and the water colour is very clear[42] (Figure 5.9). As a result, less fertile sediment is deposited in the rice fields, but the rats, pests and weeds still need to be controlled. Farmers are consequently more likely to apply more chemical fertilizers and pesticides to the rice crop in the small flood years. The existence of pest and rats is a big burden for rice farmers because they have to spend more on pesticides to safeguard their crops. Consequently, rice farmers are worse off in the small flood years. In addition, the small flood prevents fish entering the rice fields, so fishermen lose income from daily fishing activities and are worse off in such flood years.

[42] The clear water shows that there is little fertile sediment in the water. If the water is brown, it indicates more sediment being brought into the rice fields [in-deph interview with Mr Dat in Thanh My Tay commune on 25th October 2010].

Figure 5. 9: Small flood at Phu Xuan hamlet, Phu Duc commune, Tam Nong district, Dong Thap province

Source: Nguyen Van Kien (2010)

> Most people worry about a low water season occurring in this area because the low water brings less fertile sediments. Consequently, rice farmers are worse off because they have to spend more for rice farming. Poor people who rely on fishing are also worse off because there is no fish to catch [Mr Hai, aged 61, a president of farmer association, living in Thnh Loi 1 hamlet in FGD_TA01 on 30th December 2009].

The results from the household survey indicate that a total of 58.3 per cent of respondents experienced negative impacts from small floods. Some 44.8 per cent thought that small floods bring more rats; 44.2 per cent reported an increase in mosquitoes; 31.1 per cent reported an increase in input costs for the winter-spring rice crop; 29.1 per cent experienced an increase in winter crop pests; 28.1 per cent suffered from a reduced income from fishing; and 26.8 per cent said they had suffered reduced yields from the winter-spring rice crop. Fewer than 5.0 per cent reported that small floods had affected their agricultural labouring activities and fishing and prawn farming (Figure 5.10).

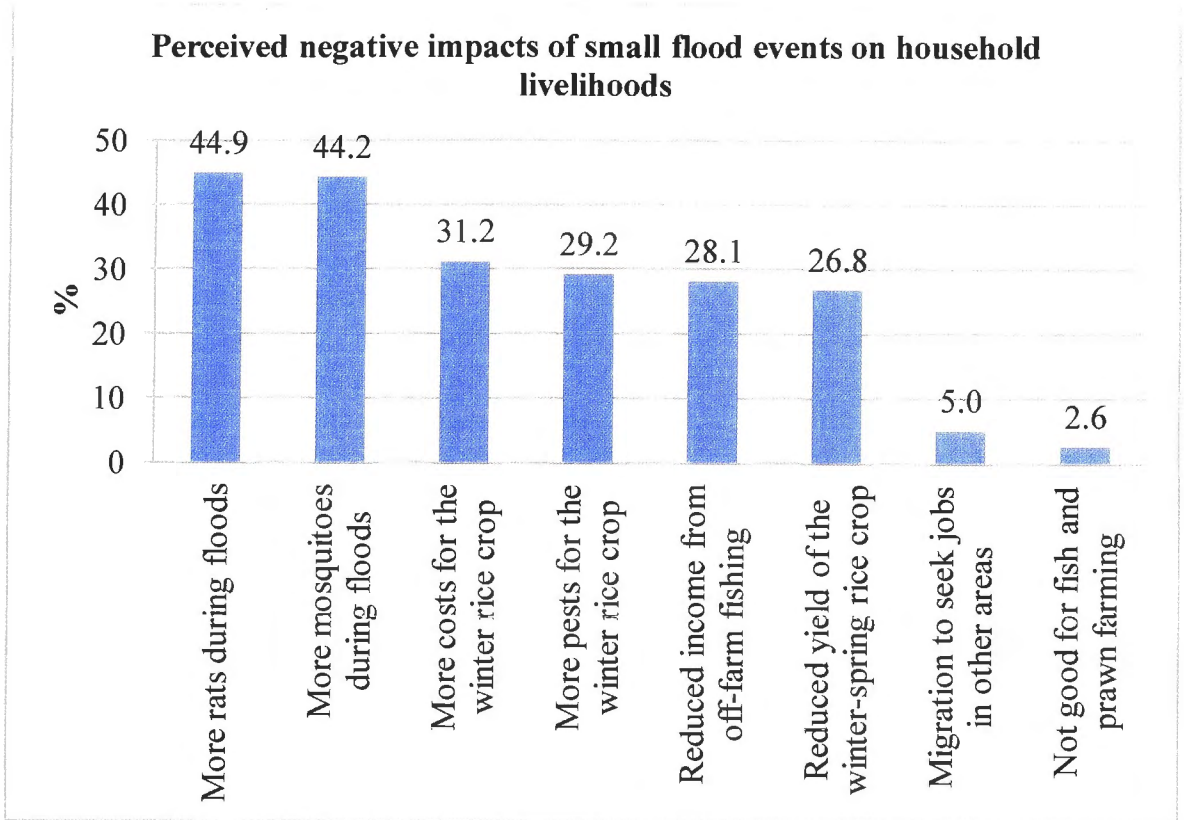

Figure 5. 10: Perceived negative impacts of small flood events on household livelihoods

Surprisingly, better-off and medium households become worse off from the impacts of small floods. In particular, better-off households were more likely to experience an increase in input costs, reduced yields and more pests during the winter-spring rice crop. This can be explained by the fact that poor households are often landless or own little land, so they are less likely to experience negative impacts from small flood events. The chi-square test also shows that there is a statistically significant difference in the experience between socio-economic groups in increased input costs for the winter-spring rice crop ($p<0.001$); reduced yield of the winter rice crop ($p<0.001$); more pests during the winter-spring rice crop ($p<0.001$); more rats during the flood season ($p<0.05$); and a need for seasonal migration to seek jobs during the flood season ($p<0.001$) (Table 5.9). However, poor households were more likely to experience seasonal migration to seek jobs as a result of a small flood than those from better-off and medium households ($p<0.05$). As there are fewer fish when floods are small, the livelihoods of the poor are negatively affected. As a result, more poor people need to migrate during a small flood season to search for jobs to survive.

Table 5. 9: Perceived negative impacts of small flood events on household livelihoods by socio-economic group

Negative impacts of small flood events (%)	Social group		
	Poor	Medium	Better-off
N	181	132	146
More rats during floods**	37.57	48.48	50.68
More mosquitoes during floods (ns)	41.44	44.70	47.26
More costs for the winter rice crop***	11.60	43.18	44.52
More pests for the winter rice crop***	9.39	40.15	43.84
Reduced income from off-farm fishing (ns)	34.81	28.03	19.86
Reduced yield of the winter-spring rice crop***	9.39	37.12	39.04
Migration to seek jobs in other areas***	12.15	0.76	0.00
Not good for fish and prawn farming (ns)	2.76	3.79	1.37

Note: Test of significant difference is based on Chi-Square, ***p<0.001, ** p<0.01; *p<0.05; ns is not significant

It is not surprising that people in the high flood region were much more likely to experience negative impacts of small flood events since their livelihoods are heavily reliant on flood-based income sources (Table 5.10). On the other hand, people in the moderate and low flood prone regions have more opportunities to engage in off-farm and non-farm activities, so the impacts of the small flood are less severe. These results also illustrate the great importance of floods as a pest control measure for people in the high flood-prone area.

Table 5. 10: Perceived negative impacts of small flood events on household livelihoods by region

Negative impacts of small flood events (%)	Flood region		
	High	Moderate	Low
N	150	159	150
More rats during floods***	66.00	38.99	30.00
More mosquitoes during floods***	63.33	39.62	30.00
More cost for the winter rice crop***	47.33	25.79	20.67
More pests for the winter rice crop***	38.67	27.67	21.33
Reducing income from off farm fishing***	46.67	25.16	12.67
Reducing yield of the winter-spring rice crop***	37.33	22.64	20.67
Seeking jobs in other areas***	10.00	5.03	0.00
Not good for fish and prawn farming***	6.00	1.89	0.00

Note: Test of significant difference is based on Chi-Square, ***p<0.001, ** p<0.01; *p<0.05; ns is not significant

5.5.2 Perceived benefits of small flood events to household livelihoods

However, small floods also provide benefits for rural households in the MRD. Figure 5. 11 shows that the two greatest benefits of small floods were thought to be convenient

rural transportation and the fact that homes are unaffected by small floods. As can be seen, most people reside along the small roads or in internal canals, so transportation during a big flood is extremely difficult. However, a small flood does not submerge roads, so transportation within the village is more convenient. Some 47.0 per cent of respondents said that they were not worried about their homes collapsing due to small floods. Respondents also said that small floods did not interfere with going to school (46.0 per cent), and are good for raising animals (44.4 per cent). Most rural households raise pigs, chickens and ducks, so the small floods do not affect the places for animal rearing. Some 28.5 per cent had not experienced small floods in their lives because they thought that a flood is always big or moderate. This information was presented in Chapter four as the perception of the flood level varies among different respondents. Some people thought the flood in 2000 was big, but others perceived the 2000 flood as moderate.

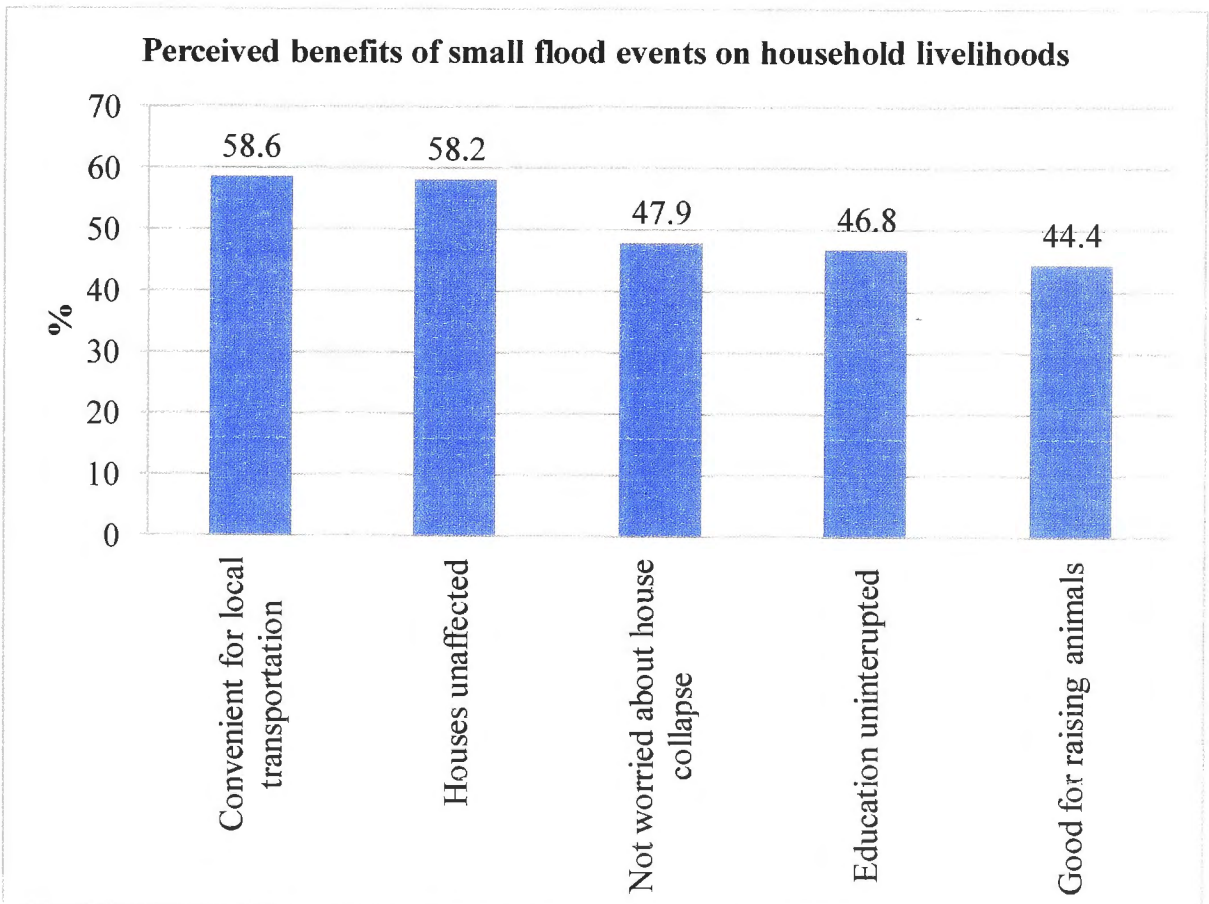

Figure 5. 11: Perceived benefits of small flood events to household livelihoods

With respect to the 62.0 per cent of respondents who reported that small floods bring benefits for rural households, there were no statistically significant differences in the perceived benefits of small floods according to socio-economic groups with regard to housing, transportation, education, and animal rearing. This means that all types of

household benefit equally from small floods with regard to these four livelihood assets. The most notable benefit of small floods for poor households is the absence of anxiety about their homes being negatively affected. For well-off households, small floods are less likely to be considered beneficial for their housing security because they have the means to construct houses that are protected from floods of any level (Table 5.11).

Table 5. 11: Perceived benefits of small flood events to household livelihoods by socio-economic group

Benefits of small flood events (%)	**Socio-economic group**		
	Poor	**Medium**	**Better-off**
N	181	132	146
Convenient for transportation (ns)	61.33	60.61	53.42
Houses unaffected (ns)	61.33	61.36	51.37
Not worried about house collapse**	53.59	53.03	36.30
Education uninterrupted (ns)	43.65	52.27	45.89
Good for raising animals (ns)	48.62	45.45	38.36

Note: Test of significant difference is based on Chi-Square, ***p<0.001, ** p<0.01; *p<0.05; ns is not significant

Regarding the benefits of the small floods by regional factors, more respondents in the high flood region state that a small flood provides benefits (p<0.001) in five different livelihood activities and assets compared with those in the other regions (Table 5.12). Because housing and transportation were perceived to be negatively affected in the big or moderate flood years in the high and moderate flood-prone regions, people living there are more likely to report that a small flood is good for transportation and less dangerous for housing.

Table 5. 12: Perceived benefits of small floods to household livelihoods by region

Benefits of small flood events (%)	**Flood region**		
	High	**Moderate**	**Low**
N	150	159	150
Convenient for transportation***	73.33	67.92	34.00
Not affect house***	75.33	67.92	30.67
Not worried about collapsed house***	58.67	61.64	22.67
Convenient for going to school***	56.67	56.60	26.67
Good for animal raising***	48.62	45.45	38.36

Note: Test of significant difference is based on Chi-Square, ***p<0.001, ** p<0.01; *p<0.05; ns is not significant

5.6 Conclusion

Flooding is not always a hazard to farmers in the MRD. This finding is relevant to flooding in Bangladesh and other flood-prone parts of the developing world (Paul 1984, Paul 1997, Blaikie et al. 1994). Floods bring both negative and positive impacts to rural communities. The study identified that the impacts of floods on households' livelihood activities and assets are very complex. Different levels of floods (small, moderate and big) caused different impacts. However, a moderate flood is considered a 'beautiful flood' because it brings less harm, but more benefits to rural households.

The findings indicate that the impacts of floods are nuanced and vary by different livelihood activities and assets, different flood levels, different socio-economic groups and in different flood regions where people live. It is not appropriate to aggregate the impacts of floods when analysing the flood impacts on various social groups. The disaggregated analysis of flood impacts on the various livelihood activities and the different socio-economic groups in the three flood prone regions provides in-depth understanding about the complexity of flood impacts on rural household livelihoods in the MRD.

The study found that the impacts of the big, moderate and small floods on housing, rice crop, and off-farm fishing activities are statistically significant. It also found that poor people might be winners in the moderate flood event because they can catch fish for survival, while they may become losers in small flood events because there is less fish to catch. However, poor people may be more vulnerable to big flood events as their houses are not strong enough to cope with the flood. In contrast, better-off households were more likely to benefit from big flood events as they reduce significant input costs for the winter-spring rice crop afterward. Their house foundation is often strong enough to cope with the big flood events. Results show that fewer better-off and medium households experienced submerged houses, destroyed houses and total house damage in big flood events.

However, poor people are less likely to worry in the small flood event, as their houses would not be affected. In contrast, better-off households are more likely to be worse off because a small flood event often brings less fertile silt, but more weeds, pests and rats so they have to pay more to protect the winter-spring rice crop.

The moderate flood is seen as the most 'beautiful water event' by the three socio-economic groups. Better-off people are more likely to benefit from the environmental services provided by moderate floods for rice farming, while poor people can benefit from fishing and are less likely to worry about their homes collapsing under the floods.

This study provides insights into flood impacts on rural livelihoods for decision makers as well as floodplain users. Policies should focus more on communicating the complexity of the flood impacts on different livelihood activities and assets to people in the MRD so that they can develop different coping strategies for different flood levels, for different socio-economic groups, and for people living in different flood regions of the MRD.

The next chapter will conceptualize and operationalize households' resilience to floods in the MRD.

Chapter 6

Conceptualizing and operationalizing households' resilience to floods in the Mekong River Delta[43]

6.1 Introduction

In this chapter, to define households' resilience, I will first present qualitative findings and later findings from the survey using factor analysis. The results from focus-group discussions and in-depth interviews that I conducted in the three study sites in the MRD are discussed here. The focus-group discussions included males and females from poor and better-off social groups while in-depth interviews were conducted with government staff and key informants. The focus groups discussions provided information that facilitated a description of local indicators for living with floods, while the in-depth interviews provided evidence to make the case of respondents who adapt successfully to the flood events.

This chapter aims to render the concept of social resilience operational in the context of living with floods in the MRD. The first property of resilience is the amount of disturbance that a household can absorb and still remain within the same stage or domain of attraction. Amount of disturbance in this context means the magnitude of the annual flood event. The magnitude of a flood reflects the level of flood rhythms each year, which can be categorized as big, moderate and small floods. The second characteristic of resilience is the "degree to which the system is capable of self-organization" (Carpenter et al. 2001). In the context of living with floods, the capacity to self-organize reflects the capacity of households to maintain their income, secure food, human health, houses and safely evacuate during flood months, and recover after the flood event. The final property of resilience is the capacity of households to build and increase capacity for learning and adaptation. A flood is considered a disaster for some social groups, yet it becomes a beneficial resource for other groups as well. In particular, several farmers identified the significant benefits of floods and invested in

[43] A draft of this chapter with the title "Measuring households' resilience to floods: a case study in the Mekong River Delta" has been submitted to *Journal of Ecology and Society* for publication. The author received helpful comments from reviewers and editors for minor revisions. It will be resubmitted for further consideration.

flood-based farming practices (real adaptation to flood). Those farming activities allow them to augment their household's income during months of floods.

This chapter covers five sections. Section one discusses the meaning of households' resilience to floods from a local point of view. Section two briefly reviews the methodological approach for measuring households' resilience. Section three defines the perspectives of households' resilience from living with floods. Section four conceptualizes households' resilience to floods and the conclusion is presented in section five.

6.2 Resilience to floods in the MRD from qualitative perspectives

To provide insights into the local concept of living with floods, the following discussions illustrate the term 'living with floods' from the perspectives of the different socio-economic groups in three different flood-prone regions in the MRD. The discussion explores the ways people perceive 'living with floods' in a local way to provide meaningful indicators of living with floods.

> Mr Tien: Living with floods means that we still live here during the flood season, try to save money and rice for survival during the flood months. However, poor households worry a lot. They worry that they have not enough rice to eat, not enough money to buy food during the flood season. They have to work for daily survival. If they stop working for several days, they worry that their family members will not have money to buy food [a medium farmer in Phu Xuan helmet in FGD_PD1 on 12th January 2010].

> Mr Kich: Some households may not have money to buy a tiny boat for going fishing. In this area, I think at least 30 per cent of households are landless and they are poor like us. Their livelihoods rely on daily agricultural labour in the dry season such as harvesting rice or doing off-farm fishing during the flood season. If the flood is too big or too small, their daily income is severely affected, and their livelihoods are very vulnerable to the flood season [a poor landless male farmer in Phu Xuan hamlet in FGD_PD01 on 12th January 2010].

> Mrs Tho: Poor people like us worry about many things: our houses may be swept away by big floods any time; we may not have enough rice to eat or have money to purchase food and have to spend time taking care of children, while better-off families often send their children to kindergarten, they have sufficient food to eat, or they can borrow money easily [a poor female farmer in Phu Xuan hamlet in FGD_PD03 on 12th January 2010].

> Mr Canh: For children, we have to take care of them very carefully because the flood season is very risky for children. Some people send

children to mobile kindergartens so children are less at risk during the flood in recent years [a primary teacher as a farmer in K9 hamlet in FGD_PD02 on 11th January 2010].

Mr Canh: Living with the flood means not only exploiting the natural benefits of flood such as fish, but also some people can grow prawns and fish to improve their income during the flood season. Most rich people invest billions of VND in farming prawns and they can earn millions of VND during the floods. But .....not many people in this village cultivate prawns. However, in Phu Tho commune, many rich households raise prawns and they become richer thanks to the floodwaters [a primary teacher as a farmer in K9 hamlet in FGD_PD02 on 11 January 2010].

Mrs Hanh: During the water season, most people worry about not having a stable income and houses being swept away by flood anytime. Houses are most important to us. Rich people do not worry much during the flood season because they have concrete houses or houses built on concrete stilts and enough rice to eat [a poor female in K9 hamlet in FGD_PD04 on 11th January 2010].

There are many definitions of living with floods in the MRD. Some people define 'living with floods' as 'the capacity to secure food, income, health during the flood season'. Securing food, income, livelihoods, health of family members and homes are seen as the most important indicators of living with the flood season. Securing income is the most critical issue during the water season as noted by most poor participants in the FGDs in the three flood regions. Households who experience insecurity of income during the flood season are less resilient to floods. However, others are concerned about the capacity to secure homes from the impacts of flooding. This is because, on the one hand, poor households are more likely to construct houses that are unsafe and more likely to be affected by floods. On the other hand, rich families often build houses on high ground or on safe stilts or concrete foundations which are safer for coping with floodwaters. Poor households rely heavily on environmental resources for livelihoods, so they prepare fishing nets and boats for the harvest season to maintain the household income and expenditure. However, some poor households cannot catch fish, but have young labourers; seasonal migration is the more likely way to secure their income for survival during the flood season. If their income stream is disrupted by the presence of the water or flood season, they may find it difficult to survive without external assistance from the communities. Finally, securing children's lives is most important for every household during the flood season as many children have drowned in the last few years. Other people are more likely to be concerned about the capacity to exploit the natural benefits from the flood season. Therefore, living with floods is defined as the

capacity of households to secure food, income, health, evacuate, recover and benefit from the flood event.

6.3 Measuring households' resilience to floods

When faced with annual disturbances, floodplain residents have to enhance their livelihoods' resilience to floods. As local residents may not be able to move out of the delta during the flood season, they have to build their houses and construct their livelihoods on the floodplain. They know that the flood is an annual event, which may bring beneficial resources for livelihood development; but they also know that the flood can be disadvantageous to some extent, as discussed in Chapter five. Households which have the capacity to respond positively and adapt well to the flood season for maintaining their livelihoods are more likely to be resilient.

The study employed a multiple items approach using both Likert scales and a dichotomous response to design questionnaires for measuring household resilience. As noted by deVaus (2002: 180 - 181) it is beneficial to use multiple indicators to measure the complexity of a concept. Multiple items also help to increase the reliability and precision of a measure. The multiple item approach using Likert scales is widely accepted in measuring individual resilience to stresses in the psychology disciplines (Wagnild and Young 1993, Connor and Davidson 2003, Yu and Zhang 2007, Wang et al. 2010, Baek et al. 2010), and individual resilience to institutional changes (Marshall and Marshall 2007). As rural households in the MRD have experienced the impacts of annual flood events for many years, this thesis argues that using a subjective wellbeing approach helps to identify the ability of households to live with, adapt to and benefit from floods. If the households have a high level of wellbeing, they are expected to be resilient to floods. Ten attitudinal and behavioural statements, which reflect subjective wellbeing of rural households living with floods, were developed from qualitative data obtained from FGDs and in-depth interviews. The statements related to confidence in keeping houses, secure food, income and health of family members, evacuation, and recovery after the flood; confidence in securing homes in a big flood such as the 2000 flood, and their interest in learning and carrying out new ways of adapting to floods which were perceived as the most important indicators of living with floods. The respondents, who represent their households, were asked to rate their attitudes towards 10 statements. The responses to the first nine items were placed on a five-point Likert scale, while a dichotomous response was applied for the last item (Table 6.1).

Table 6. 1: Statements used for measuring households' resilience to floods in the MRD (ten items)

Items	Statements (N=459)	Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
		%				
1	I can replace my house quickly when it is affected by floods[+].	8.50	28.10	3.70	32.46	27.23
2	I am confident that my house will not be submerged by the highest floods in the last 20 years[+].	8.06	23.53	4.79	31.37	32.24
3	I am confident that my house will not collapse or be swept away by the highest floods in the last 20 years[+].	11.55	25.93	4.79	32.68	25.05
4	I am confident that my household has enough rice to eat during the flood season[+].	9.15	25.93	15.25	37.04	12.64
5	I am confident that my household will not need to borrow rice or money from informal sources during the flood season[+].	1.53	6.97	10.68	48.15	32.68
6	I am confident that my household can find a safe place to evacuate to if there is an extreme flood event in the future[+].	1.74	12.20	13.73	54.03	18.30
7	I am confident that children and elderly people are safe during the extreme flood[+].	10.46	24.40	4.36	22.22	38.56
8	I am confident that the health of my family members will not be negatively affected by the flood[+].	13.51	25.93	6.75	23.53	30.28
9	I want to learn new farming practices to cope with floods, such as fishing, prawn farming[+].	13.07	40.74	1.09	29.41	15.69
10	I have used new farming practices to cope with floods such as fishing, fish, and vegetables or prawn farming[++].	Agree 27.7			Disagree 77.3	

Note: +Statements were measured on a 5-point scale for the first nine items: 1 strongly disagree, 2 disagree, 3 neither agree nor disagree, 4 agree, 5 strongly agree. ++Statement was measured by the binary response (0, No; 1, Yes) for the ten items.

6.4 Derivation of resilience factors or resilience properties

As discussed in section 2.5.1, factor analysis has been used in this thesis as a data reduction method to select a number of composite variables from a variety of variables that can be later grouped into three properties of resilience: (1) Confidence to secure food, income, safe evacuation during flooding and recovery after floods; (2) Confidence to make sure homes were not affected by flooding like the 2000 flood; and (3) Interest in learning and practising flood-based livelihoods during floods. Each factor derived from the analysis is scaled from low to high resilience scores. Factors derived from these three categories are further analysed by multiple regression with the socio-economic and demographic variables of age, sex, education, income, regional flood characteristics, social capital variables, and livelihood diversity in the following chapters.

6.5 Defining households' resilience to floods

Results from factor analysis indicate that nine of ten statements reliably contribute to the scale, and these formed the basis for measuring household's resilience to floods in this study (Table 6.2). The factor analysis in SPSS shows that the responses to the statements were best described by three factors which represent the three components of resilience. The findings from the factor analysis conducted in MPLUS[44] showed similar results, including the three factors comprising nine items (see Appendix 6.1). These total factors in SPSS represented 68.0 per cent of the variance. The first component represents 37.1 per cent of the variance, including five statements (1, 4, 5, 6, 8) relating to securing food, income, health, safe evacuation during the flood season and recovery after floods. The second component, representing 17.5 per cent of the variance, consists of two statements (2 and 3) related to the magnitude of the future flood compared to the threshold flood of 2000 that households are confident that their houses will be not affected (submerged or collapsed) by a big flood like the 2000 flood. The third component, representing 13.3 per cent of variance, was comprised of two statements (9 and 10) related to interest in learning and practising new flood-based farming techniques for adapting to floods.

[44] The description of MPLUS can be found at http://www.statmodel.com/programs.shtml

Table 6. 2: Factor matrix of household resilience, Mekong River Delta, Vietnam, 2010 (nine final standardized items)

Items	Statements	Factor loadings			Communality
		Factor 1	Factor 2	Factor 3	
1	I can replace my house quickly when it is affected by floods[+].	0.71			0.58
4	I am confident that my household has enough rice to eat during the flood season[+].	0.90			0.83
5	I am confident that my household will not need to borrow rice or money from informal sources during the flood season[+].	0.88			0.80
6	I am confident that my household can find a safe place to evacuate to if there is an extreme flood event in the future[+].	0.41			0.22
8	I am confident that the health of my family members will not be negatively affected by the flood[+].	0.59			0.39
2	I am confident that my house will not be submerged by the highest floods in the last 20 years[+].		0.92		0.90
3	I am confident that my house will not collapse or be swept away by the highest floods in the last 20 years[+].		0.92		0.89
9	I want to learn new farming practices to cope with floods, such as fishing, prawn farming[+].			0.86	0.75
10	I have used new farming practices to cope with floods, such as fishing, prawn farming[++].			0.84	0.71
	Eigenvalues	3.34	1.58	1.19	6.12
	% of variance	37.14	17.55	13.32	68.01

Note: +Statements were measured on a 5-point scale for the first nine items: 1 strongly disagree, 2 disagree, 3 neither agree nor disagree, 4 agree, 5 strongly agree. ++Statement was measured by the binary response (0, No; 1, Yes). All items were standardized into z-score (0,1).
Selected factors having Eigenvalue greater than 1
Select variables having factor leading greater than 0.3
Total variance is 68.0

Reliability analysis in Table 6.3 shows that Cronbach's α coefficient of factor one is 0.77; factor two is 0.89; and factor three is 0.67. The three factor scores are suitable for the multiple regression analysis carried out in Chapter seven.

Table 6. 3: Descriptive statistics and reliability analysis for responses from the sample of flood plain residents to each survey item; α is Chronbach's α

Items	Item-Total Statistics	Mean	Std.	Item-Total Correlation	Alpha if Item Deleted
1	I can replace my house quickly when it is affected by floods.	0.000	1.000	0.593	0.725
4	I am confident that my household has enough rice to eat during the flood season.	0.000	1.000	0.738	0.673
5	I am confident that my household will not need to borrow rice or money from informal sources during the flood season.	0.000	1.000	0.705	0.685
6	I am confident that my household can find a safe place to evacuate to if there is an extreme flood event in the future.	0.000	1.000	0.307	0.816
8	I am confident that the health of my family members will not be negatively affected by the flood.	0.000	1.000	0.460	0.769
2	I am confident that my house will not be submerged by the highest floods in the last 20 years.	0.000	1.000	0.808	
3	I am confident that my house will not collapse or be swept away by the highest floods in the last 20 years.	0.000	1.000	0.808	
9	I want to learn new farming practices to cope with floods, such as fishing, prawn farming.	0.000	1.000	0.265	
10	I have used new farming practices to cope with floods such as fish, prawn farming	0.000	1.000	0.265	

Note: All items were standardized before conducting reliability test. The mean is zero (0) and standard deviation is one (1) in Table 6.3 because the original data were normalized (0,1).

6.6 Interpretation of resilience components

6.6.1 Confidence to secure food, income, safe evacuation during flooding and recovery after floods

Results from FGDs and in-depth interviews reveal that participants are concerned about several issues for surviving and for maintaining livelihoods during and after floods. These include: (1) capacity to secure food, (2) income and (3) health of family members during the floods; (4) capacity to find a safe place if evacuated during floods; and (5) capacity to recover if houses are affected.

Flooding frequently lasts from two to six months every year, so it often disrupts the income sources of some social groups. Poor people's livelihoods rely heavily on collecting fish and aquatic resources, and agricultural wage labour during the flood season. When a big flood occurs, there are strong winds and giant waves, which disrupt daily livelihood activities. So, if households are not confident that they will have sufficient food and income to survive during flooding, they feel that they are vulnerable to floods. However, if they can access resources from neighbours and social networks, they may be confident of securing food and income during the flood season. For example, seasonal migration may provide remittances to send to their family members to help them survive during the flood season.

> Mrs Hanh aged 26, a poor woman living in K9 hamlet, Phu Duc district, Dong Thap province, and Mrs Tu, aged 33, a poor woman said that poor people worried 7-8 times more during flooding, while better-off households just worried 2-3 times more. They are concerned about shortage of income for purchasing rice [in FGD_PD04 on 11th January 2010].

Child deaths during the flood season were the key concerns of most participants in twelve FGDs. Children were recognized as the group most vulnerable to flooding, especially during big flood events. Children's deaths were most frequently reported in the highest and moderate flood-prone regions, while very few cases were mentioned in the low-flood region. Importantly, most people said that child deaths were more likely to happen in households that had settled in the paddy fields. Poor households that went fishing during the floods must leave their children at home alone or with their brothers and sisters, or relatives, with a lack of supervision, resulting in vulnerability to floods.

Evacuation during the flood is one of the most important indicators of living with floods at the household level. If the flood submerges homes, having a safe place to evacuate to

provides confidence to cope with floods. In the flood of 2000, many people could not move out of their homes for several days. They had to stay on the roofs of their houses for several days, when the water was rising. Their lives were at risk all the time during this flood.

> Mrs Nuoc, aged 35, a poor woman in Phu Duc commune, said that her house was deeply submerged in the 2000 flood; all her clothes were wet, and there was no rice to eat. No family members could sleep at night and they lost weight. Her house was located along the canal banks, and was cut off by floodwaters. It was very difficult to find a safe place to evacuate to [in FGD_PD03 on 112th January 2010].

Recovery after the floods was considered one of the most important indicators of coping with floods. Evidence shows that the flood in 2000 destroyed and submerged thousands of homes in the MRD (MRC 2005, Nguyễn Hữu Ninh et al. 2007). If someone could recover more quickly they would be more resilient to flood impacts. Poor people live in unsafe conditions (in simple houses without protective materials inside the flooded fields), which were easily destroyed by flooding and during storms. In contrast, medium and better-off households are more confident that their homes could be secured as they had built good quality homes.

6.6.2 Confidence to secure homes not being affected by flooding as big as the flood 2000

As reported by most participants in the FGDs, the flood in 2000 can be seen as a historical flood. In flood years, many homes are submerged or destroyed by flooding. The flood level in 2000 is considered as the threshold for designing housing structures by most rural households. Through field observation and FGDs with participants in the three study sites, it was found that both richer and poorer households that resided in residential clusters were more likely to be confident that their houses would not be submerged or destroyed by a flood as big as the 2000 flood. This indicator reflects the threshold that rural households can cope with floods in terms of the housing sector. Two items which made up the factor explaining this threshold were included: (1) I am confident that my house will not be submerged by the highest floods in the last 20 years; and (2) I am confident that my house will not collapse or be swept away by the highest floods in the last 20 years.

6.6.3 Interests in learning and practising flood-based livelihoods during floods

As noted by Paul (1984, 1995, 1997) and Shaw (1989), floods have brought both abnormalities and resources for development. However, as stated in Chapter 4, some people may see floods as disasters, but others consider floods as benefits (Lebel et al. 2006). Floods in the MRD create significant costs to households and communities in big flood years, but farmers can also benefit from the resources that nature provides to people. In particular, the floods bring an abundance of aquatic resources such as fish, crabs and snails. Many farmers rely on income from collecting fish, crabs and snails during the flood season for maintaining livelihoods. However, poor people may not have enough financial resources to buy fishing tools (a small boat, nets or traps), which may make them more vulnerable to food insecurity during the flood season. In some cases, they borrow informal credit to purchase a boat and nets. However, they may incur a debt during the big flood, which may sweep away their nets. This excerpt from an in-depth interview illustrates the ways in which people adapt to the flood season in the highest flood prone region.

> Mr Ranh, aged 42 in PD commune, said that his household income relies on two rice crops (1.0 ha) in the dry season and fishing during the flood season. He grows two rice crops (winter-spring and summer-autumn) from December to July each year. He said that the flood is his favourite season, because he can earn at least VND 200-300,000 (~USD 10-15) each day from trapping fish, while a construction worker can earn VND 80,000 (~USD 4.0) per day. However, he was concerned that poor people may not have the financial capacity to buy a boat and fishing nets. He estimated that a fisherman may need VND 1.5 million (~USD 75.0) to buy a tiny boat, and VND 1.5 million (~USD 75.0) to buy nets, so he may need to ask for informal credits at a high interest rate [in-depth interview with Mr Ranh on 15th December 2009].

Interestingly, rural people have adapted to floods in innovative ways for improving their household income in the moderate flood prone region. The golden snails have been seen as pests for rice farmers in the MRD. However, they become a valuable resource for people who collect them to maintain their livelihoods during flooding. Most poor and medium income households engage in similar livelihood activities because these require less capital investment and labour. Especially, young poor or landless couples are more likely to participate in this activity for survival, while medium households are more likely to accumulate capital by conducting this business.

> Mr Luoc, aged 45, is a medium-income farmer in TMT commune. His household income relies on rice farming (two crops) and collecting golden snails during the flood season. He said that local people are very interested in livelihood activities during the flood season. He uses a small motorboat to travel to many places in An Giang, Dong Thap and Kien Giang provinces to collect snails. He can earn a net income of around VND 300,000.0 (~USD 15.0) per day. He can save at least VND 10.0 mil (USD 480.0) in a flood season, which equals the net income from 2.0 ha of rice. Mr Luoc realized that the water season is a wonderful income season for his family and his neighbours. Fish, prawn and duck farmers can buy low priced snails, a cheap source of protein to feed their stock. Children and old people in his neighbourhood can earn about VND 50,000 (~USD 3.5) a day to take off the snail shells for him [in-depth interview with Mr Luoc on 5th January 2010].

Local people not only benefit from exploiting the natural fish, crabs or snails from the floodplain, but also they create new farming activities that are totally adapted to floodwaters. For example, medium and better-off farmers who have paddy land are more likely to develop the aquatic *Neptunia prostrate* vegetable (water mimosa), fish, and prawn farming activities during the flood season. These farming activities have been introduced by farmers since 2001. They were firstly tested on an individual basis and expanded to the community level. The following stories show that farmers have been more resilient to floods by transforming their flooded fields into flood-based farming practices.

> Mr Cai, aged 63, is a medium-income farmer, in TMT commune. His household income is dependent on growing 1.5 ha of double rice crops and 0.4 ha of a *Neptunia prostrate* vegetable crop during the flood season. He started this business more than 10 years ago. He reported that this farming practice is very resilient to floods, 'a real way of living with floods'. Annually he grows *Neptunia prostrate* after harvesting the summer rice crops in August, when the floodwater rises 0.4 metres (m) above the paddy field. He starts to harvest the stems of *Neptunia prostrate* after growing only two weeks, and continues to cut stems once every two weeks over several months of flooding. He sells the vegetables to middle men in his village who retail the vegetables in local communal, district, and provincial markets, even in HCM City. In Thanh My Tay commune, more than 200 households grew *Neptunia prostrate*, which accounted for over 100.0 ha of *Neptunia prostrate* in 2009. He said a 1,000 m^2 of *Neptunia prostrate* may give him a net benefit of about VND 7.0 million ($350) if he is offered a good price. The lowest net benefit of a 1000 m^2 plot may be VND 3.0 million (USD 150.0). Additionally, this business also creates many jobs for local labourers for women in particular who pick and select the stems for growers. A woman can earn VND 7,000 (USD 0.3) per hour of collecting. On average, each labourer can earn about 50,000 VND per day (USD2.4) per day. Importantly, the *Neptunia prostrate* holds fertile sediment through its root system during the flood season. When farmers harvest the last crop, they buried the stems in the soil, and it becomes

natural fertilizer for the rice crop in the winter-spring season. Farmers gain double benefits from this flood-based system, which is more ecologically and socially resilient to floods [in-depth interview with Mr Cai on 6th January 2010].

6.7 Conclusion

This study has identified the key characteristics of households that determine the capacity of households to cope with, adapt to and benefit from floods. As discussed by deVaus (2002) it is better to use multiple items to measure a multidimensional concept. Although resilience is a multidimensional concept, it can be grouped into three different components in the context of living with floods in the MRD. Three factors found by this study were: (1) the capacity of the households to secure food, income, health of their family members during the flood season, safe evacuation during the future extreme flood event, and recovery after an extreme flood if they are affected; (2) the capacity of households to secure their homes during a big flood such as the 2000 historic flood; (3) the level of interest in learning and doing new flood-based livelihoods during the flood season to improve their livelihood security. Those three factors are consistent with the general resilience theory and practices. A novel point of this study is to identify the capacity to learn from disturbance for genuine adaptation to floods. The ways in which farmers use the floodwater for growing prawns, fish, eels and vegetables are very innovative and contribute to their adaptive capacity.

The first property of resilience in this study is related to the degree to which households are capable of self-organization. This characteristic is mostly accepted by resilience scholars (Carpenter et al. 2001, Klein et al. 2003, Folke 2006). However, it is difficult to translate the term 'capacity for self-organization' in the local context of the MRD. In particular, the capacity for self-organization comprises several dimensions of livelihoods whereby people are mostly concerned with the impacts of previous flood events. These capacities comprise: (1) confidence that they have sufficient food to eat during the flood season; (2) confidence that they do not need to use informal credit during the flood season; (3) confidence that they can find a safe place to evacuate to during a future extreme flood event; and (4) confidence that the health of family members is secured. In particular, rice is the most important staple food for rural households in the MRD. If the households do not have enough rice to eat, they feel very anxious about coping with the flood season. Because the flood season often disrupts income streams of some social groups, borrowing money from local informal lenders is the common way of coping with six months of flooding. Accessing informal credit at a

high interest rate is a fear of most poor households during the flood season. Landless households are the most vulnerable groups to being in chronic debt with informal credit providers because they do not have land title to borrow against for formal credit to survive during the flood season. However, if households are confident that they will not have to borrow this type of credit, they may be able to borrow from their relatives, family members and the banks at low interest. Health of family members, especially children is the most serious concern during floods. Many children have died due to drowning. If households are confident they can secure their children in the face of flooding, they are more likely to be resilient.

The second property of resilience is related to the amount of disturbance that a system can cope with, but still maintain its function in terms of the housing sector. This characteristic has been widely accepted in recent natural hazards literature. In this study, the amount of disturbance is seen as the amount or magnitude of the flood event in the MRD. The historic flood in 2000 was perceived as the most serious, destructive flood of the last century in the MRD. Thousands of homes were submerged, damaged and swept away by the flood. Since that event, local people have upgraded their house floors or raised the house foundation above the flood level. However, not all households can adjust their home to a particular level of stability because they lack financial capacity. The capacity to secure their homes from a 2000-level flood is determined by their wellbeing or capacity to cope with floods. Those who can upgrade their houses are more resilient to the impacts of floods.

The third characteristic of household resilience is their interest in learning and doing new, creative things. This is consistent with the third property of resilience, the capacity to transform and innovate (Folke et al. 2002, Walker et al. 2004, Marschke and Berkes 2006, Marshall and Marshall 2007, Pelling and Manuel-Navarrete 2011). However, what are the new creative things in this context? Many farmers have developed an innovative way of living with floods by exploiting the flood benefits as well as conducting flood-based farming activities. These farming practices allow them to improve their household income and also create jobs for local labourers to maintain their livelihoods during flood months. These emerging flood-based farming practices not only provide income and food security for rural households, but also help to maintain agricultural sustainability. The perception of floods has transformed them from natural disasters into beneficial resources for livelihood development.

The use of the subjective wellbeing approach in measuring households' resilience reflects the actual capacity of households to cope with flood events. Because resilience is a multidimensional concept, the use of multiple items can help to capture a wide range of factors that contribute to households' resilience in a specific context. The use of standardized data yielded better underlying factors than non-standardized data in this context. While the former captured nine items in three factors, the latter only obtained five items. While a standard factor analysis cannot deal with dichotomous variables, the standardized data approach allowed the conduct of a factor analysis with dichotomous responses. This approach was well validated by using both SPSS and MPLUS software. By combining qualitative and quantitative analytical methods, this chapter has sought to highlight new aspects of resilience among farmers in the MRD. Their responses and adaptive behaviours enable some of them to sustain their livelihoods during floods and recover quickly after floods.

However, the use of the subjective wellbeing approach to obtain the perceived capacity from the household level to cope with historical flood events may be subject to some limitations. Although one item (item 6 in Table 6.2) in the questionnaire reflects the capacity to evacuate in a future extreme flood event, it does not capture all dimensions in a future big flood. It is argued that the determinants of resilience may include demographic, social capital, cultural, economic, political, aspects of natural hazards, information, and geographical setting of places (Gaillard 2007, Norris et al. 2008). For example, information is vital for people in the disaster prone area to make behavioural decisions. Some socio-economic groups can cope well with floods, but others are more vulnerable. However, these factors may be variable at different scales of analysis. Social capital of the community is important for accessing resources to cope with the natural events. However, some of these indicators are not included in the current measures of households' resilience to floods. The current measures of household's resilience focus on households' confidence to cope with floods in terms of their own resources. Some factors such as social capital are often treated as an exogenous variable (Narayan and Pritchett 1997). The factors obtained from this resilience measure will be used as latent variables to investigate their relationships with social capital, and socio-economic variables in further analysis. Further study should be carried out to improve the current measures of resilience to capture different levels of analysis and wider dimensions.

Chapter seven will explore the formation and socio-economic variation of social capital in the MRD and investigate the relationships between the household resilience

properties obtained in this Chapter with social capital and socio-economic characteristics of households.

Chapter 7

Socio-economic variation of social capital of households and household's resilience to floods in the MRD

> Through my observations of people living in the flood prone areas for years, I have identified that rural households invest in social capital by formulating good relationships with their neighbours, friends, and participation in local groups or associations. In particular, neighbours cultivate relationships with their neighbours through daily reciprocal activities. For example, neighbours help each other to prepare houses before the flood season, share with neighbours about the traditional ways of protecting their homes from strong winds, if houses are submerged by floodwater, or saving lives if they are in danger of drowning due to high waves. The relationship between neighbours and neighbours, and friends is also cultivated through their social lives such as participation in hamlet meetings and recreational activities in the village, meeting at local coffee shops and markets in the early morning, participating in funerals, wedding parties, ancestor anniversary days, *Tết* (lunar new year days), and religious activities. Besides, these people also participate in several local groups and associations. Through these social ties, people may access resources from government policies and other opportunities. The diversity of relationships reflects the diversity of social resources that rural households rely on for maintaining their livelihoods (my personal experience).

7.1 Introduction

Social capital has become a topical issue in studying adaptation to climate change and natural disasters recently. It is clear that social capital plays an important role in economic development (Narayan 1999, Narayan and Pritchett 1997, Grootaert 2002, Grootaert et al. 2002, Nguyễn Văn Hà et al. 2004, Bourdieu 1986), education (Coleman 1988), occupational attainment (Lin 2001), and health (Veenstra et al. 2005). The role of social capital in adaptation to climate change has been investigated by Adger (2003) and Pelling and High (2005). In the MRD of Vietnam, people have lived with floods for years; however, some people become highly vulnerable to floods, while others can build livelihood resilience to flood events. In this chapter, the role of social capital of households in improving livelihood resilience to floods is explored. It is argued that building social capital is vital for improving household resilience to annual flood events in the MRD.

In this Chapter, the social capital of households in the MRD is measured and discussed in a quantitative way. Both formal and informal forms of social capital of households were examined in the context of living with floods as well as in the daily social lives of

this agrarian society. The socio-economic variations of the social capital of households are explored. The creation of social capital in the village is presented in the local context. The relationship between social capital of households and households' resilience to floods, obtained from Chapter six, will be tested. Scores of neighbourhood attachment, participation in groups and associations, and social supportive networks will be used as latent variables in a regression analysis in this chapter.

7.2 Social capital of households and socio-economic variation in the MRD

7.2.1 Neighbourhood attachment–informal social capital of households

Household's attachment to neighbourhood is important in health and job market studies and in development studies. However, little is known about how neighbourhood attachment social capital is formulated and the role of neighbours in daily social lives of rural households in the MRD. A Vietnamese proverb says *(bà con xa không bằng láng giềng gần)* or 'relatives living far away are less important than the close neighbours'. This means that neighbours are very important in daily lives. Neighbours help neighbours to repair a house, prepare a wedding party, attend funerals, memorials, and other occasions in the village.

The term 'neighbourhood attachment' can be translated into Vietnamese language in the MRD as *(sự gắn bó với bà con hàng xóm) or (ở đời biết điều với hàng xóm)*. According to Mr Anh, aged 40 living in My Binh hamlet, Thanh My Tay commune of Chau Phu district, 'neighbourhood attachment' means that he should help neighbours when they are in difficulty. If neighbours have a wedding party, a funeral, memorials, the first birthday *(thôi nôi hoặc đầy năm)* of their children, or repairing their house, he should provide his labour to help his neighbours. When the neighbours need a boat, he should be willing to give it to them. The term *(biết điều)* can be also understood as 'norms of reciprocity' in the local communities. In particular, neighbours exchange labour and food with each other. The tighter the attachment to neighbours, the more they can receive support from each other.

After discussing with local people the meanings of 'neighbourhood attachment' in the local context, particularly in the Mekong River Delta, I developed a measure for neighbourhood attachment using a multiple-items approach. This approach was widely accepted in measurement of social capital in health and job market studies in developed countries (Li et al. 2005). In this study, households' attachment to their neighbours was

measured using twelve statements with five-point Likert scales (see section 2.5.3.1 in Chapter 2). The items were generated from focus group discussions and in-depth interviews with local people in the project areas. While Li et al. (2005) constructed items based on associational life with neighbours, several items of neighbourhood attachment in this study were designed to address specific issues of living with floods and daily reciprocity in the village. The neighbourhood attachment of a household is cultivated by associational activities and daily reciprocity within the neighbourhood. The 12 items cover several dimensions of neighbourhood lives (Table 7.1).

The frequency distribution in Table 7.1 shows that respondents had a positive attitude to most of the neighbourhood attachment statements. In particular, more than 97.0 per cent of the respondents agreed that neighbours mean a lot to them; more than 85.0 per cent agreed that advice is available from neighbours; more than 63.0 per cent have coffee regularly with neighbours; more than 94.0 per cent help their neighbours out when they are sick; more than 67.0 per cent discuss with their neighbours the way of living with floods; more than 57.0 per cent participate in hamlet meetings to discuss ways of coping with floods; more than 79.0 per cent help neighbours if they are affected by floods; more than 70.0 per cent help with rice and money if they are affected by extreme flood events; and more than 95.0 per cent are invited to participate in neighbourhood events such as wedding parties, memorials, and funerals.

However, more than 76.0 per cent of the respondents are less likely to participate in recreational activities such as sports and more than 58.0 per cent are less likely to participate in cultural and religious activities. The reason for this is that most of the respondents (82.4 per cent) are over 40 years old, and 14.6 per cent of the respondents are females. Through my observations and in-depth interviews, I found that females and older people are less likely to play sports or do any recreational activities. The reason for the low proportions of people participating in religious activities is because there are fewer females in the sample than males. Females are more likely to participate in religious activities or go to local pagodas than males. Another reason for the low participation in religious activities is that most of the respondents belong to Hoa Hao Buddhism; they are more likely to pray at home. While young people and males are less likely to participate in the religious activities, most of the respondents in the sample are males.

Table 7. 1: Responses to twelve items that measure neighbourhood attachment by respondents (household survey in October 2010)

Items	Neighborhood attachment statements (%)	Strongly disagree	Disagree	Neither agree / disagree	Agree	Strongly agree
1	Neighbors in my neighborhood mean a lot to me	0.00	1.96	0.22	44.23	53.59
2	Advice is available from my neighbors when I face difficulties	0.44	10.46	3.70	69.28	16.12
3	I regularly have coffee/tea with my neighbors	6.54	28.98	0.44	38.78	25.27
4	I help my neighbors when they are sick	1.09	3.70	0.00	54.68	40.52
5	I discuss with neighbors ways of living with the flood season	10.02	31.37	1.31	48.80	8.50
6	I regularly participate in recreational (leisure) activities in the neighborhood	22.22	54.68	0.87	15.90	6.32
7	I regularly participate in cultural and religious activities in the neighborhood	15.90	42.92	1.31	31.81	8.06
8	I regularly participate in hamlet meetings to discuss ways to cope with flood	10.89	30.07	1.53	46.84	10.68
9	I assist my neighbors to recover if they are affected by floods	4.36	14.16	1.74	58.39	21.35
10	I help my neighbors with money or rice when they are affected by extreme floods	8.50	20.70	1.09	50.54	19.17
11	I am regularly invited to attend parties (weddings, birthday…)	0.65	3.49	0.44	41.18	54.25
12	I am regularly invited to participate in important events in the neighborhood such as conflict resolution	19.61	44.44	3.27	24.40	8.28

Note: Statements were measured on a 5-point scale: 1 strongly disagree, 2 disagree, 3 neither agree nor disagree, 4 agree, 5 strongly agree.

As discussed in section 2.5.3.1 in Chapter two, factor analysis was carried out using principal components for extraction and the verimax rotation approach to identify the underlying factors of social capital of neighbourhood attachment because this approach will enhance the interpretability of the factors (Cutter et al. 2003, Utomo 1997). Data was standardized into z-score prior to conducting data analysis. The factor scores of underlying factors which have Eiganvalues greater than 1 will be selected (deVaus 2002). The results from the first factor analysis show that there are three factors which have Eigenvalues greater than 1. However, item 4 has a loading greater than 0.3 on two factors (2 and 3) and item 9 has a loading greater than 0.3 on two factors (1 and 2). According to deVaus (2002) if one item has a loading greater than 0.3 on two factors, it is better to drop the item. Therefore, items 4 and 9 were dropped before conducting a second factor analysis.

The result of the second factor analysis (without items 4 and 9) shows that KMO and Bartlett's Test coefficient is greater than 0.7 (0.785) which is suitable for a factor analysis. The findings from factor analysis indicate that the responses to the statements were captured by two factors. These factors represented 38.3 per cent of the variance (Table 7.2). The first component, representing 26.5 per cent of the variance, consisted of items related to neighbourhood attachment. This includes item (3) regularly drinking coffee or tea together, (5) discussing with neighbours ways of living with the flood season, (6) regularly participating in recreational activities in the neighbourhood, (7) regularly participating in cultural and religious activities in the neighbourhood, (8) regularly participating in hamlet meetings to discuss ways to cope with flood, (10) helping my neighbours with money or rice when they are affected by extreme floods, (11) regularly invited to attend parties (weddings, birthday...) and (12) regularly participating in important community events such as conflict resolution. The second component, representing 11.7 per cent of variance, consisted of statements related to the perceived values of the neighbourhood where the respondents are living. This includes (1) neighbours in my neighbourhood mean a lot to me, and (2) advice is available from my neighbours when I face difficulties.

Table 7. 2: Factor matrix of social capital (neighbourhood attachment, Mekong River Delta, Vietnam, 2010 (eight final items)

Statements	Factor loading		Communality
	Factor 1	Factor 2	
Neighbors in my neighborhood mean a lot to me		0.748	0.560
Advice is available from my neighbors when I face difficulty		0.736	0.554
I regularly have coffee/tea with my neighbors	0.531		0.353
I discuss with neighbors ways of living with the flood season	0.625		0.421
I regularly participate in recreational activities in the neighborhood	0.532		0.283
I regularly participate in cultural and religious activities in the neighborhood	0.453		0.214
I regularly participate in hamlet meetings to discuss the ways to cope with floods	0.606		0.375
I help my neighbors with money or rice when they are affected by extreme floods	0.586		0.395
I am regularly invited to attend parties (wedding, birthday…)	0.565		0.320
I am regularly invited to participate in important events in the neighborhood such as conflict resolution	0.589		0.362
Eigenvalues	2.66	1.18	3.84
Percentage of variance	26.59	11.78	38.37

Note: Statements were measured on a 5-point scale: 1 strongly disagree, 2 disagree, 3 neither agree nor disagree, 4 agree, 5 strongly agree. Items were standardized into z-score (0,1) prior conducting factor analysis.
Selected factor having Eigenvalue greater than 1
Select variables having factor leading greater than 0.3

A reliability test was used for testing the reliability of the scales. The result of the reliability analysis shows that Cronbach's alpha is 0.696 for the first factor and 0.365 for the second factor. The item-total correlations indicate that the coefficient of underlying items of the first factor is greater than 0.3 which are sufficiently reliable to form part of a unidimensional scale (Table 7.3). The second factor which has Cronbach's alpha is too low (0.35), so it was dropped. Finally, only underlying items of the first factor were used in this analysis of neighbourhood attachment of the respondents who represent the households. The underlying items of neighbourhood attachment capture the issues of daily reciprocity among neighbours rather than the perception of the values of neighbourhood.

Table 7. 3: Descriptive statistics and reliability analysis for responses of the sample of floodplain residents to each survey item; alpha is Cronbach's alpha (eight items of factor 1)

Statements	Mean[+]	Standard deviation	Item-total correlation	Cronbach's Alpha if Item Deleted
I regularly have coffee/tea with my neighbors	0.00	1.00	0.39	0.67
I discuss with neighbors ways of living with the flood season	0.00	1.00	0.46	0.65
I regularly participate in recreational activities in the neighborhood	0.00	1.00	0.35	0.68
I regularly participate in cultural and religious activities in the neighborhood	0.00	1.00	0.30	0.69
I regularly participate in hamlet meetings to discuss ways to cope with flood	0.00	1.00	0.43	0.66
I help my neighbors with money or rice when they are affected by extreme floods	0.00	1.00	0.36	0.67
I am regularly invited to attend parties (wedding, birthday...)	0.00	1.00	0.38	0.67
I am regularly invited to participate in important events in the neighborhood such as conflict resolution	0.00	1.00	0.42	0.66

Note: Statements were measured on a 5-point scale: 1 strongly disagree, 2 disagree, 3 neither agree nor disagree, 4 agree, 5 strongly agree. Items were standardized into z-score (0,1) prior conducting factor analysis.
Cronbach's alpha is 0.69 in the reliability test.

7.2.2 Supportive social networks–informal social capital of households

In section 2.5.3.2 of Chapter two, I discussed the approach used to measure social supportive networks of the respondents in people's daily lives as well as in coping with the floods. I adapted the definition of social supportive network from Li et al. (2005: 112). They state that social network is measured by people's interaction with those beyond the immediate family, and the extent to which people feel they have supportive networks. There is no specific assumption about the geographical closeness of the network ties. However, there may be confusion in understanding neighbourhood attachment and social supportive networks because the questionnaires do not differentiate between neighbours and people in the networks. The respondents may include their neighbours in the network. To avoid that confusion, interviewers were

trained carefully to ask respondents about stating their networks, but not including their neighbours whom they mentioned in section 2.5.3.2 of Chapter two.

I adapted the approach of measuring social networks from Li et al. (2005) which does not assume geographical proximity of ego in network size, but there is a modification in the content of items that reflect local context in the MRD. In particular, we asked respondents if they can access material and expressive resources when they are in need. Especially, some items are related to coping with floods using resources from networks. Items were created from the qualitative results of in-depth interviews with key informants in the first field work period. The index of social supportive network was measured by nine items using a binary response (1, yes or 0, no) (Table 7.4) Those items include access to financial resources, informal credit, trust, received favours (skills, money, rice, boat, access to public relief in need, access to shelter for coping with floods and participating in informal loan saving groups). In addition, the respondents were also asked to state from which types of persons they can access resources if they said "yes". Those persons include family members, friends, local authorities, and religious groups.

The results indicate that in only four items do more than 80.0 per cent of the respondents say that they can access resources from networks. In particular, 88.0 per cent said that there is someone who believes them when they seek advice; 86.5 per cent said that there is someone to lend them money or rice during the flood season if they need it urgently; 80.9 per cent said that there is someone to lend them a boat during the flood season if they need it; and 80.0 per cent said that there is someone who helps them out when they have financial difficulty. Of four items which have the greatest frequency of responses, two items are related to coping with floods and the others are related to financial and emotional issues. Some 73.4 per cent of the respondents state that they can borrow VND 1.0 million immediately from the network, if they need it urgently. Money is an important resource for daily livelihoods. However, some 26.6 per cent of the respondents cannot borrow when they need money in an emergency. The reason for this fact is that some poor people may not have the capacity to pay back or they have lost their prestige *(uy tín)* from previous loans. Four items have less than 50.0 per cent of respondents saying that they can access resources. For example, 45.3 per cent said that there is someone to help them access public relief/assistance *(cứu trợ lũ lụt)* from Government, NGOs, and local religious groups if needed; 41.6 per cent said that there is

someone who invites them to participate in local cycling fund groups [45]*(chơi hụi)*; 30.9 per cent said that there is someone to help them access residential cluster for relocation in coping with floods (cụm dân cư vượt lũ) if they want to move; and 19.4 per cent said that there is someone to help them to learn new skills for exploiting the benefits of floods.

As discussed in section 2.5.3.2 concerning the approach to construct the social supportive network of respondents, the respondents who have greater weighted score, have a greater social supportive network. The results indicate that question 4 has the greatest weight (5.16) as fewer people said that there is someone to help them to learn new skills for exploiting the benefits of floods. On the other hand, the weight for question 2 is lowest (1.14).

Table 7. 4: Supportive social networks of respondents obtained from the flood prone regions of the MRD in 2010

No	Supportive social networks (n=459)	Yes	% Yes	Weight
1	If you need 1,000,000 VND urgently, can you borrow immediately?	337	73.40	1.36
2	Is there anyone who believes you when you seek advice from them?	404	88.00	1.14
3	Is there anyone who helps you out when you have financial difficulty?	367	80.00	1.25
4	Is there anyone to help you to learn new skills for exploiting the benefits of floods?	89	19.40	5.16
5	Is there anyone to lend you money or rice during the flood season if you need it urgently?	397	86.50	1.16
6	Is there anyone to lend you a boat during the flood season if you need it?	376	81.90	1.22
7	Is there anyone to help you to access public relief/assistance *(cứu trợ lũ lụt)* from Government, NGOs, and local religious groups if you need it?	208	45.30	2.21
8	Is there anyone to help you to move to residential cluster *(cụm dân cư vượt lũ)* if you want to move?	142	30.90	3.23
9	Is there anyone who invites you to participate in local loan saving groups *(nhóm chơi hụi)*?	191	41.60	2.40

Note: Weight is total sample divided by frequency of "Yes" for each item, e.g. weight of item one is 459/337, which equals 1.36. The total social supportive network index is the sum of the weight of nine items for each household.

[45] This is an informal financial group which is formed based on trust in each other. Each group has several members. Each group member contributes an amount of money to the leader of the group. Group has its rule for each member to participate in. The principle of this group is to help financial capacity for its members when in need. A group has a monthly meeting for their members to ask for withdrawing money. When a member withdraws the amount of money in term, they will pay the money back to the group in the following term. Another member will withdrew money in the next meeting, and this is repeatable for other members.

Family members and friends are the key resources of the respondents in most situations (Table 7.5). In particular, 70.2 per cent and 71.5 per cent of the respondents said they can borrow VND 1,000,000 urgently from their family members or friends, respectively. Some 70.2 per cent and 71.5 per cent believe that they can borrow money and rice during the flood season from a family member or friends, respectively. Some 56.6 per cent to 72.5 per cent said that they trust someone to advise them from among family members and friends. This figure is similar to the case when someone needs to borrow a boat during the floods. However, local authorities are helpful in supporting the respondents to access public relief (37.3 per cent) or to move to residential clusters (28.8 per cent). Some 37.3 per cent of the authorities help the respondents when they have financial difficulties. The reason for this is that some local government staff from farmers' and women's associations have introduced a rural credit program with a low interest rate scheme to some people in the commune. For example, local government staffs help some people access the low interest loan to build toilets, and to upgrade house foundations. However, very few of the respondents in the focus group discussions said that they have access to these resources. An old farmer (Mr Hai) said in FGD_TA01 in Trung An commune that he had heard about the low interest loan for the poor to improve sanitation facilities. But, when he asked the head of the farmer association, who is a leader of this program in Trung An commune, he said that the program had run out. The farmer association leader is more likely to help his relatives or close friends in their own network. Other people are often excluded from government programs, because they do not have a good relationship with them. Some 35.3 per cent of the respondents said they have been called to participate in local informal cycling fund groups from their friends. Although such informal recycling fund activity is operated illegally in Vietnam, this financial arrangement is helpful for people who cannot access formal credit from government programs. Very few religious groups help out the respondents in any of the above activities.

Table 7. 5: Proportion of the respondents (%) who said 'yes' to the following questions and types of ego (persons) in social networks (N=459)

No	Questions (%)	% Yes	Family member	Friends	Local authority	Religious groups
1	If you need 1,000,000 VND urgently, can you borrow it immediately?	73.40	70.20	71.50	1.30	1.70
2	Is there anyone who believes you when you advise them?	88.00	56.60	72.50	1.10	0.00
3	Is there anyone who helps you out when you have financial difficulty?	80.00	5.70	9.40	37.30	5.20
4	Is there anyone to help you learn new skills for exploiting the benefits of floods?	19.40	19.40	16.10	1.70	0.00
5	Is there anyone to lend you money or rice during the flood season if you need urgently?	86.50	70.20	71.50	1.30	1.70
6	Is there anyone to lend you a boat during the flood season if you need it?	81.90	56.60	72.50	1.10	0.00
7	Is there anyone who can help you access public relief/assistance *(cứu trợ lũ lụt)* from Government, NGOs, and local religious groups if you need?	45.30	5.70	9.40	37.30	5.20
8	Is there anyone who can help you to move to residential cluster *(cụm dân cư vượt lũ)* if you want to move?	30.90	1.20	3.10	28.80	0.20
9	Is there anyone who invites you to participate in local loan saving groups *(nhóm chơi hụi)*?	41.60	3.70	35.30	0.00	0.00

7.2.3 Participation in local groups and associations–formal social capital

Participation in groups or associations is considered to be an indicator of social capital of individuals. A World Bank research team found that participation in local groups and associations can help the poor to escape poverty because poor people can access resources from their members in the network (Narayan and Pritchett 1997). Putnam (2000) argues that social capital has declined in the USA because people are less likely to engage in groups and associations. As discussed in section 2.5.3.4 of Chapter 2, the index of formal social capital is simply measured as a raw number of memberships in groups and associations. It was found that there are 17 such local groups and associations in local communes in the Mekong River Delta (Table 7.6).

Generally, the proportion of households participating in each local group or association is low because they do not gain much from participation. The results indicate that the highest proportion of participants are members of farmer associations (17.0 per cent); followed by women's association (16.3 per cent), hamlet security groups (12.0 per cent), and Red Cross (10.7 per cent). Under 10.0 per cent of the respondents are members of each of the following groups: religious groups (9.6 per cent), youth unions (8.9 per cent), aged people associations (6.1 per cent), recreational and art clubs (5.0 per cent), flood response rescue team (4.4 per cent), farmer clubs (3.9 per cent), retired soldiers (3.3 per cent), loan saving groups (2.4 per cent), agricultural cooperatives (2.2 per cent), fishery associations (1.1 per cent), snail collecting group (0.4 per cent), and local authority (0.4 per cent).

There is no weighting on each group or association in constructing an index of formal social capital (participation in groups and associations) of households in this context. It is assumed that if households have greater numbers of memberships in associations or groups, they are more likely to own more associational social capital. This approach is quite acceptable in the Vietnam context (Nguyễn Văn Hà et al. 2004). The index is the sum of total memberships of each household.

Table 7. 6: Participation in formal groups and associations (N=459)

No	Participation in formal associations	Yes	%Yes
1	Farmers' associations	78	17.00
2	Women's associations	75	16.30
3	Youth union	41	8.90
4	Father front	4	0.90
5	Retired soldiers	15	3.30
6	Red Cross	49	10.70
7	Aged people's associations	28	6.10
8	Farmers' clubs	18	3.90
9	Loan saving groups	11	2.40
10	Flood response rescue team	20	4.40
11	Agricultural cooperatives	10	2.20
12	Religious groups	44	9.60
13	Fishery associations	5	1.10
14	Recreational and art clubs	23	5.00
15	Snail collecting group	2	0.40
16	Hamlet security group/unit	55	12.00
17	Local authority	2	0.40

Note: If a household had more than one member in a particular group or association, this study treated this as one membership.

7.2.4 Socio-economic variation of social capital of households

7.2.4.1. Neighbourhood attachment score by social group

The results from the chi-square test indicate that there is a statistically significant difference between poor, medium and better-off households in mean scores of neighbourhood attachment ($p<0.001$). In particular, the mean score of neighbourhood attachment of the poor is -0.42, while it is 0.19 for the medium households and 0.35 for the better-off households. The reason for this is that better-off households are more likely to connect closely to their neighbours than the medium and poor households (Table 7.7).

Table 7. 7: Neighbourhood attachment score by socio-economic group

Social group	N	Mean***	Std.
Poor	181	-0.42	1.06
Medium	132	0.19	0.87
Better off	146	0.35	0.83

Note: Test of significant difference is based on F-test; ***$p<0.001$, ** $p<0.01$; *$p<0.05$; ns is not significant.

7.2.4.2. Access to resources from social supportive network by social group

Poor people are less likely to be trusted, borrow money or a boat and be invited to join the informal local cycling fund group, but are more likely to be helped to access public relief by egos in the network (Table 7.8). The results show that there is a statistically significant difference between five out of nine types of resources in the social network. In particular, only 49.1 per cent of the respondents can borrow VND 1,000,000 urgently whereas 81.8 per cent and 95.8 per cent can borrow this amount urgently among the medium and better-off households, respectively ($p<0.001$). This leads the poor to be more vulnerable to food and income security. While 82.8 per cent of the poor are trusted when they advise other people, 87.1 per cent and 95.2 per cent of the medium and better-off households are trusted, respectively, by others ($p<0.01$). Fewer poor people (71.8 per cent) can borrow a boat during the floods than medium (87.8 per cent) and better-off households (95.2 per cent) ($p<0.001$). A boat is a means of catching fish during the flood season; however, not many poor people have a boat. To go fishing, they have to borrow a boat from a family member, friends or neighbours. However, the results indicate that a smaller proportion of poor people can borrow a boat than the medium and better-off households. Participating in a fund cycling group is a means to access informal credit for running farming activities for most rural households. However, poor people are less likely to be invited to join this group. It is a fact that most people do not trust the capacity of the poor to pay money back to group members. This type of fund cycling requires high trust from group members. If someone is a free rider, the system collapses. It is notable that poor people are more likely to access public relief from other social groups as the government targets the poor.

Table 7. 8: Access to resources from supportive social networks by socio-economic group

Items	Social network (n=459)	Socio-economic group		
		Poor	**Medium**	**Better off**
	N	141	132	146
1	If you need 1,000,000 VND urgently, can you borrow it immediately?***	49.17	81.82	95.89
2	Is there anyone who believes you when you advise them?**	82.87	87.12	95.21
3	Is there anyone who helps you out when you have financial difficulty? (ns)	74.59	80.30	86.30
4	Is there anyone to help you learn new skills for exploiting the benefits of floods? (ns)	18.78	17.42	21.92
5	Is there anyone to lend you money or rice during the flood season if you need it urgently? (ns)	88.40	88.64	82.19
6	Is there anyone to lend you a boat during the flood season if you need it?***	71.82	87.88	89.04
7	Is there anyone to help you to access public relief/assistance *(cứu trợ lũ lụt)* from Government, NGOs, and local religious groups if you need?**	55.25	37.88	39.73
8	Is there anyone to help you to move to a residential cluster *(cụm dân cư vượt lũ)* if you want to move? (ns)	29.83	37.88	26.03
9	Is there anyone who invite you to participate in local *(nhóm chơi hụi)*?***	29.28	44.70	54.11

Note: Test of significant difference is based on Chi-Square, ***p<0.001, ** p<0.01; *p<0.05; ns is not significant

In general, better-off households are more likely to have wider social supportive networks when they need support. For example, better-off households have an index value of 9.48, while the index value is 9.08 and 8.15 for the medium and poor households, respectively (Table 7.9). The reason for this is that better-off people have wider relationships in the community.

Table 7. 9: Supportive social network score by socio-economic group

Socio-economic group	N	Mean**	Std.
Poor	181	8.15	3.85
Medium	132	9.08	3.97
Better off	146	9.48	3.93

Note: Test of significant difference is based on F-test; ***p<0.001, ** p<0.01; *p<0.05; ns is not significant.

7.2.4.2 Participation in local groups and associations by socio-economic groups

Among 17 local groups and associations, there is a statistically significant difference between poor, medium and better-off social groups in participating in agricultural cooperatives, recreational and art clubs, aged people's clubs/associations, and youth unions (Table 7.10). Poor households are less likely to participate in agricultural cooperatives, recreational and art clubs, and youth unions than medium and better-off households. In total 8.9 per cent of the households are members of the youth union, but the percentage are 13.7 per cent and 9.0 per cent for better-off and medium households, and only 4.9 per cent for poor households. Some 9.5 per cent and 4.5 per cent of better off and medium households are members of recreational clubs, whereas only 1.6 per cent of poor households are members. Similarly, some 5.4 per cent of better-off households are members of agricultural cooperatives. Only 0.5 per cent and 0.7 per cent of the poor and medium households have joined the agricultural cooperatives because they may be landless farmers. On the other hand, a higher proportion of poor households are members of aged people's clubs.

Table 7. 10: Membership of local groups and associations by socio-economic group

Local groups and associations	**Socio-economic group**			**Total**
	Poor	**Medium**	**Better-off**	
N	181	132	186	
Snail collecting group (ns)	1.10	0.00	0.00	0.44
Local authority (ns)	0.00	1.52	0.00	0.44
Father front (ns)	0.55	0.76	1.37	0.87
Fishery associations (ns)	0.55	2.27	0.68	1.09
Agricultural cooperatives**	0.55	0.76	5.48	2.18
Loan saving groups (ns)	1.66	2.27	3.42	2.40
Retired soldiers (ns)	4.42	1.52	3.42	3.27
Farmers' clubs (ns)	3.87	3.79	4.11	3.92
Flood response rescue team (ns)	5.52	4.55	2.74	4.36
Recreational and art clubs**	1.66	4.55	9.59	5.01
Aged people associations**	9.94	1.52	5.48	6.10
Youth union*	4.97	9.09	13.70	8.93
Religious groups (ns)	6.08	12.12	11.64	9.59
Red Cross (ns)	11.05	9.85	10.96	10.68
Hamlet security group (ns)	9.94	15.91	10.96	11.98
Women's associations (ns)	17.68	14.39	16.44	16.34
Farmers' associations (ns)	13.81	15.15	22.60	16.99

Note: Test of significant **difference** is based on Chi-Square, ***p<0.001, ** p<0.01; *p<0.05; ns is not significant

There is no statistically significant difference between social groups in participation in local groups and associations (Table 7.11). People are not likely to trust the benefits

from participating in local groups and associations, so there is no statistically significant difference in mean score of participation by different local groups and associations.

Table 7. 11: Mean score of participation in groups and associations

Socio-economic group	N	Mean[ns]	Std.
Poor	181	0.93	1.28
Medium	132	1.00	1.35
Better off	146	1.22	1.25

Note: Test of significant difference is based on F-test; ***p<0.001, ** p<0.01; *p<0.05; ns is not significant

7.2.4.3 Mean score of social capital by socio-demographics

There is a statistically significant difference in neighbourhood attachment score, participation in groups and associations, and social supportive networks by land size groups and income quintiles (Table 7.12). In particular, people with larger ownership of agricultural land and higher income are more likely to connect closely to their neighbours and have a greater supportive network than people with smaller land size, and lower level of income (p<0.001). In contrast to participation in groups and associations by social groups, people with more land and income are more likely to participate in groups and associations. This means that people with larger agricultural land areas are more likely to participate in farmer associations or farmer clubs. This indicates that farmers with land are more likely to benefit from these groups or associations.

There is no statistically significant difference between age of respondents and neighbourhood attachment and participation in groups and associations. However, people aged from 40 to less than 60 are more likely to have greater supportive networks than younger and older age groups.

Household heads who are males are more likely to have closer attachments to their neighbours and to participate in local groups and associations. This can arise from gender bias in the sampling process, because there are fewer females in the samples than males. There is no statistically significant difference in mean score of supportive networks by gender.

Generally, respondents who have completed secondary education or a higher level of education are more likely to have a closer relationship with neighbours, greater supportive networks and greater level of participation in groups and associations. Respondents who are currently in a marriage relationship are more likely to have closer

relationships with neighbours, while respondents who are single, widowed or separated are less likely to have close relationships with neighbours. These may be the most vulnerable groups in the village. There is no statistically significant difference in participation in groups and associations and scores of social supportive network by marital status of respondents.

Table 7. 12: Socio-demographic conditions by social capital mean score

Socio-demographic conditions		Neighborhood attachment score				Participation in groups and association score			Supportive social network score		
		N	Mean	Std.	Sig	Mean	Std.	Sig	Mean	Std.	Sig
Land size (ha)					***			**			***
	<= 0.5 ha	229	-0.34	1.05		0.83	1.15		8.17	3.89	
	0.5 ha – <=2.0 ha	124	0.18	0.86		1.17	1.44		9.18	3.92	
	>2.0 ha	106	0.53	0.71		1.37	1.33		9.91	3.84	
Income quintiles					***			***			***
	1st	91	-0.73	1.05		0.49	0.91		6.85	3.84	
	2nd	91	-0.18	0.86		1.14	1.37		8.63	3.67	
	3rd	93	0.10	0.99		1.02	1.30		9.17	3.96	
	4th	91	0.32	0.78		1.26	1.30		9.75	3.72	
	5th	93	0.48	0.85		1.29	1.39		9.78	3.83	
Age of respondents					ns			ns			**
	25 - <= 40	81	-0.15	0.92		0.91	1.37		8.83	4.00	
	40 - <=60	255	0.06	0.99		1.12	1.29		9.33	4.00	
	>60	123	-0.03	1.07		0.98	1.24		7.83	3.61	
Gender of respondents					***			*			ns
	Males	330	0.18	0.93		1.12	1.37		8.99	3.98	
	Females	129	-0.45	1.05		0.86	1.07		8.45	3.82	
Respondents' education level					***			**			***
	Never went to school	64	-0.62	1.20		0.53	0.84		6.79	3.71	
	Primary education	246	-0.02	0.94		1.01	1.28		8.66	3.72	
	Secondary education	107	0.30	0.83		1.29	1.32		10.10	4.03	
	High school	37	0.24	0.98		1.32	1.62		9.78	4.03	
	College	4	0.25	0.82		2.50	1.29		11.13	3.85	

	Undergraduate and above	1	1.59	.		0	.		5.93	.	
Marital status of respondents					***			ns			ns
	Single	7	-0.47	1.53		0.29	0.76		7.37	3.92	
	Married	412	0.06	0.96		1.10	1.33		8.91	3.97	
	Widowed	39	-0.52	1.08		0.62	0.85		8.52	3.56	
	Separated	1	-2.00	.		0.00	.		2.38	.	

Note: Test of significant difference is based on T-test (if a categorical variable has two values) and F-test (if a categorical value has more than three values); ***p<0.001, ** p<0.01; *p<0.05; ns is not significant. Neighbourhood attachment scores were standardized by SPSS software when running factor analysis. The scores of social networks and participation in groups were not standardized yet.

7.3 Relationship between social capital, socio-economic variables and households' resilience to floods

7.3.1 Relationship between resilience property one, social capital and socio-economic variables

The qualitative findings confirm that securing food, income, health of family members, evacuation and recovery after floods are the most important indicators of living with the floods. This property is closely related to the capacity of a system to self organize presented by the Resilience Alliance (Carpenter et al. 2001). In Chapter 6, the resilience indices were developed from the multiple item approach to group resilience dimension using factor analysis. The resilience scores obtained from the factor analysis in Chapter six are used in this chapter as latent variables for estimating its relationship with social capital and socio-demographic variables of households (Table 7.13).

Results from multiple regressions show that aggregated social capital (Model 1) has a statistically significant effect on resilience property one ($p<0.001$). Resilience factor one is denoted as household's confidence in coping with food, income, health, and evacuation during floods and recovery after floods. The more income and social capital households have, the greater their capacity to secure food, income, and health and to evacuate during the flood season as well as to recover after floods. Poor households, people living in a high flood region, and in a simple house are less resilient to floods in terms of securing food, income, health, and evacuation during floods in the recovery after floods ($p<0.01$, 0.01, and 0.01 respectively). This means that people in the most flood-prone regions are more vulnerable to food, income, and health insecurity and recovery process. However, if households are located in the residential clusters, they are more likely to be confident in coping with food security, income, health, evacuation, and recovery after the floods. There is no statistically significant effect of household size, age, gender, education of respondents and location on their resilience capacity.

In the disaggregated social capital model (Model 2), the results indicate that only neighbourhood attachment has a (positive) statistical significant effect on households' resilience property one ($p<0.001$), whereas the supportive network of households and participation in group social capital do not have statistically significant effects. The reason for this is that people can access resources from their neighbours to cope with floods. They share rice, lend money, look after children and evacuate flood victims during floods as well as helping them to repair houses immediately if houses are

affected. However, respondents are less likely to trust that they can benefit from social groups and associations. Similar to the aggregated resilience model, poor households, people living in high flood-prone regions and in simple houses are less resilient to floods in terms of securing food, income, health, and evacuation during floods and recovery after floods. Again, there is no statistically significant effect of household size, age, gender, education of respondents or location on their resilience capacity in the disaggregated model.

Interestingly, the result from the interaction effect between neighbourhood attachment of households and the economic status variable (poor/non-poor) in Model 3 shows that there is a statistically significant difference between the effects of neighbourhood attachment of the poor and non-poor households on the resilience score ($p<0.01$). In this context, it is more important for the poor households to be attached to their neighbours in order to enhance their resilience score.

Table 7. 13: Multiple regressions for resilience property one by social capital and socio-demographic variables

Dependent variable:	**Model 1**		**Model 2**		**Model 3**	
Resilience one	Beta	Sig.	Beta	Sig.	Beta	Sig.
Constant	-1.231	0.602	-0.952	0.680	-0.885	0.699
Aggregated social capital	0.164	**0.000**				
Neighbourhood attachment index (standardized)			0.257	**0.000**	0.167	0.002
Membership index (standardized data)			-0.016	0.663	-0.021	0.578
Supportive social network index (standardized data)			0.001	0.970	-0.002	0.951
Household socio-economic status *Neighbourhood					0.137	**0.007**
Household socio-economic status	-0.512	**0.000**	-0.472	**0.000**	-0.467	0.000
Household size (persons)	0.031	0.379	0.020	0.570	0.017	0.625
Age of respondent	0.062	0.085	0.036	0.312	0.028	0.430
Sex of respondent	0.056	0.114	0.034	0.325	0.020	0.570
High flood region	-0.128	**0.002**	-0.142	**0.001**	-0.143	**0.000**
Moderate flood region	-0.109	**0.014**	-0.108	**0.012**	-0.112	**0.009**
Simple house	-0.119	**0.001**	-0.080	**0.027**	-0.082	**0.022**
House in residential cluster	0.025	0.512	0.016	0.653	0.025	0.492
House inside dikes	0.047	0.181	0.042	0.227	0.042	0.222
Relief household	-0.033	0.342	-0.040	0.240	-0.041	0.229
Respondent with no schooling	0.179	0.139	0.177	0.135	0.171	0.146
Respondent with primary school	0.070	0.674	0.081	0.620	0.091	0.574
Respondent with secondary school	0.022	0.880	0.026	0.851	0.031	0.823
Respondent with high school	0.005	0.955	0.004	0.965	0.008	0.932
F test	***		***		***	
Adjusted R Square	47.0		49.6		50.3	

Note: Resilience **property** one denotes households' confidence in securing food, income, health, evacuating during floods and recovery after floods
***p<0.001; **p<0.01; *p<0.05

7.3.2 Relationship between resilience property two, social capital and socio-economic variables

Focus group discussions showed that people perceive securing their homes to be the most important indicator of living with flooding and the capacity to protect houses during big floods reflects the level of wellbeing of rural households in the MRD. Results from factor analysis indicate that factor two reflects the magnitude of flood at which households are confident that their houses will not be affected. This is relevant to the amount of disturbance that a system can cope with from the Resilience Alliance definition (Carpenter et al. 2001). Two items reflect level of confidence including (2) 'I

am confident that my house will not be submerged by the biggest flood within the last 20 years', and (3) 'I am confident that my house will not collapse or be swept away by the biggest flood within the last 20 years'. The factor score which is created by factor analysis is used in this chapter as a latent variable to test the relationship between social capital and households' resilience in terms of housing security.

Results from the multiple regressions show that aggregated social capital of households (Model 1) does not have a statistically significant effect on the resilience score (Table 7.14). However, there is a statistically significant relationship between household economic status, high and moderate flood region, and house structure, house in residential clusters, and resilience property two ($p<0.001$, 0.05, 0.05, 0.001 and 0.001 respectively). This means that the well-off households and the locations where they live have a strong influence on their capacity to secure their homes during the floods. Households with a higher income are more likely to be confident that their homes will not be submerged or swept away by future floods as significant as the floods of 2000. Richer people are more likely to be confident of securing their homes as they often live in a concrete house structure that can cope well with floods. However, people in the low flood- prone regions are less likely to experience the flood impacts on housing, so they are confident that they can cope well with floods in terms of housing security. Especially, people in residential clusters are less likely to worry about the house being affected by floods. They feel safer coping with floods in terms of housing security. This demonstrates the success of the government policy program on the relocation of vulnerable populations to avoid the impacts of flooding. This policy helps people be more confident of living with floods because they no longer worry about the impacts of the flood on their homes.

In the disaggregated social capital model (Model 2), neighbourhood does not have a significant effect on resilience, while participation in groups and associations has a negative statistically significant effect ($p<0.05$). This means that the respondents do not trust the role of participating in groups and associations to bring benefits. Supportive social networks show its significant effect on resilience property two ($p<0.01$). This means that the wider the supportive network the people have, the greater their confidence in coping with floods in terms of home security. Regional flood factors have a statistically significant effect on households' resilience to floods ($p<0.05$). People who live in high and moderate flood regions are more vulnerable to the flood in securing their houses effectively. Again, poor people and those who live in a simple house are

less confident to say that they can secure their homes in a big future flood ($p<0.001$ and 0.001 respectively). People living in residential clusters are more confident of securing homes because they do not feel that the flood will affect their homes. Households living in moderate and high flood regions and those living in simple houses are less confident of securing their homes from the floods ($p<0.05$, 0.05, and 0.001 respectively). Other variables such as household size and gender and age of respondents and education of households do not have a significant effect on household resilience in model 2.

The interaction effect between social network index of the poor and non-poor groups does not show a statistically significant difference. So, model 3 should be dropped. This means that the effects of social network on resilience of the households are equally distributed among the poor and non-poor groups.

Table 7. 14: Multiple regressions for resilience property two by social capital and socio-demographic variables

Dependent variable:	**Model 1**		**Model 2**		**Model 3**	
resilience two	Beta	Sig.	Beta	Sig.	Beta	Sig.
Constant	0.032	0.992	-0.649	0.832	-0.643	0.834
Aggregated social capital	0.062	0.209				
Neighbourhood attachment index (standardized)			0.026	0.640	0.023	0.675
Membership index (standardized data)			-0.111	**0.027**	-0.112	0.026
Supportive social network index (standardized data)			0.159	**0.002**	0.144	0.020
Household socio-economic status *Neighbourhood					0.046	0.658
Household socio-economic status	-0.180	**0.000**	-0.176	**0.000**	-0.218	0.041
Household size (persons)	0.059	0.204	0.073	0.118	0.074	0.113
Age of respondent	-0.089	0.061	-0.085	**0.073**	-0.087	0.069
Sex of respondent	0.037	0.416	0.036	0.432	0.036	0.435
High flood region	-0.116	**0.035**	-0.114	**0.035**	-0.114	0.037
Moderate flood region	-0.137	**0.018**	-0.144	**0.011**	-0.145	**0.011**
Simple house	-0.186	**0.000**	-0.169	**0.000**	-0.169	**0.000**
House in residential cluster	0.246	**0.000**	0.245	**0.000**	0.246	**0.000**
House inside dikes	0.025	0.595	0.031	0.501	0.031	0.499
Relief household	-0.024	0.606	-0.025	0.591	-0.026	0.576
Respondent with no schooling	-0.024	0.879	-0.006	0.972	-0.005	0.974
Respondent with primary school	-0.046	0.834	-0.016	0.941	-0.013	0.953
Respondent with secondary school	0.018	0.925	0.046	0.801	0.048	0.793
Respondent with high school	0.044	0.726	0.062	0.619	0.062	0.614
F test	***		***		***	
Adjusted R Square	9.4		11.2		11.1	

Note: Resilience property two denotes households' confidence in securing their homes during floods

***p<0.001; **p<0.01; *p<0.05

7.3.3 Relationship between resilience property three, social capital and socio-demographic variables

Results from factor analysis in Chapter 6 show that there are two items that reflect the capacity of households to innovate, transform and learn new ways of living with floods. The statements 'I want to learn new flood-based farming practices to cope with floods, such as fishing, *Neptunia prostrate* growing, and prawn farming' and 'I have used new farming practices to cope with floods, such as fishing, prawn farming' indicate a respondent's level of interest in learning and carrying out new flood-based livelihoods. These items formulate the capacity of households to adapt to floods in order to maintain

household income during the flood season. This kind of adaptation is a total environmental based approach.

In contrast to the second resilience property, the results from the aggregated regression model indicate that households with a greater level of social capital are more likely to learn new flood-based livelihoods to adapt to floods ($p<0.000$) (Table 7.15). This lies in the fact that social capital has a positive effect on capacity to learn and adapt to floods. Households that engage in flood-based livelihoods are more likely to have a greater level of social capital. Household size has a significant effect on households' capacity to learn and engage in flood-based livelihoods ($p<0.05$). The larger the household size, the more human resources they have to engage in such flood-based livelihood activity. People living in the moderate and high flood regions are more likely to learn and practise new livelihoods that adapt to floods ($p<0.001$). This is because people are aware that the flood season can provide significant benefits for fishing, and doing aquaculture, so they are confident of practising such livelihoods. However, older and female respondents and those living in residential clusters are less likely to learn new ways of living with floods.

> Mrs Nuoc: During the flood season, most people in residential clusters close their houses and go to Ho Chi Minh city to work in construction sectors *(đi làm hồ)*, and work in garment factories *(xưởng may)*. Working in HCM city is just for survival during the flood season. I and my husband went to HMC and returned. Life in HCM is also very hard. We returned without money [in-depth interview with Mrs Nuoc on 12th September 2010].

Older people often do not have the labour capacity to carry out flood-based activities because these activities require them to work under risky conditions. The residential cluster policy has significant benefits in terms of securing food, health, evacuation of homes, but it discourages people learning and engaging in flood-based livelihood activities.

In the disaggregated regression model, neighbourhood attachment of households has a statistically significant effect on households' capacity to adapt to floods ($p<0.05$), but there is no statistically significant relationship between social supportive network, participation in associations and resilience. Households who want to learn and practise new flood-based livelihoods often have a greater level of neighbourhood attachment. Through connections with neighbours, these households can access local knowledge and information about flood-based farming practices that allow them to exploit the

benefits of floods. Several case studies derived from in-depth interviews and FGDs demonstrate that prawn, fish and *Neptunia prostrate* farmers use the networks of their neighbours and friends in the neighbourhood to learn from each other. They also help by sharing labour, and market information. However, there is no statistically significant relationship between participation in groups and social supportive network scores. This means that the current role of groups and associations is weak in facilitating local people to engage in different livelihoods during the flood season. However, the qualitative information from the in-depth interviews confirms that these groups and associations are very important in community preparedness and recovery after the floods.

> Mr Luoc, the Red Cross president at Thanh My Tay commune, said that before the flood season, the Red Cross team was formed using local resources such as young men in the village. During the flood season, the team took a boat around the village to supervise, provide relief, and rescue victims of the floods. The team also came to the households whose houses were submerged, to repair the homes for them using local resources such as wood and bamboo to reinforce the houses [in-depth interview with Mr Luoc, a leader of Red Cross, Thanh My Tay commune on 20th October 2010].

The results also confirm that poor households are more likely to learn and adapt to floods in terms of adopting new flood-based livelihoods. In particular, there is a statistically significant relationship between a household's resilience score and the economic status of the household ($p<0.05$). This finding may contradict evidence from in-depth interviews and field observations as only rich families engage in prawn farming during the flood season in Tam Nong district and Thanh My Tay commune of Chau Phu district. However, the number of prawn farmers is very limited and only a few of them were not included in the sample. Alternatively, this can be explained by the fact that better-off households are more likely to concentrate intensively on a narrow range of income sources (rice or prawn farming). Richer farmers own large areas of rice land, so they are more likely to specialize in rice farming and take a rest during the flood season. Thus, they are less likely to be interested in learning about new flood-based livelihood activities during the flood season. However, poor households are more likely to diversify their income sources into off-farm collecting, fishing, farming fish in an effort to adapt to flooding and maintain their income during the flood season.

> Mr Gom: Several years ago, I trapped fish *(đặt dớn)* during the flood season. Now the price of nets is increasing while the fish stock is declining gradually so I only stay at home during the flood season in recent years. At that time, I raised snake head fish *(cá lốc)* for selling at

> the local market for two years. I used the small fish which I caught from fish trap for feeding the fish so that I could reduce input costs, and earn some money. Now small fish stocks are declining so the input cost is increasing. Therefore, this business is not promising anymore. I am thinking about other flood-based livelihood activities to earn some money for the flood season [in FGD_PD02 on 11th January 2010].

Households in moderate-risk and high flood-prone regions are more likely to be interested in learning new flood-based livelihoods ($p<0.05$), while people in low flood regions are less likely to do so. More people in the moderate and high flood region engage in fishing and other flood-based related livelihoods during the flood season. Female respondents are less likely to learn new ways of living with floods ($p<0.001$). It appears that women are afraid of water, so they are not interested in working in flooded conditions. I have seen very few women engage in fishing and collecting activities during the flood season. Male respondents are considered the key money earners in a household during the flood season, so they are more likely to make the livelihood choices about making a living during the flood season. In contrast to resilience property one, households who settle in residential clusters are less likely to learn flood-based farming practices ($p<0.01$). Although the residential cluster policy can help people to enhance their resilience (in coping with food, income, health, recovery, and evacuation), they are not likely to be interested in conducting flood-based livelihoods. Their livelihood activities have been changed significantly, from off-farm and on farm labour to non-farm migration. Through field observation during field work in Phu Xuan hamlet of Phu Duc commune in October 2010, I saw that about 100 out of 390 homes had closed their doors because they had gone to work far from home.

Although neighbourhood attachment has a statistically significant effect on resilience component three, there is no statistically significant effect from the interaction effect between neighbourhood attachment index and economic status variable (poor and non-poor). Therefore model 3 should be dropped. There is no different effect in neighbourhood attachment of the poor and non-poor social groups in this context.

Table 7. 15: Multiple regressions for resilience property three by social capital and socio-demographic variables

Dependent variable: resilience three	**Model 1**		**Model 2**		**Model 3**	
	Beta	Sig.	Beta	Sig.	Beta	Sig.
Constant	4.478	0.137	4.558	0.132	4.609	0.127
Aggregated social capital	0.218	**0.000**				
Neighbourhood attachment index (standardized)			0.132	**0.015**	0.064	0.359
Membership index (standardized data)			0.082	0.097	0.078	0.111
Supportive network index (standardized data)			0.079	0.123	0.077	0.137
Household socio-economic status *Neighbourhood					0.103	0.122
Household socio-economic status	0.148	**0.002**	0.156	**0.002**	0.160	**0.001**
Household size (persons)	-0.111	**0.015**	-0.114	**0.014**	-0.116	**0.012**
Age of respondent	0.179	**0.000**	0.174	**0.000**	0.167	**0.000**
Sex of respondent	0.110	**0.015**	0.105	**0.021**	0.094	**0.039**
High flood region	0.224	**0.000**	0.222	**0.000**	0.221	**0.000**
Moderate flood region	0.219	**0.000**	0.219	**0.000**	0.216	**0.000**
Simple house	0.020	0.661	0.028	0.553	0.026	0.576
House in residential cluster	-0.114	**0.017**	-0.116	**0.016**	-0.109	**0.023**
House inside dikes	-0.033	0.470	-0.034	0.453	-0.034	0.454
Relief household	0.041	0.365	0.039	0.384	0.039	0.390
Respondent with no schooling	-0.248	0.108	-0.250	0.107	-0.254	0.100
Respondent with primary school	-0.396	0.064	-0.394	0.065	-0.387	0.071
Respondent with secondary school	-0.331	0.069	-0.330	0.070	-0.327	0.073
Respondent with high school	-0.206	0.091	-0.207	0.091	-0.204	0.095
F test	***		***		***	
Adjusted R Square	13.9		13.7		13.900	

Note: Resilience factor three denotes level of interest in learning and doing new flood-based **livelihoods** for adapting to the floods
***p<0.001; **p<0.01; *p<0.05

7.4 Conclusion

It is important to use both aggregated and disaggregated measures of household's resilience to floods to see the different dimensions of resilience. The findings of this study demonstrate that using disaggregated measures of household's resilience provides in-depth understanding of living with floods in the MRD. This technique allows researchers to identify different dimensions of households' resilience to natural hazards. Some people may be resilient in the housing sector, but are less likely to be confident in securing food, income, health, evacuating and recovery, as well as in adaptation to floods.

The use of multiple items in measuring neighbourhood attachment and social supportive network of households captures a wide range of underlying factors that form the informal social capital of households in the local context.

By investigating both disaggregated and aggregated social capital indexes and disaggregated resilience indexes of households, different forms of social capital are seen to have different effects on different forms of households' resilience to floods.

By disaggregating resilience, the effects of socio-demographic variables and regional flood factors on different forms of resilience can be seen. In disaggregated resilience property one, aggregated social capital has a positive effect, but only neighbourhood attachment has a positive effect on resilience one in disaggregated social capital analysis. In addition, household economic status has a negative effect on resilience one and two, but a positive effect on resilience property three. Regional flood factors have a negative effect on resilience property one and two, but a positive effect on resilience property three.

Housing status and flood region have a negative effect on resilience property one and two, but moving to residential clusters helps evacuees improve their confidence in coping with floods in terms of housing and livelihood security, but this does not encourage them to learn and conduct flood-based livelihoods. This negative effect of moving to residential clusters discourages people from conducting flood-based farming practices.

In disaggregated resilience regression, aggregated social capital has no effect on resilience property two. However, participation in groups and associations has a negative effect on resilience property two in disaggregated social capital analysis. Social supportive network has a positive effect on resilience property two. Economic status and flood region have negative effects, but residential cluster has a positive effect on capacity to secure the home.

In relation to resilience property three, aggregated social capital has a positive effect on households' resilience. But, only neighbourhood attachment has a positive effect on capacity to learn and do flood-based livelihoods (resilience property three). In contrast, poor people are more likely to be interested in learning new ways of living with floods, and learning to be more resilient. Female respondents and people who live in residential clusters are less resilient. This means that moving to residential clusters does not

encourage them to learn and do flood-based farming practices. But those who live in heavy and moderate flood regions are more likely to learn new ways.

The findings support the argument that there is a statistically significant relationship between social capital and households' resilience to floods. However, the results only demonstrate that neighbourhood attachment of households has a positive statistically significant effect on confidence to secure food, income, health, and evacuation during floods and recovery after floods and level of interest in learning new ways of living with floods, while participation in groups and associations shows negative effects on capacity to secure homes. Social supportive networks of households have positive effects on securing homes. Those who learn and conduct flood-based livelihoods often have a good relationship with neighbours. This means that family members and friends play an important role in coping with floods in cases of crisis. Therefore, to encourage households and communities to engage in flood-based livelihood activities, banking on neighbourhood attachment would help. Maintaining neighbourhood attachment of households would help them to secure food, income, health and evacuation during the flood as well as recovery after the floods. Participation in groups and associations does not show positive effects on the three forms of resilience. It is clear that local people do not trust these groups and associations to some extents, because they often support only their own membership if they have a close relationship with them. People do not trust these groups to help them, because they do not see any benefits from participating in them.

Socio-economic conditions of households have different effects on the three properties of households' resilience to floods. Household economic status shows significant negative effects on resilience factor one and two, but a positive effect on resilience factor three. This means that poor households are less resilient in securing food, income, health, homes, evacuation and recovery than non-poor households. However, poor households are more resilient in terms of conducting flood-based livelihoods for survival during the floods. Sex of respondents has positive effects on resilience factor three as women are less likely to engage in livelihood activity during the flood season, such as fishing. Age of respondents has a positive effect on resilience property three, but not on resilience properties one and two. Household size has a negative effect on resilience property three, but not for the other properties of resilience.

Regional flood factors have different effects on the three dimensions of resilience. People in the highest flood-prone region are less resilient to floods in coping with food and the housing security, income, health security, evacuation and recovery, while they are more interested in learning and doing new ways of living with the floods. Policy for improving livelihood resilience to the flood season should focus on the moderate and heavy flood region, especially for the poor.

The next Chapter will provide an in-depth analysis of households' livelihood diversification and their resilience to floods.

Chapter 8

Livelihood diversification and households' resilience to floods in the MRD

Rice is the primary income source for most rural households in the MRD. Besides rice, farmers also raise livestock, poultry, and fish and grow vegetables and fruit in the flood-prone areas of the MRD. Some people do this for income generating, but others for subsistence. However, rice is mostly grown from November (lunar calendar) to July or August each year, not the several months of the flood season. So, there is a need to maintain income and expenditure during the flood season. Especially, poor farmers are often landless so their primary income source is agricultural labouring in the dry months and catching fish in the flood months. However, the fish stock is declining rapidly due to population growth and natural decline in stock; poor people are more likely to migrate to HCM City during the flood season to sustain their income. Some people migrate permanently, but others do seasonally, although, the livelihoods of these migrants are not always successful in the new places. Many of them return home and become more vulnerable to floods because they lose the resources in their host communities after migrating for a period of time. Some people diversify to on-farm income-generating activities such as growing vegetables, fish, and prawns during the flood season. Some people are successful in coping with floods, but others are vulnerable to floods (personal experience from the researcher).

8.1 Introduction

In developed countries people are more likely to ask after ones 'health' in daily encounters, but people are more likely to ask about 'jobs' in the MRD. The question: 'What are you doing?' *(anh chị/ông bà lúc này làm gì?)* is a common question when people meet their friends, neighbours, and relatives daily in the flood-prone region of the MRD. Some people reply that they will go to Binh Duong province to look for jobs, while others stay at home to do agricultural labouring, off-farm fishing, and snail collecting, pursue home-based business or take a rest during the flood season. Although rice is the primary income source for most rural households in the MRD, it cannot be grown year-round. Rice is mainly grown from November to August the following year in the flood-prone area. The presence of permanent high dikes in some areas allows for intensification of rice during the flood season (from August to November), but most households seek alternative livelihoods. Their normal income stream is likely to be either disrupted or generated by the occurrence of the flood season, depending on their

capacity to adapt to the flood season. Poor households are the most vulnerable group in terms of livelihood insecurity due to the occurrence of the flood season (see section 6.6.1 of Chapter six). They are often landless and their livelihoods depend heavily on a daily agricultural wage income from labouring in the dry season, so they are more likely to diversify income sources into off-farm fishing during the flood season and depend on remittance income from rural-urban seasonal migration in order to survive.

However, the natural fish stock has declined dramatically in recent years due to overexploitation arising from rapid population growth, the increase in pesticide use and the development of dikes and polders. Additionally, the average agricultural labour wage income has been reduced in recent years because of mechanization in rice harvesting [in-depth interview with Mr Hoa in Thanh My Tay commune, on 19th September 2010]. Rice farmers are more likely to hire a harvesting machine than human labour. So, the livelihoods of the poor become vulnerable during both the dry and flood seasons. To cope with such stress, these poor households and their members are more likely to migrate to industrial areas in Binh Duong province or HCM city to seek jobs to maintain their livelihoods [in-depth interview with Mr Sy in Phu Duc commune, on 20th September 2010]. Some of them migrate seasonally, but others stay in HCM city permanently. Some are successful, but others are more vulnerable to food and income insecurity due to their migratory pattern.

Livelihood diversification as a key for coping with risk and natural hazards is increasingly recognized and discussed in the literature (Adger 2000, Brouwer et al. 2007, Ellis 2000, Adger 1999). Brouwer et al. (2007) found that diversification of livelihoods into non-farm activities can reduce the risk posed by flood in rural Bangladesh. Eriksen et al. (2005) found that diversification into non-farm activities can help rural households to reduce vulnerability to drought in Kenya. However, it is also argued that diversity of income source does not necessarily improve household income in rural India because of the increase in diversification cost (Anderson and Deshingkar 2005). In addition, Carswell (2000) argues that poor households are more likely to diversify income generating activities for survival, while richer households often diversify for capital accumulation. This argument is supported by Marschke and Berkes (2006) who investigated the livelihoods of a Cambodian community. However, little evidence for livelihood diversification as a coping strategy in the flood season has been presented for the MRD. This chapter will explore the existing livelihood conditions of different socio-economic groups and genders in general, and will examine the

importance of livelihood diversification for households in coping with the flood season. In particular, this chapter explores the ways in which rural households develop their livelihood strategies to maintain household income and cope with the regular flood season. The first part of this chapter explores the diversity of occupation of the respondents (usually household heads) and the occupation of household members to illustrate the existing livelihood activities of households in the three study sites. The diversity of livelihood activities during the flood season is further explored to see whether diversification of household livelihood activities into off-farm or non-farm income generating activities is beneficial or disadvantageous in helping rural households cope with the flood season. In particular, the contribution of livelihood diversification to total household income is examined to assess whether livelihood diversification into flood-based farming, off-farm fishing and non-farm migration may be better for some socio-economic groups, but results in being worse-of for other people. The second part of this chapter provides an in-depth discussion of the key livelihood activities: (1) rice farming; (2) off-farm fishing; (3) flood-based farming; and (4) seasonal migration in order to answer two sub-questions: (1) is it good for farmers to specialize in rice farming or diversify income into flood-based farming, off-farm fishing or non-farm migration? and (2) Why don't people engage in these livelihood activities?

8.2 Livelihood diversification in the study sites

8.2.1 Diversity of occupation *(nghề nghiệp)* and job status of the respondents

The primary occupations of the respondents are quite diverse at community level in the MRD. This diversity of livelihood activities can be examined through looking at the occupations of the respondents (household heads) and their household members in the MRD. Thirteen different occupations and job status' were found in the three study sites: (1) agriculture[46], (2) animal husbandry[47], (3) aquaculture[48], (4) agricultural wage labour[49], (5) industrial labour[50] and builder, (6) small home-based business[51], (7) fishing and collecting[52], (8) government officials, (9) retired, (10) handicraft maker, (11) housekeeper, (12) unemployed and (13) others (Figure 8.1). Among these occupations, the majority undertake agricultural activities such as rice farming as their primary

[46] Agriculture includes rice and vegetable farming
[47] Animal husbandry includes livestock and poultry farming
[48] Aquaculture includes fish, eels and prawn farming
[49] Any kind of labour in the agricultural sectors
[50] Working in garment companies and building houses
[51] Any kind of home-based businesses such as coffee shops, grocery shop, clothes shop,
[52] Collecting fish, snails, wild vegetables

occupation (47.0 per cent). This figure shows that rice is an important income source for the majority of the households as well as being the most important subsistence crop. Agricultural wage labour is the second most popular activity by the respondents in these areas (17.0 per cent). Some 9.0 per cent of the respondents are retired and do not have the capacity to work. Some 6.0 per cent of them are housekeepers in the female sample group or do non-farm home based business such as running a coffee shop *(quán cà phê)*, small restaurants *(tiệm cơm)*, grocery shops *(tiệm tạp hóa)*, shoes and clothes shops *(tiệm dày hay quần áo)*. Only 3.0 per cent of the respondents do skilled labour jobs *(lao động có nghề nghiệp)*, while 3.0 per cent of them are unemployed *(thất nghiệp)*. From 1.0 to 2.0 per cent are engaged in fishing *(câu lưới chuyên nghiệp)* all year round, or work for the local government in communes or districts, or make handicrafts for sale *(thủ công mỹ nghệ)*. Again, agriculture (mainly rice farming) takes up a large proportion of the respondents' occupations. This implies that agricultural income still plays an important part in rural household livelihoods in the MRD.

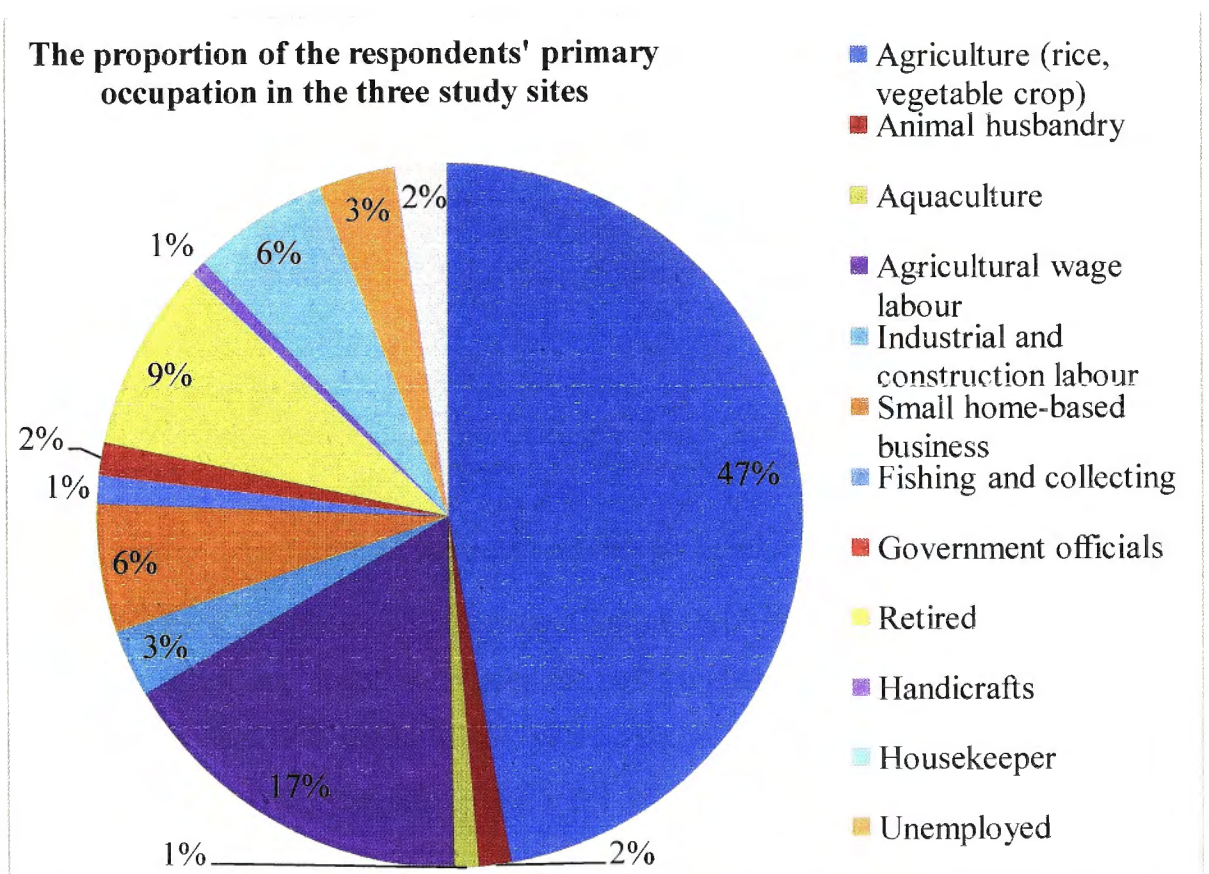

Figure 8. 1: The proportions of the respondents' primary occupation in the three study sites (N=459)

Although there is a diversity of occupation at commune level, the majority of respondents who are the representatives of households have only one occupation (Figure 8.2). About, 62.5 per cent of respondents are engaged in one job, only 31.8 per cent have two jobs, and only 5.7 per cent have three jobs. The household heads are more likely to work on the farm, and conduct a single income-generating activity. However, the number of occupations of the entire household may be very different from that of the household heads. For example, many household heads have one or two occupations, but their household members may diversify their occupations into off-farm or non-farm activities. The diversity of occupation of household members may be very important for maintaining household income.

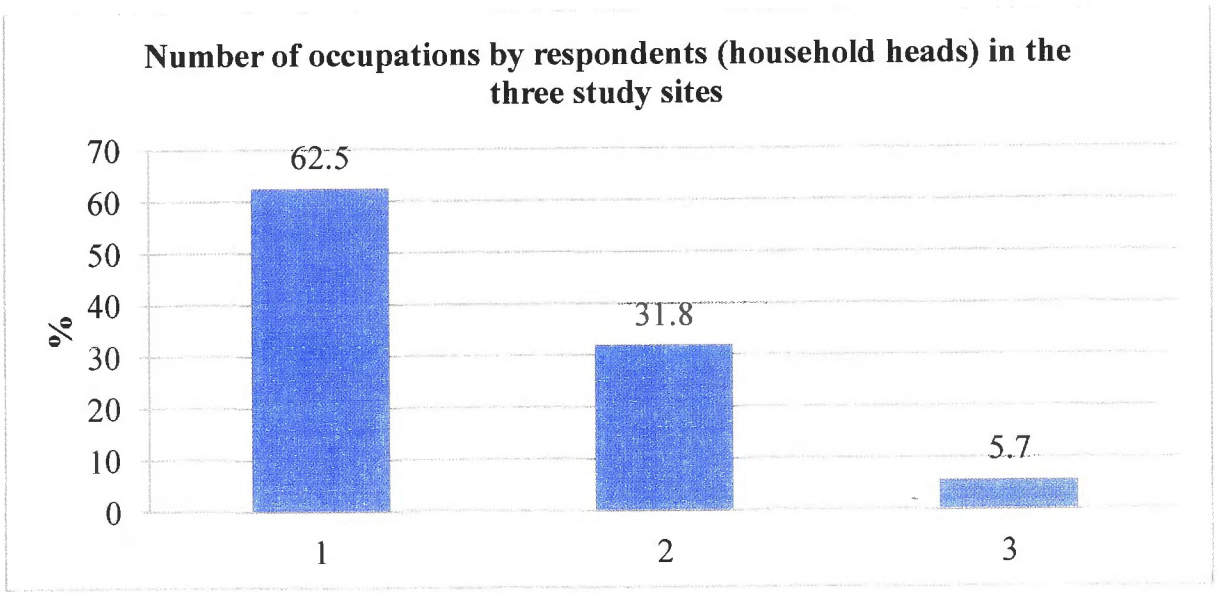

Figure 8. 2: Number of occupations by respondents (household heads) in the three study sites (N=459)

8.2.2 Primary occupation of the respondents by gender

In general, most jobs had a higher proportion of men than women listing them as their primary occupation, with the exception of handicraft making and housekeeping activities, for the 12 months of the year. Men are more likely to work on-farm in agriculture (rice and vegetables) (84.3 per cent), animal husbandry (57.1 per cent), aquaculture (60.0 per cent), agricultural labour (62.3 per cent), skilled labours (78.5 per cent), small home-based business (62.6 per cent), and government officials (71.4 per cent), retired (72.5 per cent), unemployed (81.2 per cent) and other activities than women (Figure 8.4). However, women are more likely to participate in handicraft activity (66.6 per cent of women compare with 33.3 per cent of men) such as making bags from water hyacinth stems, making candles, and making hooks for fishing. Women

are less likely to participate in farm activities than men (15.6 per cent of women compares with 88.3 per cent of men), because they prefer to do non-farm activities. There are other reasons for women being home-based, like the need to care for children, cook, or cultural reasons. In addition, there are limited farm jobs available for women, especially during the flood season.

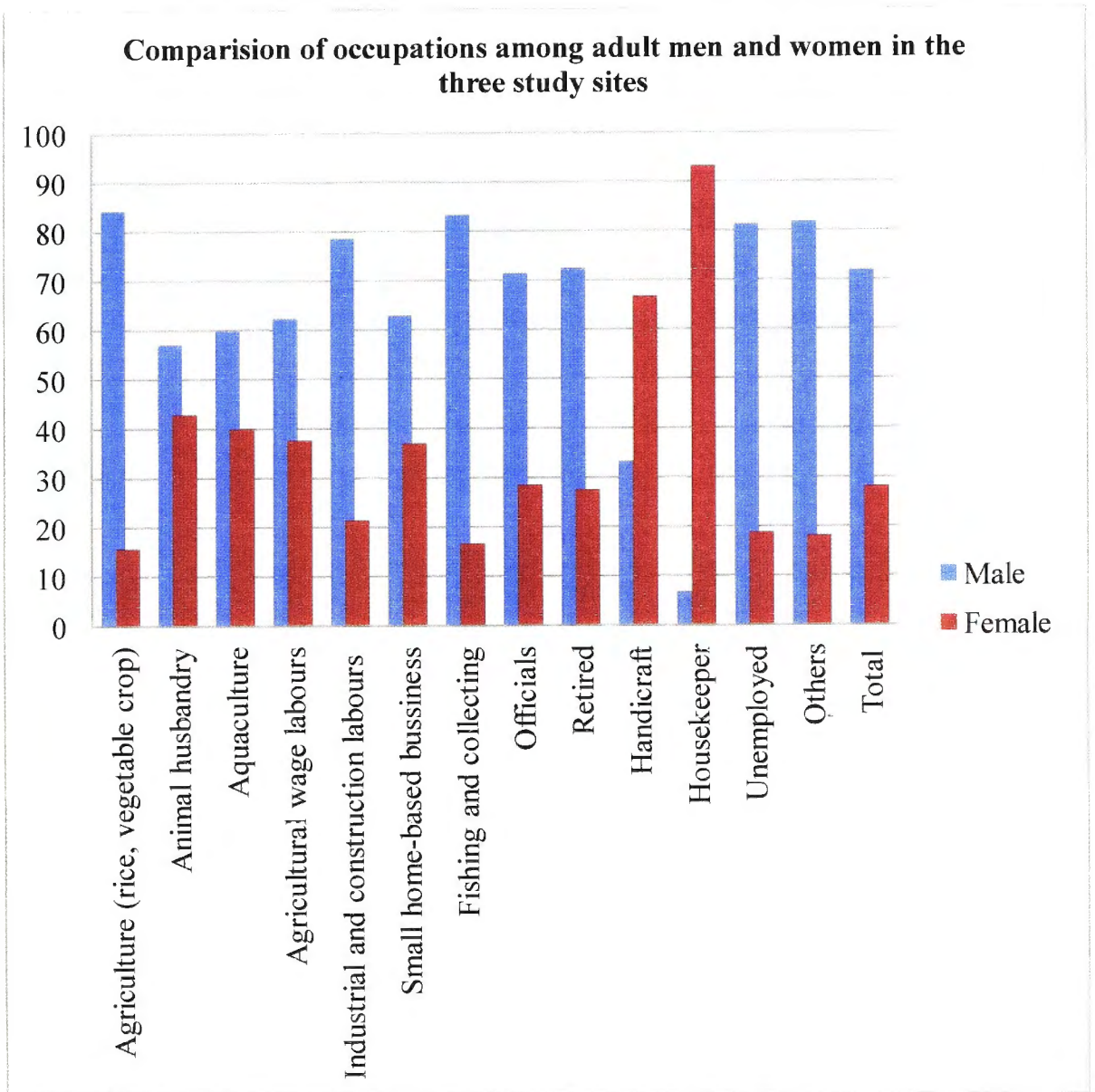

Figure 8. 3: Comparison of occupations among adult men and women in the three study sites (N=459)

8.2.3 Primary occupation of household members

A similar pattern of primary occupation is found among household members (Figure 8.3). Eleven occupation groups were identified in the sample. However, a smaller proportion of household members participated in agriculture (29.0 per cent) compared to 47.0 per cent of the household heads who did. Many household members have shifted from agriculture to off-farm and non-farm wage labour activities in recent years. In

particular, 11.0 per cent of household members are worked in small business, while only 6.0 per cent of household heads did any such activity. Some 8.0 per cent of the household members do off-farm fishing and collecting activities compared to only 1.0-2.0 per cent of the household heads who pursued this off-farm income. From 2.0 to 4.0 per cent of respondents work for the government and carry out handicraft activity or stay at home as housekeepers. However, the same pattern of household members (17.0 per cent) engaged in agricultural wage labours as the household heads emerged. The difference in diversification of occupation between household heads and household members shows that the livelihood strategy of household members is more likely to shift from on-farm rice farming to off-farm and non-farm income generating activity. The reason for this is that there have been fewer rice harvesting jobs available to the household members in the agricultural sector in recent years because many machines have been introduced to replace human labour. So these poorer people are more likely to shift to other flood-based farming practices, off-farm collecting and non-farm income activities rather than concentrating on rice farming.

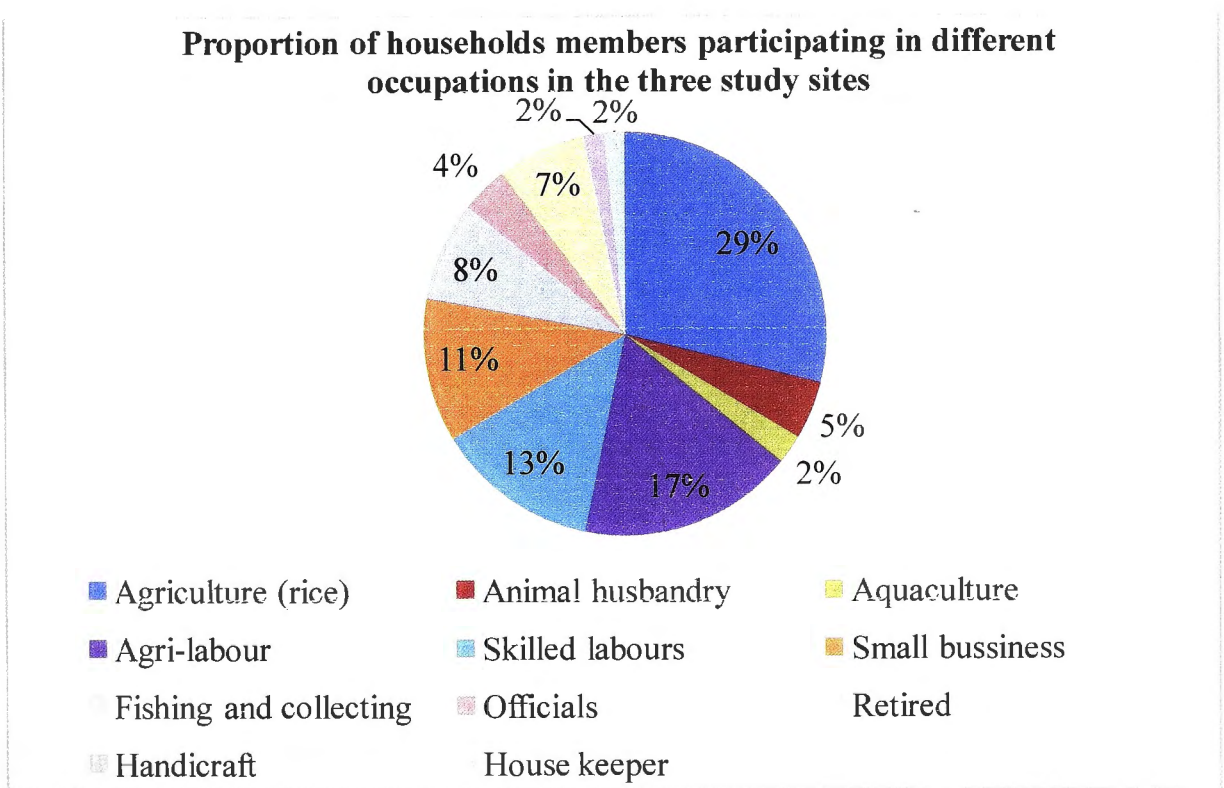

Figure 8. 4: Proportion of households members participating in different occupations in the three study sites (N=459)

8.3 Income diversification at household level

The income generating activities are greatly diversified at household level in the three study sites; however, the tendency among income-generating activities was to focus on

rice farming, home-based business and agricultural wage labour. The respondents were asked to report different income-generating activities that they carried out in the last 12 months (Figure 8.5). Fourteen types of income activities were recorded in the sample: winter-spring rice crop *(lúa Đông-Xuân)*, summer autumn rice crop *(lúa Hè-Thu)*, autumn-winter rice crop *(lúa Thu-Đông)*, vegetable crops *(cây màu)*, cattle *(gia súc)*[53], poultry *(gia cầm)*[54], aquaculture *(nuôi trồng thủy sản)*[55], agricultural labour *(làm thuê trong nông nghiệp)*[56], agricultural services *(dịch vụ nông nghiệp)*[57], fishing *(câu lưới)*[58], industrial wage labours *(làm thuê trong công nghiệp)*[59], construction labour work (builder) *(làm thuê xây dựng)*[60], government officials (cán bộ công chức), and non-farm home-based business[61]. The result further confirms that over half of the households derive their income from rice farming. In particular, 55.1 per cent and 53.6 per cent of the households grow winter-spring and summer-autumn rice crops, respectively. Very few households grow the autumn-winter rice crop because of flooding in this season (3.3 per cent). Some 41.8 per cent of the households derive income from home-based business and 34.4 per cent of households are engaged in agricultural labour. These figures show that livelihood diversification at household level was geared mainly toward off-farm labour and non-farm, home-based business during the year. However, rice farming, agricultural labour and home-based business have the highest proportion of households participating.

[53] Pig, cows and water buffaloes are raised by rural people, but pig was the most commonly recorded in the sample.
[54] Chickens and ducks are the two most common poultry items in the sample.
[55] Snake head fish and cat fish are the two most common fish in the sample. Others include white fish and eels.
[56] Weeding, spraying pesticides and harvesting rice are most common jobs for these households in the sample.
[57] Providing services for agriculture such as driving tractors, threshing machines, irrigation, and leasing land
[58] These include netting, trapping, and electricity capturing, collecting crabs, and snails.
[59] Working in local food processing factories or in textile factories in Binh Duong or Ho Chi Minh city
[60] Working in the construction sector in HCM city
[61] There are many non-farm home-based activities in the sample. These include hairdressing, coffee shop, carpenter, motorbike repairs, grocery shop, vegetable or fish sellers in the local market, and rice middle-men

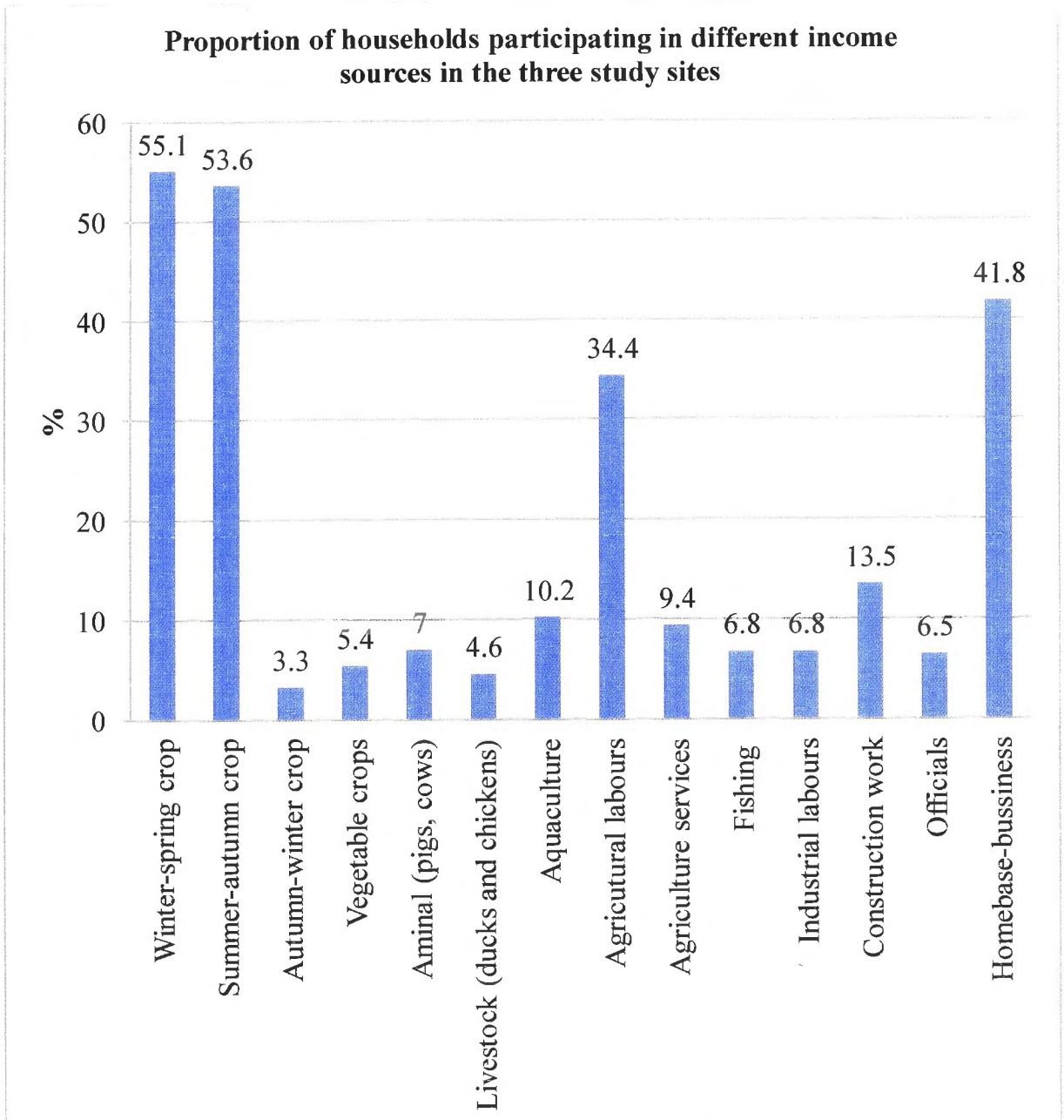

Figure 8. 5: Proportion of households participating in different income sources in the three study sites (N=459)

8.3.1 Participation in income generating activities by socio-economic group

More poor households participate in agricultural labour, fishing, industrial labour, construction work, and home-based business than better-off and medium households (Figure 8.6). The reason for this is that poor households are often landless, so they do not have natural or financial capital to invest in agricultural activities such as rice farming. Their livelihood choices are often based on the availability of human resources in the form of labour. On the other hand, medium and better-off households often own rice land, so they are more likely to produce rice in the dry season, raise high-value animals such as cows, water buffaloes and pigs, and conduct agricultural services such as ploughing up, levelling soils, and harvesting rice by machine. These farming

activities and services require high capital investment, so the poor households cannot afford to enter them. In terms of agricultural activities, the chi-square test shows that poor households are less likely to grow rice (10.1 per cent), and vegetable crops (24.1 per cent) and raise livestock (12.5 per cent) than the medium and better-off households (Figure 8.6). As discussed previously, because these farming activities require land and high financial capital, it is usually impossible for poor households to engage in them.

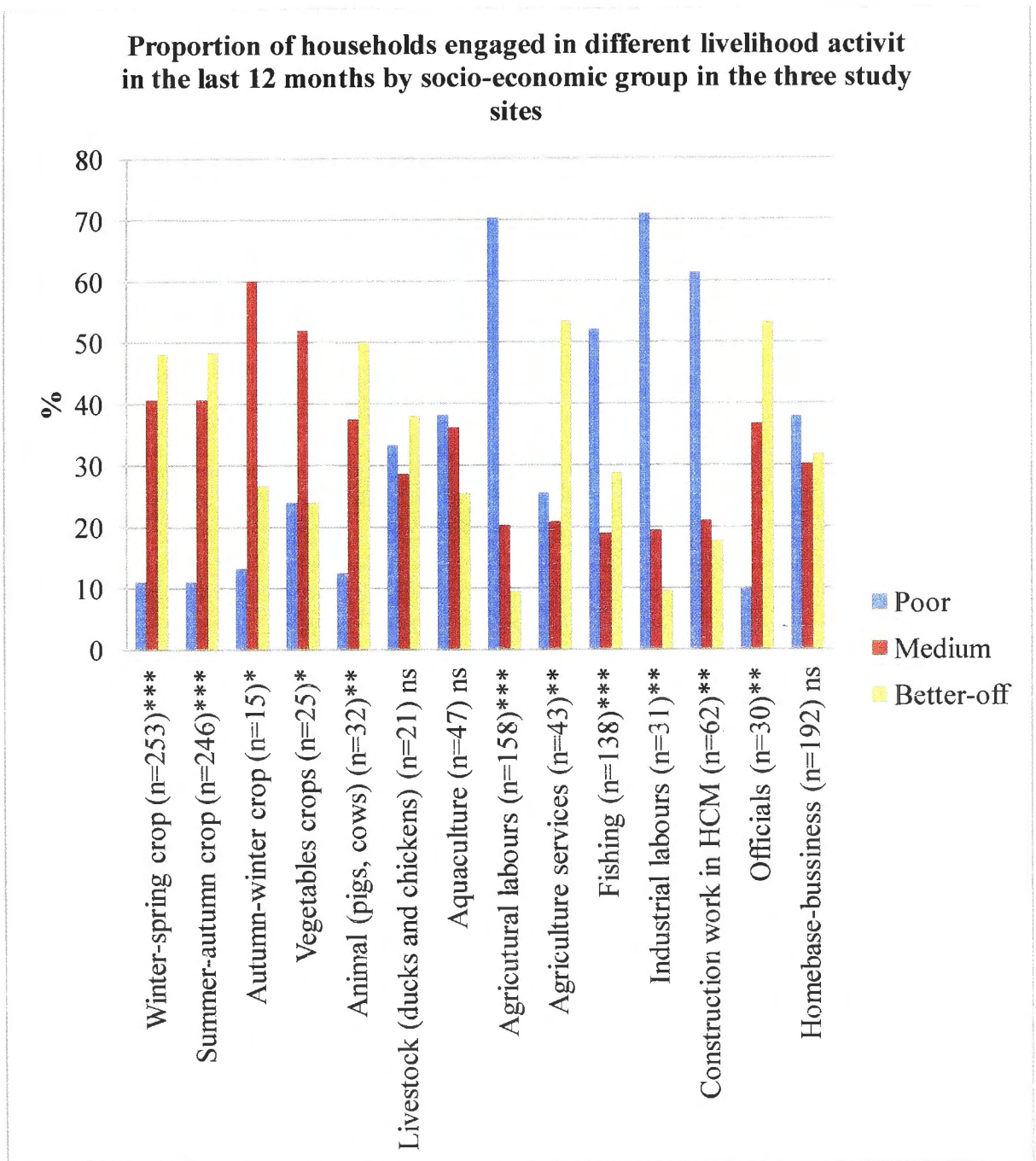

Figure 8. 6: Proportion of households engaged in different livelihood activities in the last 12 months by socio-economic group in the three study sites (N=459)

Note: Test of significant difference is based on chi-square, ***p<0.001, ** p<0.01; *p<0.05; ns is not significant

8.4 The importance of livelihood diversification activity for households during the last 12 months

A high proportion of households in Phu Duc, Thanh My Tay and Trung An communes are involved in diversification activities. But how important are these activities in terms of their contribution to household cash income and the household's capacity to cope with the flood season? In this context, farm income includes sales of crops (rice, vegetables), livestock (cows, pig), and poultry (chicken and ducks), and aquaculture (prawns and fish), while off-farm income includes fishing, snail collecting, agricultural labours, agricultural services (e.g. leasing land), and non-farm income includes industrial wage labour, and small home-based business (Figure 8.7). In particular, agriculture plays an important role in total household income (39.0 per cent). Non-farm wage labour, at 17.0 per cent, plays the second most important role in household income. Agricultural wage labour income is the third income source (13.0 per cent). The mean proportion of off-farm fishing and collecting, home-based business, agricultural services, remittances, animal rearing, and aquaculture income source is relatively low. This means that off-farm wage labour is the main way of diversifying income activity at household level.

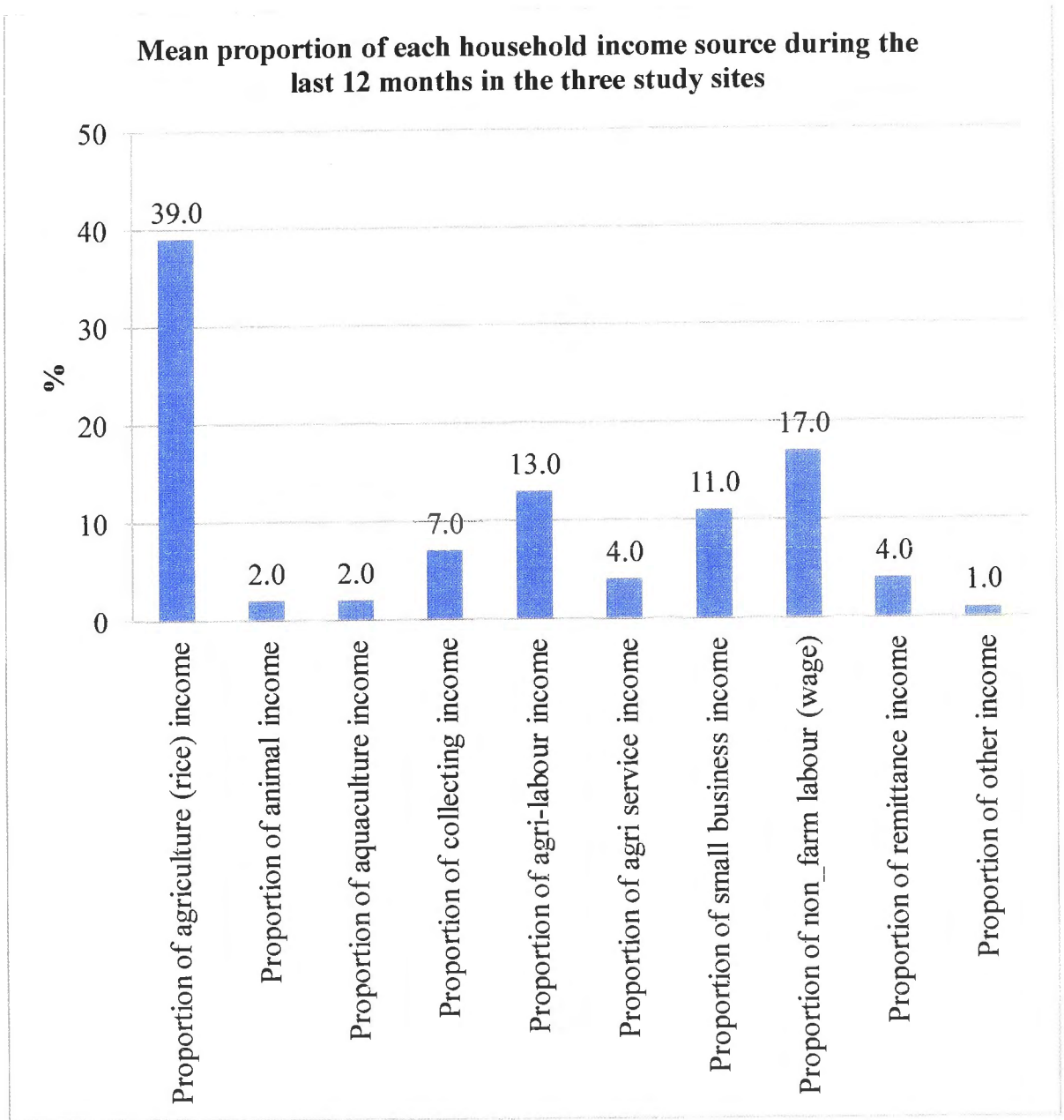

Figure 8. 7: Mean proportion of each household income source during the last 12 months in the three study sites (N=459)

Richer and medium households earn a higher proportion of their income from farming activities than medium and poor households (Figure 8.8). The chi-square test shows a statistically significant difference between farm income sources by socio-economic group ($p<0.001$). In particular, only 8.1 per cent of the poor households have farm income from rice and vegetable farming, while 56.4 per cent and 39.4 per cent of the better off households have income from agriculture, respectively. The middle-income group earns seven times more from agriculture than does the poor group. More than 60.0 per cent of the income earned by the poor comes from agricultural labour, fishing, and non-farm work (Figure 8.8). This suggests that poor households are more likely to

shift into off-farm labour, fishing, and non-farm migration, whereas richer households are more likely to specialize in farming income.

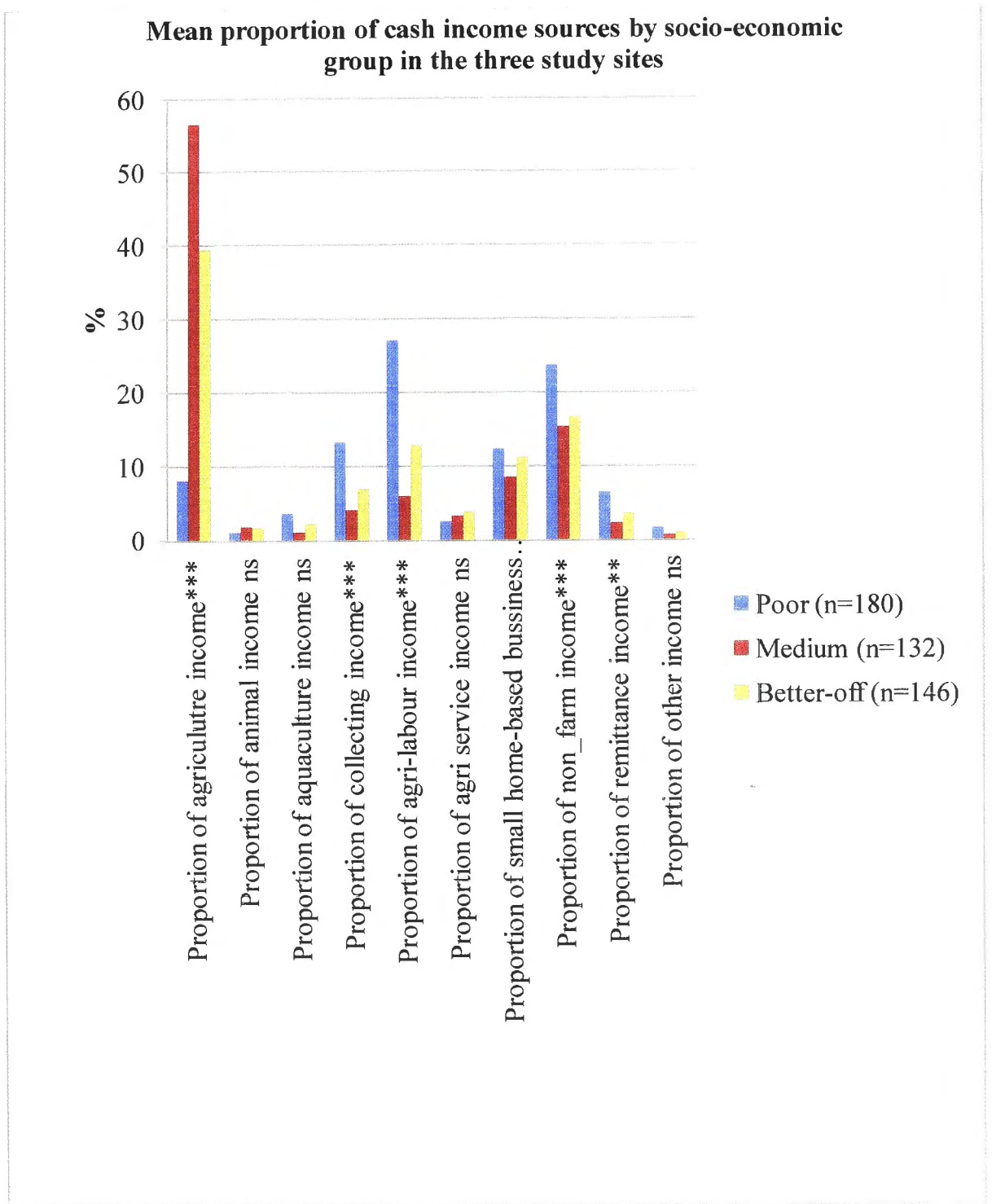

Figure 8. 8: Mean proportion of cash income sources by socio-economic group in the three study sites (N=459)

Note: Test **of** significant difference is based on F-test, ***p<0.001, ** p<0.01; *p<0.05; ns is not significant.

However, there is no statistically significant difference between the mean of the proportion of different income sources by region except for off-farm fishing and collecting activity ($p<0.001$) (Figure 8.9). This means that the distribution of income sources is relatively equal among the three regions. However, people in the high flood-prone region derive a greater proportion of income from fishing than those in the moderate and low flood region. It appears that there are more fish to catch in the highest flood region in Tam Nong district than in that of the Thanh My Tay and Trung An communes.

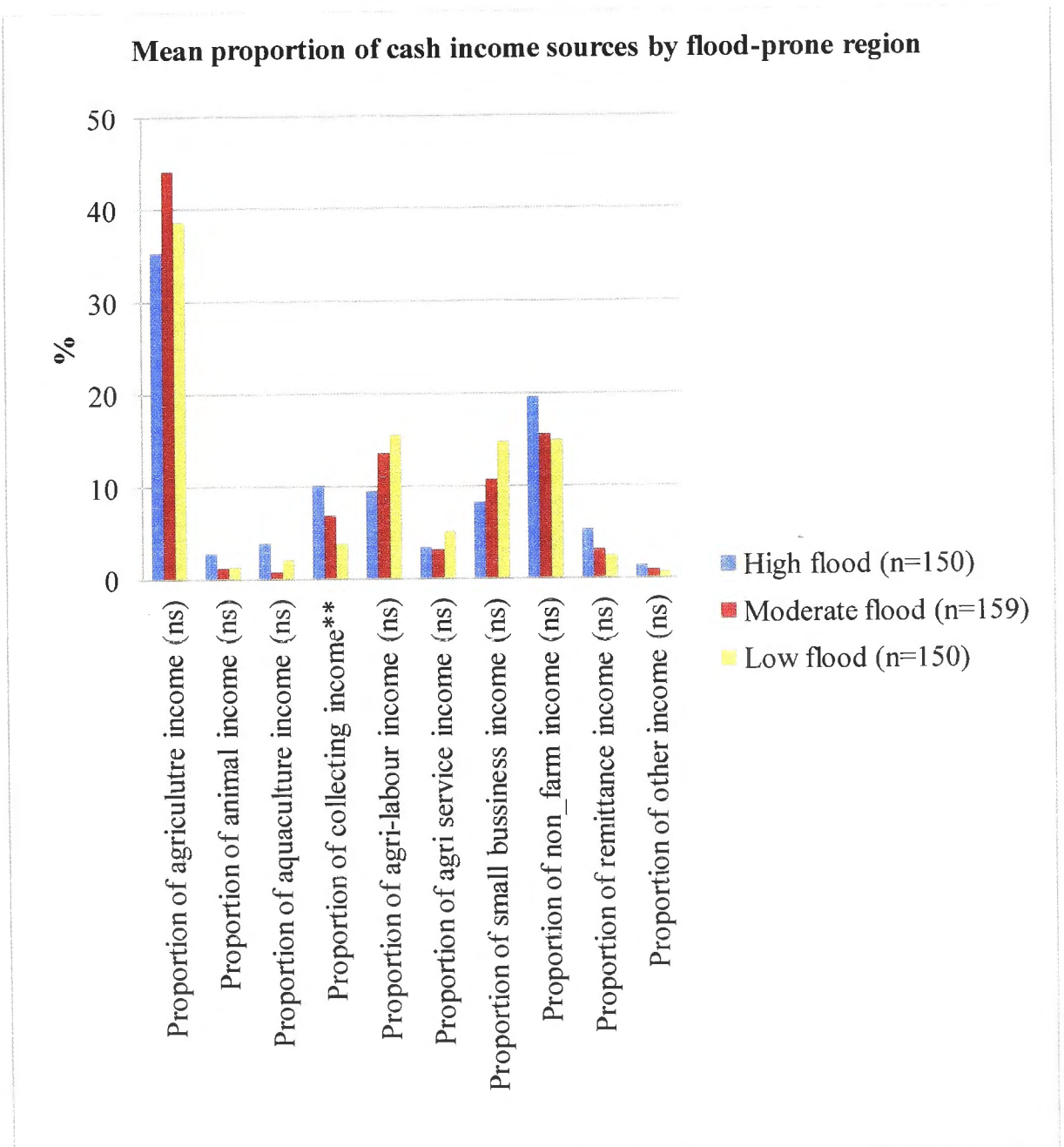

Figure 8. 9: Mean proportion of cash income sources by flood-prone region (N=459)

Note: Test of significant difference is based on F-test, ***p<0.001, ** p<0.01; *p<0.05; ns is not significant

8.5 Relationship between households' resilience to floods and livelihood diversification from quantitative perspectives

Livelihood diversification does not necessarily improve the households' resilience to floods from a quantitative perspective. The findings confirm that there is no statistically significant relationship between the livelihood diversification index and the households' resilience to flood indexes (resilience properties derived from factor analysis in Chapter six) (Table 8.1). Although researchers argue that diversification is the 'best' way to reduce risk and adapt to climate change, the households with the greater livelihood diversification index do not necessarily have a greater household resilience scores in the context of living with floods in the MRD. As seen in section 8.4, better-off and middle income households are more likely to specialize in on-farm income or have one income source (rice farming), while poor households are more likely to specialize in off-farm income sources. Richer households are more confident of living with floods, because they can secure food from their rice farming. They can save money from selling rice for expenditure during the flood season. So they are more resilient to floods.

Table 8. 1: Relationship between households' resilience to floods and livelihood diversification index (IHHD) from a quantitative perspective

	R1	R2	R3	IHHD	Hsz	Ln(income)	Landsz	Neighbour	Member	Network
R1	1									
R2	0	1								
R3	0	0	1							
IHHD	0.073	0.037	-0.074	1						
Hsz	0.123**	0.055	0.112*	0.029	1					
Ln(income)	0.605***	0.128**	0.015	0.1*	0.247***	1				
Landsz	0.349***	0.056	-0.072	0.003	0.082	0.486***	1			
Neighbour	0.475***	0.109*	0.208***	0.028	0.144**	0.42***	0.256***	1		
Member	0.121**	-0.063	0.152**	-0.007	0.005	0.209***	0.104**	0.297***	1	
Network	0.203***	0.127**	0.176***	0.057	0.027	0.26***	0.077	0.414***	0.384***	1

Note: Pearson correlation: ***p<0.001, ** p<0.01; *p<0.05; ns is not significant

- R1denotes resilience property one denotes households' confidence in securing food, income, health, evacuating during floods and recovery after floods
- R2 denotes resilience property two denotes households' confidence in securing their homes during floods
- R3 denotes resilience factor three denotes level of interest in learning and doing new flood-based livelihoods for adapting to floods
- IHHD denotes Inverse Herfindahl-Hirschman Index or livelihood diversification index
- Hsz denotes household size
- Ln(income) denotes log of household income
- Landsz denotes ownership of agricultural land of the households
- Neighbour denotes the index of neighbourhood attachment of the households
- Member denotes the index of participation in formal groups and associations of the households
- Network denotes the index of social supportive network of the households

8.6 Livelihood strategies during the flood season and households' resilience to floods

Rural households in the MRD are engaged in various livelihood strategies during the flood season. Some people engage in fishing activities[62], while others have to migrate to Binh Duong province to seek jobs. Others collect golden snails for selling at the local market to fish and duck farmers. Collecting golden snails has become a favourite job for some social groups especially for the poor and medium income groups. Some of the richer farmers are more likely to invest in high risk farming activities such as raising snake head fish and prawns in the flood waters. Others raise cattle such as cows or water buffaloes on higher ground. They store rice straw from the dry season to feed cattle during the flood season. Some poor people, who do not migrate to HCM City, stay at home to do labouring, such as picking *Neptunia prostrate* for other farmers. People, who do not have a boat or fishing nets, migrate seasonally to other remote, non-flood areas to harvest rice for rice farmers. For example, they go to Hon Dat district of Kien Giang province to cut rice. Some people are involved in small business as a middleman trading rice, vegetables and other farm products at local markets *(chợ vườn).* The choice of livelihood activities during the flood season is determined by the socio-economic conditions of the household. In particular, better-off households are more likely to engage in high investment farming activities during the flood season, for example raising prawns and fish, cows or water buffaloes. Medium households are more likely to undertake off-farm fishing for subsistence and seasonal migration during the flood season. There are two groups of poor households: poor households, who have fishing skills, are more likely to do fishing. However, poor landless households without fishing skills are more likely to migrate to non-flood areas to seek a job.

> Mr Bong, a leader of K9 hamlet of Phu Duc commune said that farmers do many things to survive during the flood season. Some people raise cows and buffaloes. Others raise ducks and fish using local resources such as fingerling *(cá con)* and golden snails from the flood plain [in-depth interview with Mr Bong on 15th September 2010].

> Mr Thanh, a rice farmer said that most people in this village grow rice in the dry season. In the water season, local people engage in many secondary jobs *(nghề phụ)* such as fishing *(giăng lưới)*, trapping fish *(đặt dớn)* in order to maintain their livelihoods during the flood season [in-depth interview with Mr Thanh on 21st September 2010].

[62] Fishing activities include netting *(giăng lưới)*, hook fishing *(giăng câu)*, trapping *(đặt lợp, lờ)*, electrical fishing *(xiệc điện cá)* and matrix netting *(đặt dớn)*.

> Mr Canh: Some women participate in making handicrafts from water hyacinth during the flood season. They can earn VND 30,000 (1.5 AUD). This amount is just to help them buy rice during the flood season. In K9 hamlet, many women went to Ho Chi Minh City to work because there is no such handicraft activity in that village [in-depth interview with Mr Canh on 20th September 2010].
>
> Mr Bieu: Population growth leads to a decline in fish catch. Some people raise cows, store rice straw and grow vegetables for feeding cattle. Some people raise pigs, but it is unsuccessful. Some people are raising poultry such as chickens for self-subsistence. Others go to Binh Duong to seek jobs. Working in Binh Duong is for survival rather than to accumulate capital. Now there is no weeding job for us, because most farmers spray weeds, they do not need hand weeding. Most young members of poor landless households migrate anywhere to look for jobs during the flood season. In some cases, the whole household members migrate to seek job [in-depth interview with Mr Bieu on 25th September 2010].

The quantitative data confirms that there are seven key types of income activities employed by households during the flood season. Fishing is a common livelihood activity for most rural households in the flood-prone region (Figure 8.10). Nearly half of the households (45.5 per cent) engage in fishing activity during the flood season. Some people do fishing for subsistence, while others consider the flood season as the main income-generating season. Most poor households engage in fishing in many forms. Some 18.5 per cent of the households go to other areas to seek jobs for survival during the flood season. Some migrate to Ho Chi Minh City and Binh Duong industrial zone to work in non-farm sectors. Others do domestic work. Alternatively, they migrate to non-flood provinces in the Mekong Delta to cut rice for farmers. Very few households raise fish and prawns, pigs, cows, ducks and chickens or grow vegetables and stay at home to provide informal credit at a high interest rate *(cho vay nóng với lãi cao)*.

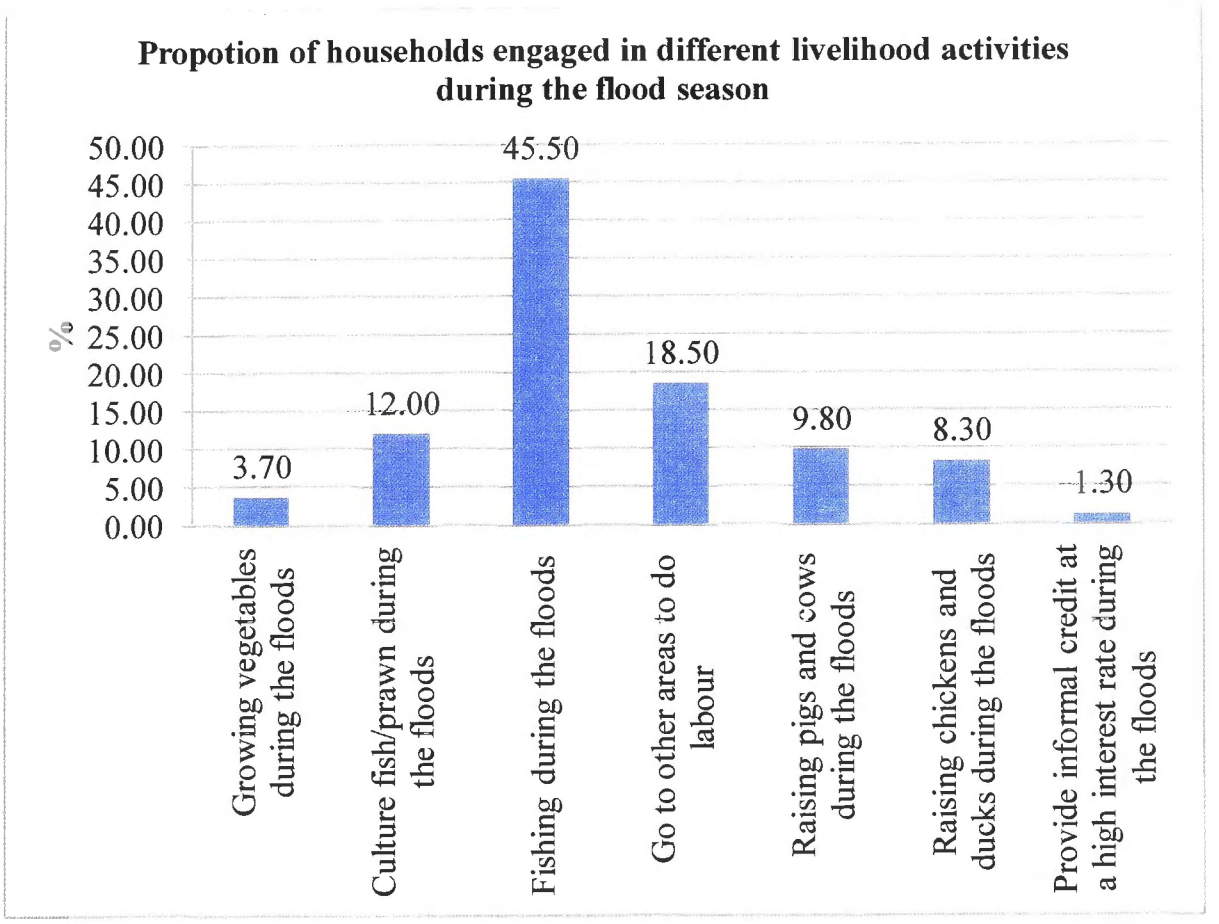

Figure 8. 10: Proportions of households engaged in different livelihood activities during the flood season (N=459)

However, some people argue that there is limited livelihood choice for people in the high flood-prone region. Besides doing rice farming in the dry season, farmers have two common options: whether to stay in the village to catch fish in the floodplain, or migrate to a non-flooded region to seek labouring opportunities. Therefore, livelihoods are less likely to be diversified in the high flood-prone area.

> Mr Binh, leader of the farmers' association in Phu Duc commune, said that there is limited choice for developing livelihoods in the flood region. Raising pigs and fish is unstable because of the fluctuation of the market price. Many farmers lost money in recent years because the price of feed is increasing, but the price of fish is declining. There is no place for animal rearing during the flood season [in-depth interview with Mr Binh on 22nd September 2010].

> Mr Gom, aged 43, a better-off farmer in K9 hamlet, Phu Duc district said that several years ago, he did matrix net fishing *(đặt dớn)* during the flood season. Now the price of nets is increasing, while the fish stock is declining gradually. So he has only stayed at home during the flood season in recent years. At that time, he raised snakehead fish *(cá lốc)* for selling at the local market for two years ago. He caught small fish in the flood plain for feeding the snake head fish so that he could reduce input costs, and earn some money. Now, the stock of small fish for feeding other fish is declining, so

> the input cost is increasing. Therefore, this business is not promising anymore. I am looking for a new business to survive during the flood season [in-depth interview with Mr Gom on 22nd September 2010].

Some livelihood activities make some people more resilient to floods, but make other social groups vulnerable to the flood season. In particular, some households become well-off during the flood season thanks to raising prawns, snake head fish, growing *Neptunia prostrate* or collecting snails. But in recent years the market price for snakehead fish has been unstable, so this business has become risky. Similarly, prawn farming is profitable for farmers in some years, but this farming activity is risky due to market fluctuations as well as the uncertain water quality during the flood season. Fishing is another example of an unstable livelihood during the flood season, as the fish stock is declining. Additionally, poor people may not be able to buy boats and nets, so they may not engage in these activities.

> Mr Tuan, aged 61, head of the farmers' club in Ba Xua hamlet, TMT commune said that fishing is unstable and risky. If there are no fish, they have to borrow informal credit. Fishing is just for survival. Fishing is perceived as a low-money career *(nghề hạ bạc)*. Many migrate to HCM city to seek jobs. But life in HCM city is difficult for families with children. Only young males and females can save some money [in-depth interview with Mr Tuan on 25th September 2010].

However, some people assert that poor households are better-off during the flood season because they can catch fish. Some people may earn 200,000 VND per day from fishing. Many respondents in Thanh My Tay, Phu Duc and Trung An communes argued that fishing is good for poor people. It is true that some poor people can maintain their income during the flood season by engaging in fishing activity. Earning income this way is better than doing construction work in HCM city.

> Mr Ranh, a rice farmer in K9 hamlet, Phu Duc commune, has 1.0 ha rice land. He traps fish *(đặt lợp)* during the flood season. He loves the flood season very much because he can earn an extra VND 200,000.0-300,000.0 per day from this off-farm activity [in-depth interview with Mr Ranh on 15th September 2010].

Poor households are more likely to engage in fishing as their primary income source for coping with floods. The chi-square test shows that there is a statistically significant difference between engaging in fishing and seeking non-skilled jobs in the flood season by socio-economic group (Figure 8.11). Among 45.5 per cent of the households engaged in fishing, 48.3 per cent of the poor households participate in this livelihood activity, while only 25.4 per cent and 26.3 per cent of the better-off and medium

households chose fishing as the key income source during the flood. Similarly, there is a statistically significant difference between migration to other areas and social groups during the flood season ($p<0.001$). Poor households are more likely to seek jobs in other areas for survival during the flood season.

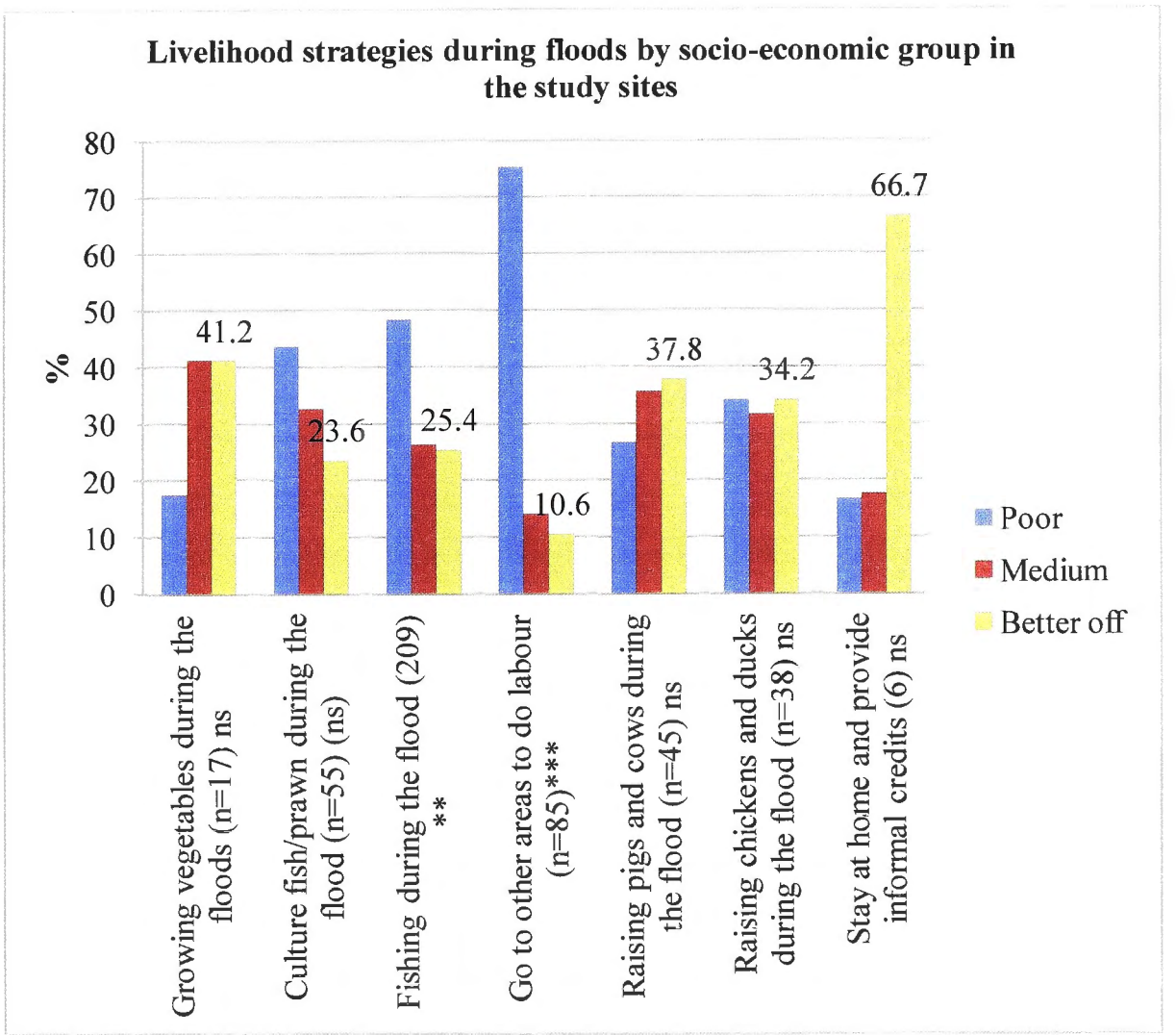

Figure 8. 11: Livelihood strategies during floods by socio-economic group in the study sites (N=459)

Note: Test of significant difference is based on chi-square, ***$p<0.001$, ** $p<0.01$; *$p<0.05$; ns is not significant.

8.7 Key livelihood activities and households' resilience

8.7.1 Rice farming

Rice is the main income source for many rural families in the MRD. During the 1980s, farmers grew only one crop of rice called 'floating rice' per year in the flood-prone area of the MRD. This rice variety was resistant to floodwaters (Catling 1992). Farmers started to sow rice in April or May when the first rain fell and harvested in December when the floodwaters receded (Nguyễn Hữu Chiếm 1994). Because of population

growth and the high demand for food security during this period (1990s), local governments persuaded farmers to convert to two crops per year using a high yield variety[63]. This rice variety allows farmers to grow two or three crops per year. Each crop needs at least 100 days for growth and harvest, so two crops need more than six months of growing. In the study sites, more than half of the households (55.1 per cent) grow a winter-spring rice crop, 53.6 per cent of the households grow a summer-autumn rice crop and only 3.3 per cent of them grow a third rice crop (autumn-winter crop) during the flood season. At least 54.7 per cent of households in the sample have rice lands *(đất trồng lúa)*. The minimum land area is 0.13 ha per household, while the maximum land area is 22.0 ha.

Rice farming is considered as the most stable livelihood option in the MRD, according to local perception in the study sites. Animal and aquaculture farming are more likely to be risky because of the market variation, disease[64] of pigs, cows and buffaloes, and a lack of space for animal rearing in the flood season [in-depth interview with Mrs Hien, a leader of Women's Association, Phu Duc commune on 10th December 2010]. Even farmers may not benefit much from rice farming some years, but they are confident that they have sufficient rice to eat, which secures food during the flood season. In the rural areas of the MRD, most households store harvested rice for milling and to eat. However, the poor households are more likely to buy rice, because they do not have extra rice to store. So, farmers in the flood-prone region perceive growing rice as the most stable income source and occupation.

> Mr Canh, a primary teacher and farmer in Phu Duc commune said that growing rice is more stable than doing other livelihood activities in this area. He thinks if dikes were built in this area [to assist in] growing three crops, farmers may be better off. However, dikes are difficult to build because the soil foundation is not strong enough to build a safe dike. He saw farmers in neighbouring districts (such as Tan Hong district of Dong Thap province) growing rice all year round, so they not only gain high yields but also gain high prices. They are richer now [in-depth interview with Mr Canh 20th Sep 2010).

However, rice farming is vulnerable to big flood events. In 1978, a big flood destroyed most floating rice areas in Phu Duc and Thanh My Tay communes. People had to migrate elsewhere to seek new income sources for survival. Most participants in FGDs said that if the one crop fails, it takes at least three years to recover. To cope with this

[63] High yield rice variety needs a shorter time to mature than traditional floating rice; farmers can harvest a higher yield within 100 days and so can grow two crops per year.
[64] Foot and Mouth disease

problem, a recent strategy of local people has been to sell land, borrow informal credit at a high interest rate, or migrate to non-flooded areas in the MRD to do agricultural labour such as rice harvesting *(cắt lúa mướn)*.

8.7.2 Fishing, off-farm collecting and flood-based farming

Fishing is a common activity in the three study sites during the flood season. Off-farm fishing and snail collecting helped rural households to secure food and income during the floods in the past. However, this traditional income source is likely to disappear because the natural fish stock has declined in recent years. The fishing income is unstable. Migration is an emerging livelihood activity of people in the flood-prone area to assist them to maintain income for adaption to future flooding.

> Mr Muoi: There are no agricultural labouring jobs during the water season. So, poor households are more likely to go fishing during the flood season [in-depth interview with Mr Muoi, a poor man in Thanh My Tay commune on 17th Septemer 2010].
>
> Mr Sang: In this flood season I am going to raise snake head fish in blankets. According to Mr Bon the cost of raising fish is increasing, so I should shift to other activities such as netting *(giăng lưới)* fish rather than raising fish [in-depth interview with Mr Sang, a medium man in Phu Duc commune on 16th September 2010].
>
> Mr To: During the water season, I trap fish and raise cows. The water season is better for me than the dry. However, if there are storms or strong winds, there will be no money because there is no fishing. Some people raise prawns during the water season, but some of them suffer losses. But others can earn a lot of money [in-depth interview with Mr To, a medium man in Thanh My Tay commune on 21st October 2010].
>
> Mr Bieu, a medium prawn farmer in Thanh My Tay commune told a successful story of growing prawns during the flood season. Although raising prawns can earn much money, this farming activity is very risky. He worries *(cực trí)* that the high waves and wind will destroy the nets and local thieves may take his prawns anytime [in-depth interview with Mr Bieu, a prawn farmer in Thanh My Tay commune on 20th September 2010].

8.7.3 Seasonal migration – both opportunities and challenges

Seasonal migration provides an important opportunity for coping with floods, but it is also a challenge. However, this type of livelihood diversification is not distributed equally among socio-economic groups. Poor households are more likely to stay in the village and to engage in off-farm fishing or snail collecting activities, while poor households without the capacity to buy boats and nets are more likely to migrate to HCM city or non-flooded provinces to seek new income sources to survive during the

flood months. On the other hand, better-off rice farmers are more likely to develop flood-based farming activities such as raising fish or prawns and growing vegetables. Box 8.1 illustrates the livelihood strategies of different socio-economic groups in the flood season.

Box 8. 1: Seasonal migration in Thanh My Tay commune

> The president of the Thanh My Tay commune reported that there are about 5,000 seasonal migrants in this commune in 2009. Some poor migrants go to HCM City to work in the construction sector such as 'builder' to avoid the flood and come back to do agricultural labour in the dry season. Other migrants stay permanently in HCM city, if they find a good job. It seems to be that there are two types of migration: push and pull. Some successful migrants send remittances to their family. For example, Mr Chin has two sons working in HCM City; they send him a remittance each month. He can live well with the flood now. However, migration is not stable for some social groups. Some people cannot save money or even go into debt because they did not find a good job in HCM city [in-depth interview with Mr Sieu on 15th September 2010].

Among gender and age groups, most female respondents reported that young females and males are likely to migrate to HCM for working in the non-farm sector. Females are more likely to work in textile or shoe companies whereas males do labouring work for construction companies. They set up an informal network based on neighbor relationships to inform each other about job availability in HCM city. On the other hand, middle–aged males and females are likely to stay at home and engage in fishing and handicraft making, respectively, in the village.

> Mrs Hanh: My husband works for a construction company in HCM city as a builder *(làm thợ hồ)*. Income from labouring in HCM is more stable than working in this Phu Duc commune. Some days are off, but some days we work. The job is not stable here *(sống ở đây bữa có cá bữa không, không ổn định)* [in-depth interview with Mrs Hanh, a poor woman in Phu Duc commune on 11th September 2010].

> Mrs Nuoc: During the flood season, most people in residential clusters close their houses and go to Ho Chi Minh city to work in the construction sector *(đi làm hồ)*, and work in garment factories *(xưởng may)*. Working in HCM city is for survival during the flood season. I and my husband went to HMC and returned to do agricultural labour in the dry season. Life in HCM is also very hard. We returned without any money. We lost networks in the village. We feel life is more difficult than previously [in-depth interview with Mrs Nuoc, a poor woman in Phu Duc commune on 12th September 2010].

Mr Ngoc, a leader of a farmers' association. Now the natural fish have declined dramatically, so fishing is more difficult during the flood season. So, they have to go to Binh Duong. For example, more than 5000 people have gone to Binh Duong from this commune. Among them, most people go to Binh Duong for survival rather than capital accumulation. Mr Ngoc said that about 30.0 per cent of them might save some money. However, other people argue that poor people can work regularly in BD, while fishing is unstable in this area because of weather events [in-depth interview with Mr Ngoc on 22th October 2010].

Mr Buu, aged 40, 3 years in school, a poor landless farmer in Thanh My Tay commune, said his household income relies entirely on agricultural labour. During the dry season, he works in the farm sector such as spraying pesticides for rice farmers, weeding and harvesting rice. However, he said that life is so difficult here in the water season because he does not have the capacity to buy boats or nets as others do. Therefore, he must migrate seasonally to other non-flooded provinces to harvest rice. Annually, he takes his two children and his wife to Kien Giang province (about 80 km from his house) to work and returns home when the flood recedes by riding an old bike. He said that income from harvesting rice helps his family survive during the flood season [in-depth interview with Mr Buu on 25th October 2010].

8.8 Conclusion

Usually, the flood event lasts for several months in the MRD. This affects the income stream of many households, especially poor households in the flood prone-regions. Rice is the most important source of income for most households, especially the better-off farmers because they often own agricultural lands. On the other hand, poor people are less likely to have rice income, but their livelihood relies on off-farm agricultural labour, non-farm wage labour, and fishing during the flood season. Poor households diversify income sources for survival rather than capital accumulation. So, diversification is the main livelihood strategy for poor rural households to cope with several months of flooding which enables them to secure food and income, a livelihood strategy for household resilience.

Diversification of livelihood activities is undertaken by a significant proportion of households in the study sites and makes an important contribution to cash income sources, particularly of the poorer households. However, Anderson and Deshingkar (2005:72) have argued that diversification of income sources does not necessarily improve total income for households because the cost of diversification is high. In addition, it has also been argued by that poor households diversify income sources for survival, while better-off households diversify for capital accumulation (Carswell 2000:

4). However, the great benefit of livelihood diversification is to reduce vulnerability to environmentally based natural disasters (Ellis 2000).

In the context of living with floods in the MRD, diversification into off-farm or non-farm migration is due to the limited choices for developing livelihood activities available during the flood season. Some people engage in off-farm fishing because they do not have the financial resources to invest in high capital income-generating activities. Some poor people are more likely to migrate to HCM city or Binh Duong province to look for non-farm jobs because they do not have the capacity to buy boats and nets to engage in fishing. On the other hand, the fish stock is declining, so fishing is not a favourable income generating activity any more. Some people can cope with the flood season by diversification of income sources into off-farm and non-farm activities. However, this study found that poor households are more likely to diversify income sources in order to survive during the flood season rather than to accumulate money. This confirms the findings of a study by Carswell (2000) in Southern Ethiopia and by Marschke and Berkes (2006) in a rural Cambodian fishing village, where poor households tend to diversify livelihoods for survival. However, medium and better-off households are more likely to invest in a high-risk income-generating activity such as raising fish and prawns during the flood season. For example, Mr Bieu, Mr Luot, Mr Sau, Mr Ranh have become well-off thanks to growing prawns, collecting golden snails, raising ducks and fish, and trapping fish during the flood season over the last few years.

Migration has become an emerging livelihood strategy for many poor households in the flood season. However, migration is not an optimum livelihood activity for many poor households because the cost of living in HCM city is very high. Many households return home without money, go into debt and become more vulnerable to the flood season. However, some households can be very successful as a result of migration. Especially for those who do not have fishing skills, migration helps them to survive during the flood season. The policy of 'living with floods' should therefore strike a balance between migration and exploring the natural benefits of floods in order to enhance households' capacity to adapt to floods.

Chapter 9

Conclusion

This chapter outlines the key findings from this study. The key aim of this study is to advance our understanding about the perception of the flood events, flood impacts, and households' capacity to live with floods in the MRD of Vietnam. To address the broad aim, four objectives were formulated: (1) to explore the perceptions of and coping with the flood events held by different socio-economic groups in the MRD; (ii) to examine the impacts of three levels of flooding on different household livelihoods in the MRD, (iii) to examine the relationship between different forms of social capital of households and households' resilience to floods in the MRD; and (iv) to investigate the relationship between livelihood adaptation (diversification or specialization) and households' resilience to floods in the MRD. Four research questions were formed to achieve the stated object of the research. The findings of these four questions are set out in section 9.1.

Based on the major findings from this study and taking the limitations into account in section 9.2, some policy implications are discussed in section 9.3.

9.1 Summary of findings

The research found that people from different social groups, regions, and from local to national government use different terms when talking about flood events in the MRD. The terms, flood and water season, are used in different contexts. A high inundation event is called a 'flood season'. Otherwise, local people call it the 'rising water season'. Government and scientists refer to 'floods', while common people refer to the 'rising water season'.

The rising water season brings both costs and benefits to rural livelihoods, but the outcomes vary according to different flood levels, social groups, and regions. Compared with other social groups, poor households are more likely to have to adjust their livelihoods in order to cope with floods. Big and moderate flood events may be very good for poor households to catch fish, but their houses are vulnerable to floods.

Similarly, richer households are better off from big and moderate flood events because they may harvest good yields for the winter-spring rice crop. However, they become vulnerable to pests and rats if the water event is too small. The moderate flood is considered as the most "beautiful" one compared to the small and big floods.

Three components of household resilience were found from this study:

1. Household confidence to secure food, income, safe evacuation during flooding and recovery after floods;

2. Household confidence to secure homes so long as the flooding does not reach the levels of the 2000 flood;

3. Household interests in learning and adopting new flood-based livelihoods during floods.

The findings enrich the on-going debates on the relationship between resilience and diversification. Livelihood activities are diversified at the household level but income from rice farming remains significant for total household income.

Diversification of income sources does not necessarily improve resilience scores for households (Table 9.1). The quantitative findings do not support a relationship between resilience and diversification. Some people are better off from on-farm flood-based livelihood diversification, while others are worse off due to seasonal migration to cities. Poor households are more likely to shift into off-farm and non-farm income. Better-off and medium-income households are more likely to focus on rice farming. However, the qualitative data partly support the view that diversification to non-farm livelihood activities leads to households being more resilient to floods.

Social capital has a significant effect on households' resilience score in aggregated terms (Table 9.1). However, neighbourhood attachment has a significant effect on resilience properties one and three but no effect on resilience property two. A socially supportive network has a significant effect on resilience property two but no effect on resilience properties one and three. Participation in groups and associations has no significant effect on resilience properties one and three but a negative effect on resilience property two.

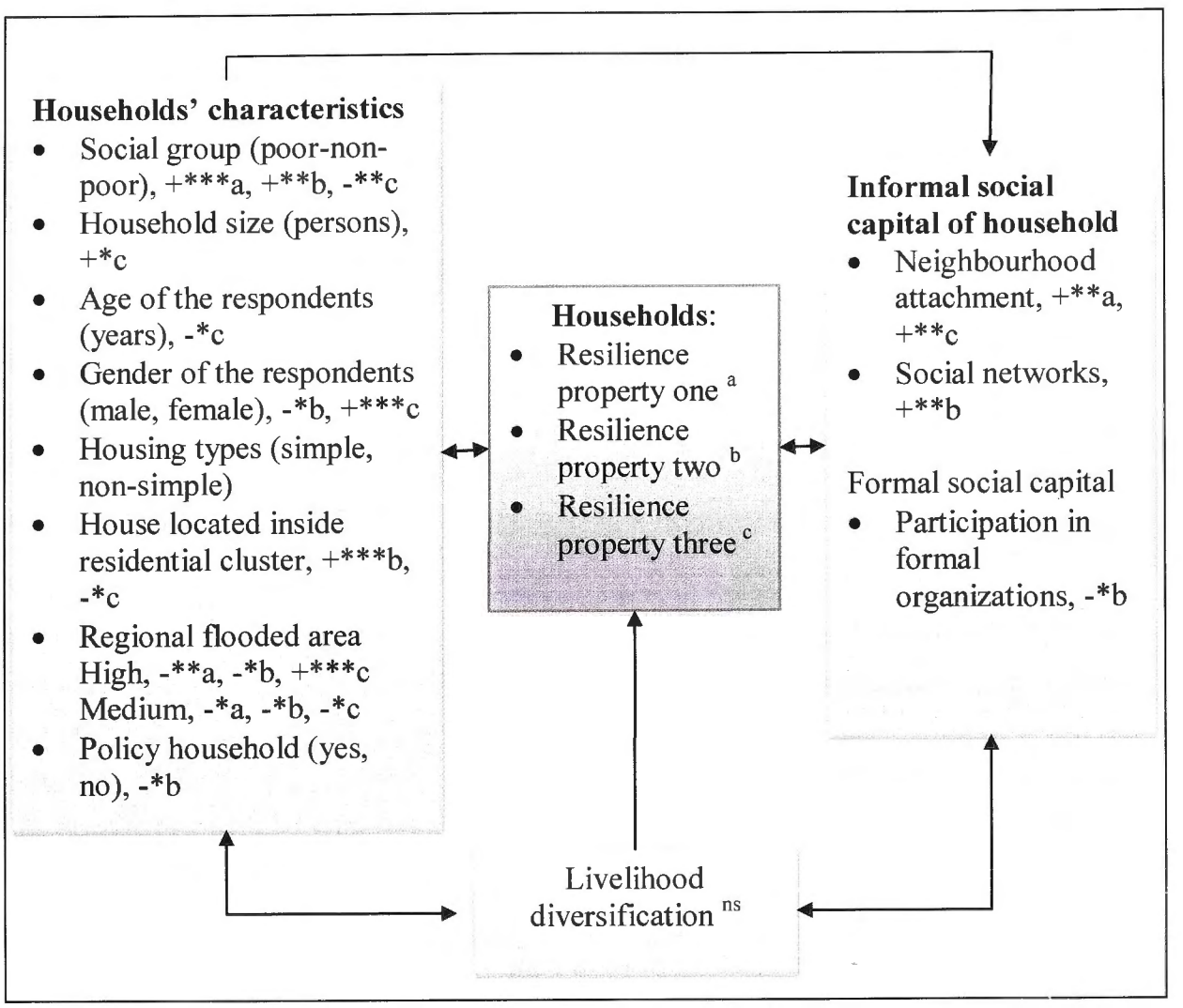

Figure 9. 1: Relationship between household resilience, social capital and livelihood diversification.

Note: Different ***, **, * denote ***p<0.001; **p<0.01; *p<0.05; ns is not significant

a, b, c denote resilience properties one, two and three

-/+denote negative or positive relationship

9.1.1 How does the perceptions of, and coping with the flood events in the MRD, vary by different socio-economic group and region, from local to state government?

The analysis of the qualitative data shows that local people use a variety of value-laden terms to talk about the water events in the MRD. In particular, most participants use three common terms to describe the water event: the 'rising water season', the 'water season', and the 'flood season'. However, local people are more likely to use the term 'rising water season', while government staff and local researchers call it the 'flood

season'. The 'rising water season' refers to 'gentle' whereas the 'flood season' refers to 'disaster'.

Men are more likely to call it the 'water season' while women usually call it the 'flood season'. Women are more likely to be anxious about the flood season because they may lose their jobs, suffer unstable livelihoods, and their children may be harmed. Therefore women seem to be more concerned about the flood season.

Although the use of the terms 'flood season' or 'water season' is repeated in the public discourse in everyday conversation, it has different meanings in the local contexts. The term 'flood' refers to a 'devastating flooding' or a 'dangerous event' such as the flooding which occurs in Central Vietnam. It is a negative term, and relates to damage and death. However, the term, 'water season' or 'rising water season' indicates that the water is rising slowly which does not threaten livelihoods and the humans living in the local area. Most deaths recorded in recent years have been due to the lack of supervision and the carelessness of adults, rather than to the actual devastation of the flood event.

The local, regional and national media are more likely to respond to floods in terms of their severity, property damage, deaths, and human health problems. Little news reports the benefits of floods. More flood news is reported in the local newspapers such as the *An Giang* newspaper during the flood events than in the regional newspapers such as the *CanTho* newspapers or in the national ones such as the *Dai Doan Ket*, the *Tuoi Tre*, and the *Thanh Nien*. Especially, flood news is published more intensively in September, October and November with little flood news reported in August or December. This means that the media are more likely to present hot news such as flood damage, deaths, information about the rising of the water, rain and storms, and evacuation and relief activities.

As, the flood is closely linked to the livelihoods of the millions of people who live in the MRD, the media sometimes use the term 'returning flood' when there is a small flood event. This implies that when the flood is small, it affects the livelihoods of fishermen. In this context, the expectation of the water season is compared to a 'wife who waits for her husband to return from the war'.

However, a paradox lies in this fact that most local government staff and local scientists refer to the annual water event as the 'flood season' *(lũ)*, while local residents prefer to use the term, 'water season' *(mùa nước)*. Because the water event is perceived as

'flood' and therefore 'not good' or 'disadvantageous', the aim of the government is to control the floods, rather than assist the people to adapt to the floods. Although the An Giang newspaper said that "fighting against floods is fighting against an enemy", on the other hand, if the flood is perceived as a daily life event, coping behaviours are more likely to adapt to it, rather than control it.

In terms of flood severity, most previous studies have been concerned with the depth and duration of the water event in examining the flood damage (Tang et al. 1992). My study identified that the flood occurrence, along with the storms, is considered as the most dangerous one in the MRD beside the depth and duration. However, the floods in the MRD are usually gentle, but become dangerous if there is a big storm during the flood season. The period of highest flood severity is found to mark a significant point for flood preparedness for each of the three flood regions in the MRD. For example, the most serious month was found to be August for the heaviest flood region, while it is perceived to be September in the medium and low flood regions.

The final significant findings inform the first question, that households adopt different coping behaviours during the small, moderate and big flood events. However, poor households are more likely to adjust their livelihood activities than the medium and better-off households in several ways: evacuation, borrowing money and rice from neighbours, borrowing money from informal credit, waiting for public relief, reducing normal meals, migrating seasonally, praying at home, strengthening the house before the floods, and elevating the floor above the annual flood level during big, moderate and small flood seasons. As better off and medium households are more likely to secure their homes, food, and income, they do not undertake temporary coping behaviours in the same ways as poor households do. Poor households have to cope with the floods yearly.

9.1.2 How do the impacts of the different flood levels (small, moderate, and big) on household livelihoods vary among different socio-economic groups in geographically different flood-prone regions of the MRD?

The quantitative analysis of the impacts of different levels of floods on different rural household livelihoods in different geographical flood prone regions identified that the impacts are variable by socio-economic group and region. Firstly, different flood levels have different impacts on the livelihoods of the three different socio-economic groups.

In particular, the rich and medium social groups are able to benefit more from the big and moderate flood events, because they gain good yields from rice farming in the winter-spring crop. However, they may become worse off in a small flood event because the small flood does not submerge the rice straw, kill pests, or wash away farm residue. As a result, farmers have to pay for more agricultural inputs. On the other hand, poor landless farmers may be less vulnerable to a small flood event in terms of housing damage, as the small floods do not threaten the houses. However, they are more vulnerable to livelihood insecurity as there are fewer fish to catch for survival during the flood season.

It is notable that the impacts are nuanced across different livelihood activities. The disaggregated analysis of the impacts of different flood levels on livelihoods of the three different socio-economic groups brought insight into understanding the disadvantages and advantages of all flood events. This understanding is important for developing rural livelihood strategies for households and communities in ways to minimize the costs of flooding, while enhancing its full benefits. This information should be integrated into community development decision-making processes to foster the sustainable use of the flood plain in the MRD.

The findings of this thesis are in accord with those from other flood studies elsewhere, for example Bangladesh, where different types of flood were perceived to create different costs and benefits to rural livelihoods. It is recognized that the flood often has both costs and benefits (Paul 1984, Cuny 1991, Phóng Trần et al. 2008, Paul 1995, Paul 1997, Brammer 1990, Shaw 1989). However, the significant findings of this study show details about the winners and losers in living with floods in the MRD. In particular, this study unpacks the significant benefits and costs of the natural flood events for the particular socio-economic groups in the MRD.

9.1.3 To what extent is there a relationship between livelihood diversification or specialization and households' capacity to live with floods?

The quantitative data analysis in this study showed that the occupations of the respondents are highly diverse at community level. However, the majority of respondents who are household heads have specialized in one occupation; just over a third of them have a second and third occupation. This means that the livelihood activity of the household heads is not highly diversified because most of them work in

agriculture such as rice farming. However, the occupations of the household members are more likely to shift from farm to off-farm work and non-farm migration for maintaining household livelihoods.

Income generating activities are less likely to be diverse at household level. In particular, more than 50.0 per cent of the households specialize in agricultural activity such as rice farming. A high proportion of households engaged in home-based business and agricultural wage labour. The results further confirm that more poor households participate in agricultural labour, fishing, industrial labour, construction work, and home-based business than the better-off and medium households. The reason for this is that poor households are often landless, so they do not have natural and financial capital to invest in agricultural activities such as rice farming. Their livelihood choices are often based on the availability of human resources in the form of labouring. On the other hand, the medium and better-off households often own rice land, so they are more likely to produce rice in the dry season, raise high value animals such as cows, water buffaloes and pigs, conduct agricultural services such as ploughing, levelling soils, and harvesting rice by machine.

Agriculture plays an important role in total household income (39.0 per cent). Non-farm wage labour which constitutes 17.0 per cent plays the second role of household income. Agricultural wage labour income is the third income source (13.0 per cent). This means that off-farm wage labour is one way of diversifying income activity at the household level. Richer and medium households earn a higher proportion of their income from farming than medium and poor households. More than 60.0 per cent of the income earned by the poor households comes from agricultural labour, fishing, and non-farm work. However, there is no statistical significance between the mean proportion of different income sources by region except for off-farm fishing and collecting activity.

Livelihood diversification does not necessarily improve households' resilience scores to floods from a quantitative perspective. The quantitative data confirms that there are seven key types of income activities engaged in by the households during the flood season. Fishing is the most common livelihood activity during the flood season for the highest proportion of rural households in the flood-prone region.

Some livelihood activities make some people more resilient to floods, but make other socio-economic groups vulnerable to the flood season. Some are well-off due to the flood season, but others are worse-off. More poor people engage in fishing in order to cope with floods, but fewer medium and better-off people do. Growing rice is the most stable income activity, but rice is vulnerable to big flood events in terms of damage, such as in the 1978 flood. Fishing is good for some, but not good for others, and is risky. Flood-based livelihood activities are good for households to diversify on-farm activity to generate new income. Migration is good for some, but not good for others.

Poor households are more likely to diversify their livelihood activities during the flood season toward off-farm and seasonal migration, because there is no livelihood choice for them. So diversification of livelihoods into non-farm and off-farm fishing activities is for survival rather than capital accumulation. This finding is similar to findings by Carswell (2000) and Marschke and Berkes (2006).

Specialization in agriculture can improve households' confidence to secure food and income during the flood season. For those who have medium and larger agricultural land areas, specialization in rice farming is the key livelihood strategy.

9.1.4 To what extent is there a relationship between different forms of social capital of households and their capacity to live with floods?

Social capital has been identified as very important for economic development, environmental management, health, wellbeing, disaster risk reduction, and adaptation to climate change worldwide. However, little is known about the effects of different forms of individual levels of social capital on coping and resilience to floods in the MRD. The findings from the quantitative data analysis have indicated that neighbourhood attachment of households is cultivated through norms of reciprocity *(biết điều)* in the neighbourhood. The findings indicate that neighbourhood attachment has a statistically significant effect on households' resilience in most situations. Mean neighbourhood attachment score is lowest for the poor group and highest for the better-off group. This indicates that the poorer household groups are less likely to be attached to their neighbours in terms of the norms of reciprocity. Importantly, the interaction effect between neighbourhood attachment and economic status of the households (poor/non-poor) indicates that it is more important for the poor to invest in social capital

(neighbourhood attachment). Supportive social networks play an important role in securing homes. The richer households already have a high level of social capital.

Different social ties have different effects on the capacity of households to access resources in times of need. Families and friends are important resources in most situations, while local authorities are helpful to access public relief and move to residential clusters or to some extent, at times of financial difficulties. Poor households are less likely to be trusted by other social groups. For example, they have less capacity to borrow money, borrow a boat, or to be invited into a fund-recycling group. However, poor households are more likely to access public relief than the better-off and medium households with support from local authorities. Poor households have a lower score on the social supportive network than the medium and better-off households, as they have less capacity to access important resources for daily life as well as living with floods.

In terms of participation in formal social capital, the highest proportion of respondents was members of the farmers' association and women's' associations among the 18 local groups and association. It is true that most participants are rice farmers. However, the number of members of farmers' association is relatively limited compared to the total number of rice farmers.

In general, aggregated social capital has a statistically significant relationship with resilience properties. However, neighbourhood attachment also has a statistically significant relationship with resilience properties one and three, while participation in local groups and associations is not statistically significant. This means that people are not likely to trust in the benefits coming from participation. This result is relevant to a study of social capital of recycling households in the North of Vietnam, where the local people do not trust participation in groups and associations (Nguyễn Văn Hà et al. 2004).

However, aggregated social capital has a significant relationship with resilience property one. This means that the greater amount of social capital they own, the greater their capacity to cope with floods in terms of food, income, health security, and evacuation during the flood and recovery after the floods. Thanks to relationships with neighbours, they can access resources in an emergency during the floods.

In the disaggregated model, it is found that neighbourhood attachment has in a statistically significant relationship with resilience property one. This means that a close

relationship with neighbours helps households to be more confident to secure food, income, health, evacuate and recover after the flood event. Neighbours help neighbours during a crisis as well as on a daily basis. Respondents reported that most people borrow rice and money from their neighbours. However, social supportive network has a statistically significant relationship with resilience property two. This indicates that households are more likely to be confident of securing their homes against the effects of big floods, for example as in the 2000 floods; they rely on their strong relationships within the supportive network. Again, the capacity to innovate or transform using flood-based livelihoods is reliant on their connectedness to their neighbours, as good neighbours share information about the benefits of the floodwaters in order to facilitate their neighbours' adaptation to floods. Many case studies show that neighbours are the important source of information for living with floods. Finally, the role of local groups and associations is very limited. In particular, local people do not have confidence that participation in such groups and associations will result in benefits. There is no statistically significant relationship between resilience property three and social networks and participation in groups and associations.

In terms of methodology, neighbourhood attachment can be measured using multiple items with support from a factor analysis approach. The multiple item approach captures a wide range of norms of reciprocity within the neighbourhood. The approach allows conceptualizing the underlying factors that contribute to neighbourhood attachment. Similarly, factor analysis can be a useful tool to conceptualize resilience. In the context of living with floods, multiple items using successful factor analysis drew out the resilience properties.

Using the weighting approach to measure social supportive networks is appropriate, and allows the researcher to see the importance of each network type and the commonality of information from the network. This approach facilitates the scoring of the importance of networks with the households in a daily life situation.

9.2 Limitations of the research

The research has made significant contributions to the existing knowledge of the perceptions of floods, their impacts on household livelihoods, conceptualizing households' resilience to floods, and showing the relationships among households' resilience to floods and social capital of households, livelihood diversification at household level, and socio-economic characteristics of households in the flood-prone

regions of the MRD. Importantly, the research has contributed significantly to the measurement of households' resilience to floods in the real context of living with floods in the MRD, using a subjective wellbeing approach and factor analysis to construct indexes of households' resilience. However, the research may be subjected to gender bias because there are fewer females than males in the sample. Therefore, interpretation of the results should be taken with caution in relation to gender.

9.3 Policy implications

As noted in Chapter one, the flood has both negative and positive effects. This study found that different flood levels have different negative or positive impacts on household livelihoods and on different socio-economic groups and in different geographical areas. Enhancing the capacity of households to minimize the negative impacts and maximize the benefits of the floodwaters enhances resilience in living with floods.

There is a problem in current flood risk communication by local, regional, and national newspapers, and government bodies about the natural phenomenon of the flood season in the MRD. This may lead to underestimating the value of the flood season. Improving methods of flood risk communication to emphasize the advantageous aspects of floods may help rural households and communities to be more confident in living with floods in terms of livelihood security.

Investing in social capital for households will help them to improve their capacity to live with floods. Especially, investing in the bonding social capital of neighborhood attachment and social supportive networks may help rural households to cope well with the flood events in terms of securing income, food, health, evacuation, and recovery as well as securing homes and entering into new flood-based livelihoods.

Enhancing the trust of households to encourage them to participate in groups and associations may help them to benefit fully from these organizations. At present, people do not benefit fully from their support. This would allow them to participate in the resources available through bridging and linking social capital.

Developing flood-based livelihoods is a potential livelihood strategy for coping with the flood season. These on-farm livelihood activities make some people better off.

However, the flood-based farming activities are sensitive to market variation. Expansion of these farming practices should be linked with development of the market.

Migration can be a viable livelihood choice for some rural poor households during the flood season. However, migration does not necessarily improve resilience for poor households. Policy formulation to encourage rural-urban remittances through migration should be undertaken with caution because migrants may not be able to afford the costs of living in the urban areas. Importantly, many households found that they had lost their bonding social capital when they returned home. This research found that such migration could make them more vulnerable to floods in future.

There is an urgent need to engage communities in disaster risk management. In the context of living with floods in the Mekong River Delta, diversity of livelihood activities and empowerment of local social resources such as neighbourhood attachment of households and informal social networks will enhance community resilience to natural disasters. These are the key actions that the HFA (2005-2015) aims to achieve by 2015 (International Strategy for Disaster Reduction 2005).

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Appendices

Appendix 2. 1: Focus group discussion guidelines

The Australian National University
College of Arts and Social Sciences
Australian Demographic and Social Research Institute

Focus Group Guidelines
(to be translated into Vietnamese)

Social capital, livelihood diversification and households' resilience to floods in the Vietnamese Mekong River Delta

Principle investigator:	Nguyen Van Kien
Research Sites:	Phu Duc commune, Tam Nong district, Dong Thap province. Thanh My Tay commune, Chau Phu district, An Giang province Trung An commune, Thot Not district, Can Tho City

Introduction and objectives of focus group discussions

Thank you for coming and being willing to participate in this focus group discussion.

Your willingness to come and participate in the discussion is highly appreciated and important for the success of my study.

My name is Nguyen Van Kien, a lecturer in An Giang University. Currently, I am a PhD candidate at the Australian Demographic and Social Research Institute, College of Arts and Social Sciences, the Australian National University located in Canberra, ACT, in Australia. I am collecting data for my PhD thesis about social capital, livelihood diversification and resilience to floods in the Vietnamese Mekong River Delta. I am conducting my studies in three rural flood prone communes, Thanh My Tay commune of Chau Phu district in An Giang province, Phu Duc commune of Tam Nong district in Dong Thap province, and Trung An commune of Thot Not district in Cantho City. Beside focus group discussions, I will also collect data from in-depth interviews and household surveys.

For those of you who have never experienced participating in a focus group discussion, I just want to introduce briefly what a focus group discussion is. Focus group discussion is a method to gather information through a discussion. This approach is often used for market research. In the discussion, I will raise several questions or issues and any of you are welcome to respond or comment. Your participation in the discussion is strongly expected.

In this discussion, we will discuss the impacts of annual floods on households' livelihood activities, the ways you adapt to floods, the effectiveness of livelihood diversification or specialization on households' income to cope with floods, the existence and roles of social capital in coping with floods. I am interested to hear your opinion, comments and any experience you have relating to those issues.

In the discussion, there is no right or wrong answer, any kind of response whether it has a positive or negative side is welcome. You can criticize any issues that are being discussed.

Feel free to have a different opinion from the rest of the group, I would like to hear as many comments, opinions and criticisms as possible.

This discussion will be recorded, but your confidentiality is safe, so do not feel threatened by the recording. The recording is necessary for my research so I can transcribe the discussion and make a detailed report on it. This is essential for later analysis.

I would like this to be a group discussion, so do not wait for me to ask each of you to comment. You are free to make comments, but please remember that when someone is speaking others who would like to make comments will have to wait until the first person has finished talking.

But anytime when I am talking and you want to comment just remind me that you want to say something. Once again feel free to make any kind of remarks or comments and remember that your confidentiality is safe.

Objectives of the focus group discussion

The objective of this study is to gather information on the impacts of annual floods on households' livelihood assets, your coping strategies, the effect of livelihood diversification or livelihood specialization on households' income, and the existence and roles of social capital on coping with floods in three communes in An Giang, Dong Thap provinces and Can Tho City. The results of this study will be useful for identifying the adaptation strategies for living with the annual flood events in the region in the future.

Questions that will be raised in our discussion are related to flood impacts on households' livelihoods, income, coping strategies, the effects of livelihood diversity or specialization on households income, the existence of different forms of social capital, and the effects of social capital on coping with the annual flood events. Those questions are not sensitive so I encourage all of you to participate actively in the discussion. Again, I would like to say that your confidentiality is safe and we have a relaxed and informal discussion. Every people are freely to talk. Thank again for your willingness to participate.

Now we start the first part of discussion.

First, I would like to discuss about the characteristics of annual floods in this commune.

1. Does this area experience floods?
2. Do they happen every year? When does it occur? What month is it the worst?
3. Is 'flood' the right word for me to use in this research or are there some other terms like high water season or big water or rising water season or small flood season that you use to describe these events?
4. Do you classify the floods of different years, for example, as high, medium or low flood years, or in some other way? Do you recall what year was the worst? What happened then?
5. How do people here measure flood severity?

Impacts of annual floods on households' livelihood assets and activities

6. What do you think about the impacts of floods on livelihood assets and activities: negative, positive, or mixed?
7. What types of livelihood assets are most affected by annual floods?
8. Do you think some floods are worst than other? In which year or years were floods the worst? Who are most affected by floods? Who are not affected?
9. Are there any benefits from floods? Who can benefit from floods, if anyone? In what way are they better off from floods?
10. What do you think about the term "living with flood" in your community and your family? Who can live with floods? Who need assistance to cope with floods?
11. Does the concept of "living with floods" change overtime?
12. Can you live with floods or adapt to annual floods?
13. What kinds of livelihood strategy are better to cope with annual floods? Is livelihood diversification viable to cope with floods? Are there other livelihood strategies to cope with floods such as livelihoods' specialization or migration? Who are more likely to specialize but others prefer to diversify?
14. What types of livelihood activities are able to cope well with floods?
15. What livelihood activities are most affected by floods?
16. What are the impacts of floods for men and for women? What are the roles of men and women during the flood season?
17. If, the future floods were extreme, what would you do to maintain your livelihoods?

It is helpful to hear your opinions and experience of living with floods, now we come to the final part of today's discussion.

Social capital and coping with floods

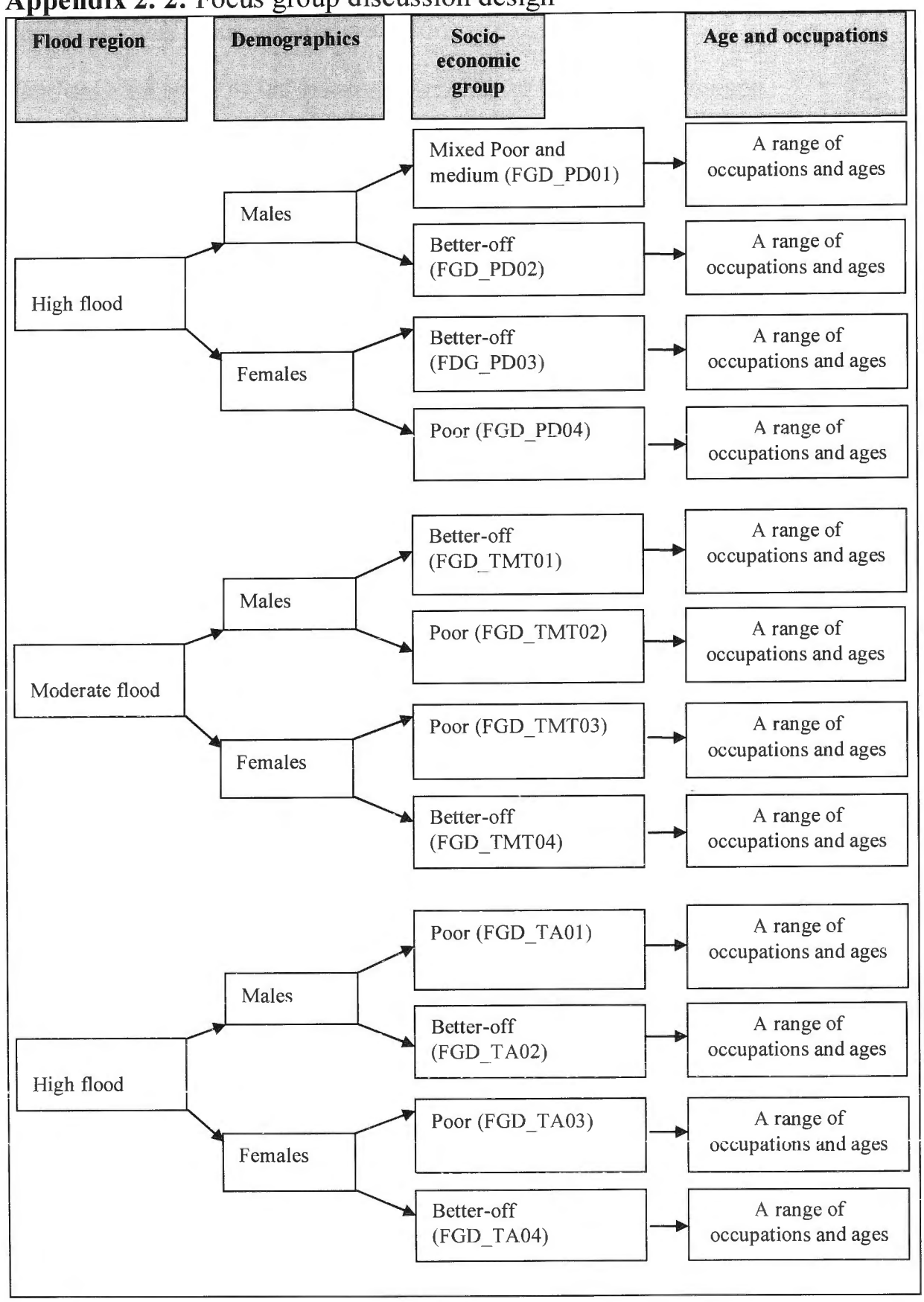
17. What types of social groups and organizations are existing in this area when responding to floods (e.g. kinship, neighbourhood relations, church membership, or participation in a mass organization)?
18. Is the term social capital right to be used in this area? Is there other terms to reflect the social capital such as social relations or others?

19. Is social capital considered vital in coping with the annual floods? If so, in what ways is social capital important?
20. Is lack of social capital considered a reason for failure to adapt to the normal annual floods?
21. Is social capital diversification considered better than the concentration of social capital in just one set of social relationships or activities in coping with annual floods?
22. Is trust in social capital considered important more than diversification of social relations?
23. Is vertical social relation or capital better than horizontal social capital in coping with floods?
24. Are there any social relations that you try to develop to cope with floods?
25. Is there any social relation that you think it is important to cope with floods, but you cannot access to it?
26. How can you accumulate social capital?
27. Can you give us examples of social capital in coping with floods in these areas?

Are there any questions that you want to raise today? If not, I would like to thank for your great cooperation.

Close discussion

Appendix 2. 2: Focus group discussion design



Appendix 2. 3: Socio-economic and demographic characteristics of participants in focus group discussions

High flood prone area: Phu Duc commune, Tam Nong district, Dong Thap province

FGD_PD01:
Name of the group: Mixed poor and medium male group
Date of discussion: 12th January 2010
Location of discussion: Phu Xuan hamlet office, Phu Duc commune, Tam Nong district
Moderator: Nguyen van Kien (key investigator)
Observer: Mr Vo Duy Thanh

Participants:

1. **Mr Trong**, aged 34, 7 years in school. He has lived here since 1992. He originated from Cai Lay district, Tieng Giang province. His house is located along internal canal bank. He married and has two children. His family income is from rice (1.5 ha), fishery capture during the flood season. He is a hamlet staff.
2. **Mr Tien,** aged 35, 9 years in school. He has lived there since he was born. His house is located along the internal canal and in a residential cluster (Phu Xuan residential cluster). He is married and has two children. His household income is from rice (1.0 ha), agricultural labour. He is a leader of youth union in the hamlet.
3. **Mr Kich,** aged 68, 5 years in school. He originated from Thanh Binh district of Dong Thap province. He used to live in internal canal. He has moved into Phu Xuan residential cluster since 2003. He is married and has 4 children. His family income is from small business (coffee shop) and remittance from family members working in Binh Duong province. He is a member of aged people.
4. **Mr Moi,** aged 65, 2 years in school. He originated from Lap Vo district of Dong Thap province. He migrated there in since 1987 to claim the forestland to grow rice. Currently, there are eight members in his family. His family income is from rice (2.0 ha) rice dryer services, and pig. He is a member of the farmer association and Red Cross in Phu Duc commune.
5. **Mr Chien,** aged 49, 6 years in school. He originated from Lap Vo district. He used to live in internal canal. He has moved into Phu Xuan residential cluster in 2003. He is married and has two children. His family income from rice (1.5 ha) and fish capture during the water season. He is not a member of any association.
6. **Mr Hong,** aged 57, 6 years in school. He originated from Lap Vo district. He moved to this area in 1993. His house is located in internal canal. His family income is from rice and agricultural labour.

FGD_PD02:
Name of the group: Better-off male group
Date of discussion: 11th January 2010
Location of discussion: Mr Thanh's house, K9 hamlet, Phu Duc commune, Tam Nong district, Dong Thap province
Moderator: Nguyen Van Kien (key investigator)
Observer: Mr Vo Duy Thanh

Participants:

1. **Mr Gom,** aged 43, 2 years in school. He has lived there since he was young. His house is located along the 843 Provincial Road. He is married and has 4 children. His household income is from rice crops, and raising livestock. He is not a member of any association.
2. **Mr Sang,** aged 31, 5 years in school. He has lived there since he was young. His house is located along the canal bank. He is married and has four children. He is not a member of any association.
3. **Mr Nhat,** aged 32, 4 years in school. He has lived here since he was born. He married and has three children. His family income is from rice crops and fishery capture during flood season. He is not a membership of any association.
4. **Mr Dan,** aged 56, 3 years in school. He has lived there since he was born. His house is located along the canal bank. He is married and has eight children living in his family. His family income is from rice (04 ha), pig, and fishery capture. He is not a member of any association.
5. **Mr Nhat,** aged 26, 12 years in school. He has lived here since he was born. He lived with his mother. Family income is from rice. Currently, he is a university student. He is a member of youth union.

6. **Mr Duy,** aged 40, 10 years in school. His house is located along the road. He is married and has 3 children. His family income is come from rice.
7. **Mr Canh,** aged 41, 12 years in school. He is a primary school teacher. He has lived there since he was born. He is married and has two children. His family income is from salary (primary school teacher) and rice crop (0.8 ha). He is also a leader of youth union at the school.
8. **Mr Thanh,** aged 55, 10 years in school, has lived there since he was born. He has two sons and they are all married and living in his family. His household income is from Eucalyptus gardens, rice farming and a small coffee shop.

FGD_PD03:
Name of the group: Better-off female group
Date of discussion: 12th January 2010
Location of discussion: Mr Tien's coffee shop, Phu Xuan hamlet, Phu Duc commune, Tam Nong district, Dong Thap
Moderator: Nguyen Van Kien (key investigator)
Observer: Mr Vo Duy Thanh

Participants:

1. **Ms Thuy,** aged 44, four years in school. She has lived there since 1987. She used to live in the internal canal. She has moved into Phu Xuan residential cluster in 2003. She is married and has 2 children. Her household income is from rice (one ha of rice). She is a member of the Women's Association. She participated in a monthly meeting.
2. **Ms Ca,** aged 28, illiterate. She has lived here for 6 years. She originated from Giong Rieng district, Kien Giang province. She used to live in the internal canal, which was very vulnerable to floods. She has moved to Phu Xuan residential cluster in 2003. She is married and has 2 children. Her household income is from agricultural labour. She is a member of the Women's Association.
3. **Ms Nuoc,** aged 39, 2 years in school. She originated from Tan Quoi, Tam Nong – Dong Thap, province. She used to live in the internal canal, which is subjected to flooding each year. She is married and has 1 child. Her income is from rice (0.5 ha) and agricultural labour. She is a member of the Women's Associations. She participates in monthly meeting.
4. **Ms Thi,** aged 38, 9 years in school. She has lived there for 30 years. She originated from Cao Lanh district. She used to live in the internal canal which is subjected to annual flooding. She moved to residential clusters. She is divorced and lives with her little daughter. Her income is from agricultural labour and raising pigs. She is a member of the Women's Association.
5. **Ms Lien,** aged 25, 5 years in school. She originated from Chau Phu district of An Giang province. She used to live in the internal canal, which is subject to flooding. She moved to Phu Xuan residential cluster in 2003. She has 2 children. Her husband works in Binh Duong province. Her family income is from agricultural labour and remittance from her husband in Binh Duong. She is a member of the Women's Association
6. **Ms Tho,** aged 44, illiteracy. She originated from Hong Ngu district. She used to live in internal canal, which is subjected to flooding. She moved into Phu Xuan residential cluster in 2003. She is married and has 1 child. Her family income is from rice (3 ha), agricultural labour and tractors. She is a member of the Women's Association.

FGD_PD04:
Name of the group: Poor female group
Date of discussion: 11 January 2010
Location of discussion: Mrs Hien's house (head of women association at hamlet), K9 hamlet, Phu Duc commune, Tam Nong district, Dong Thap province
Moderator: Nguyen Van Kien
Observer: Vo Duy Thanh

Participants:

1. **Ms Tu,** aged 33, 5 years in school. She has lived there since she was young. Her house is located on the riverside of the "843" Provincial Road. She is married and has 2 children. Her household income is from rice, pigs and tailoring. She is a member of the Women's Association. She participats in three to four meetings annually.
2. **Ms Hanh**, aged 26, 8 years in school. She has lived there for 10 years. Her house is situated on the riverside of the "843" Provincial Road. She is married and has 2 children. Her husband is working in HCM city. She stays at hometown, cares for kids, and does off-farm (agricultural labour). Her

household income is mainly from remittance and farm labour. She is a member of the Women's Association. She participates in monthly.

3. **Ms Tran**, aged 32, 5 years in school. She has lived there since she was young. Her house is located along the canal. She is married and had 1 child. Her household income is from agricultural labour. She is not a member of the Women's Association.
4. **Ms Phuong**, aged 25, 4 years in school. She has lived there since she was young. Her house is located along the river. She is married and has 1 child. She captures fish and collects snails in the flood season and works in the agricultural sector in the dry season. Her husband works for a construction company in Tam Nong district. She is a member of the Women's Association.
5. **Ms Vet,** aged 44, 3 years in school. She has lived there since she was young. Her house is located along the canal. She is married and has 2 children. Her household income is from agricultural labour and raising pigs. She is a member of the Women's Association. She participates in three to four meetings each year.
6. **Ms Thich,** aged 26, 5 years in school. She originated from Thanh Binh district. She is married and moved here six years ago. Her family income is from agricultural labour and raising pigs. She is a member of the Women's Association.

Moderate flood prone area: Thanh My Tay commune, Chau Phu district, An Giang province

FGD_TMT01:
Name of the group: Better-off male group
Date of discussion: 07th January 2010, at 3pm
Location of discussion: Mr Tuan's house, internal fields, 2 km to K12, Ba Xua hamlet, Thanh My Tay commune, Chau Phu district, An Giang province
Moderator: Nguyen Van Kien (key investigator)
Observer: Mrs Pham Kien Huong
Participants:

1. **Mr Be,** aged 54, 5 years in school. He has lived there since she was born. There are six members in her family. His household income is from rice (3 ha) and agricultural labours. He is not a member of any social associations.
2. **Mr Bau,** aged 42, 6 years in schools. He has lived there since he was born. There are three members in his family. His household income is from rice (1.5 ha) and fishing during the flood season. He is not a member of any social associations.
3. **Mr Tuan,** aged 61, 5 years in school. He has lived in the internal canal for more than 20 years. Originally, he lived along the Vinh Tre road. There are four members in his family. Two sons are working in HCM city. His household income is from remittance in HCM city, rice (0.1 ha) and selling fermented fish. He is a leader of the Farmer's Association in Ba Xua hemlet.
4. **Mr Nho,** aged 37, 3 years in school. He has lived there for 37 years. His house is located along Vinh Tre canal. There are four members in his family. His household income is from rice (2.0 ha). He has a good understanding of flood and its impacts.
5. **Mr Chien,** aged 41, 12 years in school, has vocational education in pesticide protection. He lived along the Vinh Tre road. He owns a pesticide shop. The main household income is from pesticide business and rice crops. He has a good understanding of floods.
6. **Mr Khoe,** aged 30, 2 years in school. His house is located along Ba Xua canal. There are three members in his family. His main household income is from rice (0.4 ha), raising cattle and fish during the flood season.
7. **Mr Tung,** aged 58, 3 years in school. He has lived in Ba Xua canal for 50 years. Now he has moved to the residential cluster to avoid floods. There are four members in his family. His main household income is from rice (5.0 ha), and raising cattle. He is not a member of any social organizations.
8. **Mr To,** aged 38, 3 years in school. He is living in Cau Day hamlet, TMT commune. There are four members in his family. His main household income is from rice growing (0.4 ha) and raising cattle.

FGD_TMT02:
Name of the group: Poor male group
Date of discussion: 08th January 2010, 10 am
Location of discussion: Thanh Phu hamlet, Thanh My Tay commune, Chau Phu district, An Giang province
Moderator: Nguyen van Kien (key investigator)
Observer: Mrs Pham Kien Huong

Participants:

1. **Mr Canh,** aged 37, 76 years in school. He has lived there since he was born. His house is located in K7 canal. He is married and has 1 child. His household income is from agricultural labour in the dry season and fish capture in the flood season. He is not a member of any associations.
2. **Mr Muoi,** aged 39, 7 years in school. He is married and has 2 children. His house is located along K7 canal. The house is made of wood on concrete stilts. His house looks safer than other houses in this hamlet. He is the head of sub-hamlet 1. His household income is from off-farm agricultural labour and fish capture during the flood season.
3. **Mr Phong,** aged 35, 2 years in school. He has lived there since he was born. His house is located along K7 canal. His household income is from agricultural labour and fish capture.
4. **Mr Thuy,** aged 44, 10 years in school. He has lived there for 25 years. His house is located along the K7 canal. His household income is from HonDa (motorbike) carrier. He is not a member of the Farmer's Association.
5. **Mr Hoa,** aged 54, 4 years in school. There are four members in his family. He does not have a house. He lives in a small fishing boat. His household income is from agricultural labour and fish capture during the flood season.
6. **Mr Liet,** aged 36, illiteracy. He has lived there since he was born. He is married and has 1 child. His household income is from agricultural labour and fish capture during the flood season.

FGD_TMT03:
Name of the group: Poor female group
Date of discussion: 28th December 2009
Location of discussion: Mrs Thuy's house, Long Chau hamlet, Thanh My Tay, Chau Phu An Giang province
Moderator: Nguyen Van Kien (key investigator)
Observer: Mrs Pham Kien Huong
Participants:
1. **Ms Le,** 57 years old, only can write and read, lived here for 57 years, lived along the internal canal, four members in the household, main income from farm labour, netting fish during the flood season, non membership in social groups.
2. **Ms Dut,** 58 years old, non year in school, lived here for long time, along the Vinh Tre road, 6 members in the household, main income is from labour (lam thue), non membership in social groups.
3. **Ms Cuon,** 35 years old, 3 years in school, lived here 35 years, lived along Vinh Tre River, four members in family, main income is from labour, netting fish during the flood season, non membership in social groups.
4. **Ms Khang,** 54 years old, 4 years in school, lived here for 54 years, lived along the Vinh Tre road, 8 members in the family, labour and handicraft.
5. **Ms Thuy,** 39 years old, 7 years in school, lived along the Vinh Tre road, 5 members in the family, has 0.6 ha , and small business (small coffee shop), non-membership in social groups.
6. **Ms Sinh,** 50 years old, 2 years in school, lived here for long time, along the Vinh Tre river, four members in the family, labour and small home-based businesses, non-membership in social groups, seasonal migration to Binh Duong industry zone.
7. **Ms Tu,** 46 years old, cannot write and read, lived along the Vinh Tre river. Her household income is from agricultural labour and netting fish during the flood season, membership of the Women's Association.
8. **Ms Thuy,** 32 years old, non-school, originated from Hiep Xuong commune, Phu Tan district, four members in the family. Her household income is from agricultural labour and netting fish during the flood season. She is not a member in any social groups.

FGD_TMT04:
Name of the group: Better off female group
Location of discussion: Mrs Lan' house, Tay An Hamlet, Thanh My Tay, Chau Phu, An Giang province
Date of discussion: 07th January 2010
Moderator: Nguyen Van Kien (key investigator)
Observer: Mrs Pham Kien Huong

Participants:
1. **Ms Lan,** aged 40, 12 years in school. She has lived here for 21 years. She originated from Thoi Long commune, Cantho city. She is living along Vinh Tre road. Her household income is from rice (3.5 ha). She is not a member of any social groups.

2. **Ms Khanh,** aged 39, 4 years in school. She lived along the Vinh Tre road. There are five members in household. Her main household income is from agricultural labour and nail services. She is not a member of any social groups.
3. **Ms Bieu,** aged 42, 5 years in school. She has lived there 42 years. Her house located along the Vinh Tre road. There are four members in the household. Household income is mainly from rice crop (0.9 ha). She is not a member of any social groups.
4. **Ms Nguyet,** aged 58, 7 years in school. She has lived there 35 years. She originated from Long Xuyen city. Her house is located along the Vinh Tre road. There are four members in the household. Household income is from small business, rice (10.0 ha) and she is not a member of any association.
5. **Ms Phuong,** aged 42, 4 years in school. She has lived there 42 years. Her house is located along the Vinh Tre riverbank. There are 4 members in the family. Her income is from rice (0.8 ha) and she is a member of the Women's Association.
6. **Ms Hang,** aged 40, five years in school. She originated from Dao Huu Canh commune. She has lived along Vinh Tre road. There are four members in the household. Household income is from rice (1.7 ha), grocery shop. She is a member of the Women's Association.

Low flood prone area: Trung An commune, Co Do district, Can Tho City

FGD_TA01:
Name of the group: Poor male group
Date od discussion: 30th December 2009
Location of discussion: Mr Duong's house, Thanh Loc 2 hamlet, Trung An commune, Co Do district
Moderator: Nguyen Van Kien (key investigator)
Observer: Mr Tran Van Hieu

Participants:
1. **Mr Hai,** aged 61, 11 years in school. He has lived along provincial road (name 921). There are four members in the family. He is a leader of the Farmer's Association. His household income is from rice, and salary from the president of farmer association.
2. **Mr Phuong,** aged 39, 3 years in school. He has lived there for long time. His house is located in top of Tra Ech creek. There are four members in the family. His household income is from vegetable cultivation and agricultural labour. He is not a member of any social groups.
3. **Mr Duong,** aged 36, 2 years in school. He has lived at the top of Tra Ech creek. There are four members in the family. His household income is from raising pigs and agricultural labour. He is not a member of any social groups.
4. **Mr Rang,** aged 50, 2 years in school. He has lived there for 50 years. He is living along the Tra Ech creek. There are three members in the family. His household income is from agricultural labour. He is not a member of any social groups.
5. **Mr Quoi,** aged 46, 6 years in school. He has lived along the Tra Ech creek. There are four members in the family. His household income is from agricultural labour and hairdressing. He is a member of the Farmer's Association.
6. **Mr Sau,** aged 67, 3 years in school. He has lived there for 67 years. His house is located along Tra Ech creek. There are six members in school. His household income is from rice and salary from primary school teaching. He is not a member of any social groups.

FGD_TA02:
Name of the group: Better off male group
Location of discussion: Thanh Loc 2, Trung An commune, Co Do district, Can Tho City
Date of discussion: 31st December 2009
Moderator: Nguyen Van Kien (key investigator)
Observer: Mr Tran Xuan Long

Participants:
1. **Mr Sanh,** aged 64, 4 years in school. He is living along the 912 provincial road. His household income is from rice and raising pigs. He is a member of the Farmer's Association.
2. **Mr Doi,** aged 60, 10 years in school. He is living along the 921 provincial road. There are five members in the family. His household income is from rice and raising pigs. He is a member of the Farmer's Association.
3. **Mr Binh,** aged 24, 6 years in school. He has lived along the 921 provincial road. There are four members in the family. His household income is from rice. He is a member of the Farmer's Association.

4. **Mr Tong,** aged 39 years old, 4 years in school. He is living along the 921 provincial road. His household income is from rice (1.5 ha) and raising pigs. He is a member of the Farmer's Association.
5. **Mr Phai,** aged 47, 6 years in school. There are four members in his family. His household income is from rice and raising pig. He is a member of the Farmer's Association.
6. **Mr Sinh,** aged 21, 12 years in school. He is living along the 921 provincial road. There are 3 members in family. His household income is from rice and raising pigs. He is a member of the Farmer's Association.
7. **Mr Tu,** 42 years old, 5 years in school, live along the 921 provincial road, 6 members, income from rice, raising pigs. He is a member of the Farmer's Association.

FGD_TA03:
Name of the group: Poor female group
Date of discussion: 30th December 2009
Location of discussion: Trung An commune, Co Do district, Can Tho City
Modirator: Nguyen Van Kien (key investigator)
Observer: Mr Tran Van Hieu

Participants:

1. **Ms Thoa,** aged 36, 3 years in school. She originated from Trung Thanh commune of Thot Not district. She is living along provincial road 912. There are four members in the family. Her household income is from labour. She is not a member of any social groups.
2. **Ms Nhu,** aged 35, 3 years in school. She has lived here for 35 years. She is living along the Tra Ech creek. Her household income is from a small coffee shop (small business) and agricultural labour. She is not a member of any social groups.
3. **Ms Chinh,** aged 39, 6 years in school. She is living along the Tra Ech creek. There are four members in the family. Her household income is from agricultural labour. She is not a member of any social groups.
4. **Ms Du,** aged 43, 2 years in school. She originated from Co Do town. She is living along Tra Ech creek. There are five members in the family. Her household income is from agricultural labour.
5. **Ms Tam,** aged 45, illiteracy. She is living along the Tra Ech creek. There are four members in the family. Her household income is from agricultural labour and remittance from her children working in HCM city. She is not a member of any social groups.
6. **Ms Suong,** aged 38, 5 years in school. She has lived there for 13 years. She is living along the Tra Ech creek. There are six members in the family. Her household income is from labour. She is not a member of any social groups.
7. **Ms Ut,** aged 29, 3 years in school. She has lived there for 12 years. She is living along the Tra Ech Creek. There are five members in the household. Her household income is from agricultural labour. She is not a member of any social groups.

FGD_TA04:
Name of the group: Better off female group
Location of discussion: Mrs Nga's home, Trung An commue, Co Do district, Can Tho City
Date of discussion: 31st December 2009
Moderator: Nguyen Van Kien (key investigator)
Observer: Mr Tran Xuan Long

Participants:

1. **Ms Sam,** aged 49, 5 years in school. She is living along the 921 Provincial Road. There are 6 members in the household. Her household income is from agricultural labour, overseas labour export, fishing and transportation.
2. **Ms Nga,** aged 47, 2 years in school. She is living along the 921 provincial road. There are six members in the household. Her household income is from rice (1.5 ha) and agricultural labour. She is a member of the Women's Association.
3. **Ms Tuyet,** aged 42, 5 years in school. There are six members in the household. Her household income is from rice and raising pigs. She is a member of the Women's Association.
4. **Ms Ba,** aged 45, 5 years in school. There are six members in the household. Income is from rice, raising pig. She is a member of the Women's Association.

5. **Ms Se,** aged 53, 4 years in school. She is living along the 921 Provincial Road. There are seven members in the family. Her household income is from rice only. She is a member of the Women's Association.
6. **Ms Chon,** aged 46, 5 years in school. There are nine members in the family. Her household income is from rice and raising pig. She is not a member of any social organization.

Appendix 2. 4: In-depth interview guidelines

The Australian National University
College of Arts and Social Sciences
Australian Demographic and Social Research Institute

In-depth Interviewing Guidelines
(to be translate into Vietnamese)

Social capital, livelihood diversification and households' resilience to floods in the Vietnamese Mekong River Delta

PhD Research
Principle investigator: Nguyen Van Kien
Research Sites: Phu Duc commune, Tam Nong district, Dong Thap province.
Thanh My Tay commune, Chau Phu district, An Giang province
Trung An commune, Thot Not district, Can Tho City

Introduction and objectives of in-depth interview

We met in a focus group discussion in some recent days, and you gave very interesting stories about the way your household members live with floods. Today I am very interested in hearing insights into your story about how to live with floods for several years.

The objectives of this study are to gather in-depth life history about the impacts of annual floods on your households' livelihood assets, livelihood activities, your livelihood strategies, and the effect of livelihood strategies (livelihood diversification or livelihood specialization) on household coping with floods. We are also interested in the existing and roles of particular social relations on coping with floods in your family. The results of this study will be useful for identifying the adaptation strategies for living with the annual flood events in the MRD.

First, I would like to ask information about the characteristics of annual floods at your place.

1. Does this area experience 'floods'?
2. Do they happen every year? When does it occur?
3. Is 'flood' the right word for me to use in this research or is there some other terms like 'high water season' or 'big water' or small water season' or 'rising water season' that you use to describe these events?
4. Do you classify the floods of different years, for example, as high, medium or low flood years, or in some other way? Do you recall what year was the worst? What happened then?
5. How do people here measure flood severity?

Flood impacts

5. What do you think about floods - positive or negative impacts or mixed impacts from floods?
6. What were the material impacts, like on assets, or income or health or houses? Any other?
7. Are the floods worse in some years than others? In which months is flood worst?
8. According to your experience, what year or years were the floods the worst?
9. Do you think floods are overall getting worse over time?
10. In what ways were they worse that year?
11. Who were affected? Who would you say is the worst affected?
12. How can you cope with the impacts?
13. Who can recover quicker than others? How long did you recover from the impacts and return to "normal"?
14. In what year the flood is considered "normal" or not affected in general?
15. Are some livelihood activities, assets such as crops, income and other assets affected by even the normal flood?
16. Who was not affected? Or consider flood as a normal event?
17. How normal floods affect livelihoods of your family?
18. If yes, in what way were they affected?

19. What are the other impacts for example, as on individual psychology, family harmony, community relations, peace and security? Any other? Are any social groups, e.g. rich/poor, men/women, young/old, farmer/non farmer affected more seriously?
20. Who is the least affected?
21. Who can benefit from floods, if anyone? In what way they are better-off from floods?
22. What is the best strategy to minimize negative impacts of floods, while enhance the benefits?
23. How did your family experience and cope with the flood impacts?
24. What is your livelihood strategy to adapt to normal and extreme flood years?
25. What are the impacts of floods on men and women? How do men and women cope with floods?
26. What are the roles of men and women during the flood season?

Concept of living with floods

27. Is the phrase living with floods accurate to describe your experiences?
28. Where does this concept come from?
29. What do you mean by the term "living with floods"?
30. Is there a better phrase that reflects your experience with floods?
31. Can your family live with floods? If so, in what ways does your family adapt to floods?
32. According to you who can live well with floods and who experienced the most impacts and had a hard time coping with floods?
33. How has the concept of 'living with floods' change overtime?

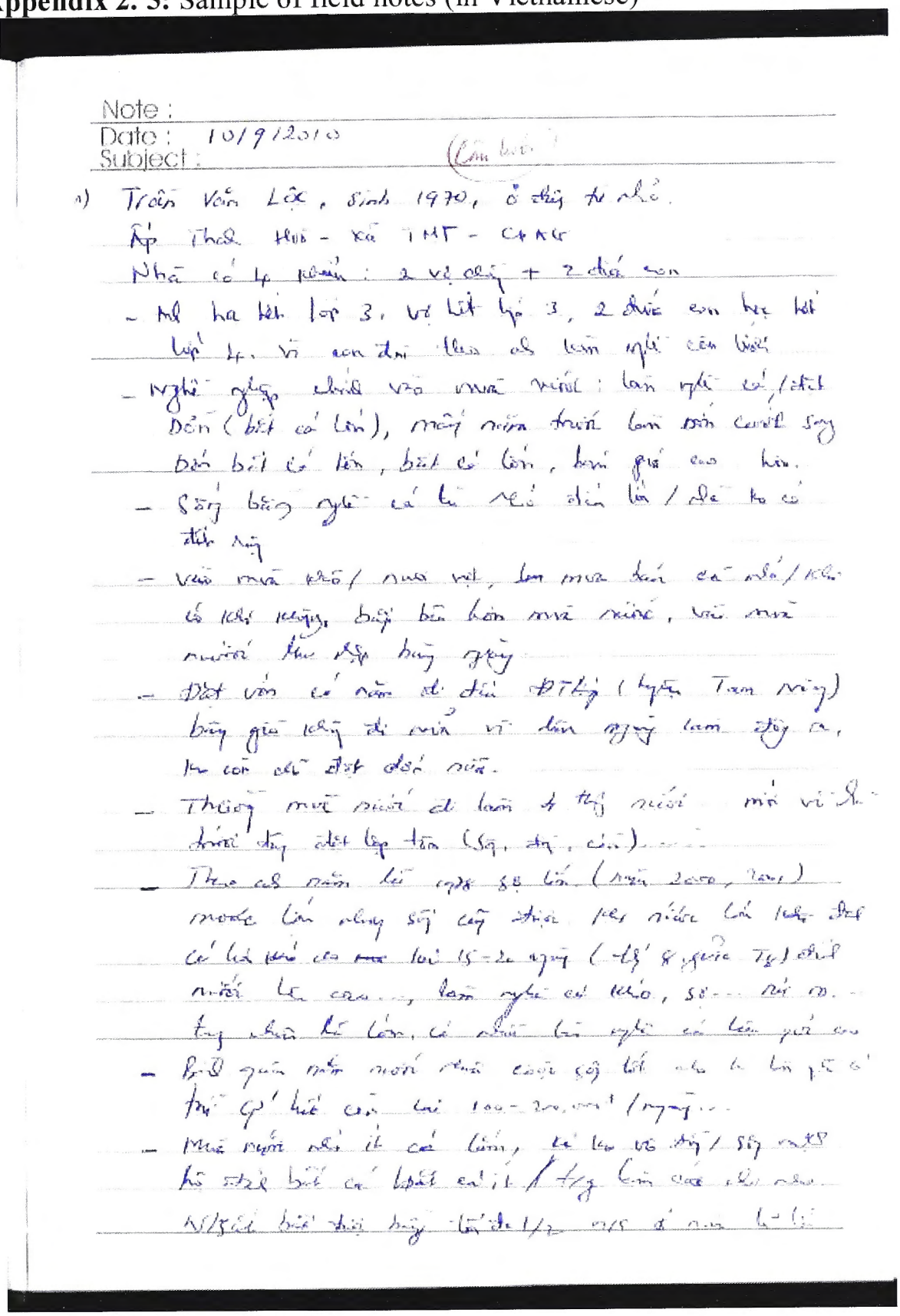
Effectiveness of livelihood adaptations (diversification, specialization, social capital)

34. What are the main strategies used by people in this sub-district to live with floods?
35. What is your livelihood strategy to cope with annual floods: normal and high floods?
36. Is income diversification the vital livelihood strategy to cope with floods?
37. Are other livelihood strategies (e.g. occupational specialization such as entry into non-farm business or migration) considered a better way to cope with normal and high flood events?
38. Is there any way to profit from floods or improve the situation of your family and quality of your life?
39. If, the future floods were extreme, what would you do to maintain your livelihoods?
40. What kinds of social groups or organizations are you a member? If you are not a member, do you access to those social groups?
41. Is the term social relation right to explain the social capital in your experience of living with floods?
42. How important is social relations in coping with floods?
43. What types of social relations are considered vital in coping with floods? Is vertical social relation better than horizontal social relations in coping with floods?
44. Is social relation diversification considered better than the concentration of just one set of social relationships in coping with annual floods?
45. Is trust in one set of social capital more important than diversification of social relations in coping with floods?
46. What is your strategy to accumulate social relations to cope with floods?
47. What do you mean by specialization of social relations in coping with floods?
48. Do you think some social relations are better in coping with floods, but you cannot access to it? And why?
49. Do increased social relations (quantity or quality) enhance capacity to live with floods?
50. If future floods are more extreme, how would you prepare to adapt to floods?
51. What assistance do you believe would improve this adaptation to floods in the future?
52. Are there any issues that you want to raise from living with floods in this area?

Thank you very much!

Close in-depth interview

Appendix 2. 5: Sample of field notes (in Vietnamese)



Note :
Date : 10/9/2010
Subject :

1) Trần Văn Lộc, sinh 1970, ở thị trấn nhỏ.
Ấp Thạch Hưng - xã TMT - CMKG
Nhà có 4 người : 2 vợ chồng + 2 đứa con
- Nộ ha tới lớp 3, vì bắt lớp 3, 2 đứa em học tới lớp 4. Vì con đi thêm thì ảnh hưởng đến việc
- Nghề nghiệp chính vào mùa mưa : làm nghề cắt/bắt Dơn (bắt cá lớn), mấy năm trước làm mình cuốc sống bằng bắt cá lớn, bắt cá lớn, bán giá cao hơn.
- Sống bằng nghề cá là nhờ đến lúa / để ko có thêm nợ
- Vào mùa khô / mưa ít, lúa mùa bán cá nhỏ / khô có khi không, bắp bên hàng mùa mưa, vào mùa nước thu hẹp hơn ngày
- Đất vườn có năm đi đến 4Tỷ (huyện Tam Nông) bây giờ không đi mua vì đến ngày làm ăn ra, ko còn chỗ đất đâu nữa.
- Thường mùa nước đi làm 4 tháng nước mới về. Ở đây đang đắt lắp tôm (sú, vẹt, cóc)
- Theo cả năm lời nghề bắt cá (năm 2008, 2009) mọi lần những sống cũng thấp, nhưng lần lớn đắt có khi lên 15-20 ngày (-tỷ 8 người Tỷ) thì nước lên ... làm nghề có nhiều, số... nói ra... ông nhà kể lớn, có thêm bắt nghề cá lớn giá cao
- Bắt quen mắt mới mua cuộc sống khá ổn hơn trước đây thì 4/ khá cần lưới 100-200.000 / ngày...
- Mùa nước nhỏ ít cá lớn, kể lớn về tỷ / sống mặt hồ nhỏ bắt cá khác ít / tỷ làm cách nhau 1/2 mùa ở nơi khác

Appendix 2. 6: Sampling approach for household survey in October 2010 (in Vietnamese)

Danh sách hộ khảo sát tại xã Trung An – Cờ Đỏ - Cần Thơ
Ấp Thạnh Lộc I
Trưởng Ấp: Lê Công Trứ.
Hộ nghèo và cận nghèo

STT	Họ và Tên
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Hộ Trung bình

STT	Họ và Tên
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Hộ khá giàu

STT	Họ và Tên
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Appendix 2. 7: Household questionnaires

The Australian National University
College of Arts and Social Sciences
Australian Demographic and Social Research Institute

Household Survey
(to be translate into Vietnamese)

Social capital, livelihood diversification and households' resilience to floods in the Vietnamese Mekong River Delta

PhD Research	
Principle investigator:	Nguyen Van Kien
Research Sites:	Phu Duc commune, Tam Nong district, Dong Thap province.
	Thanh My Tay commune, Chau Phu district, An Giang province
	Trung An commune, Co Do district, Can Tho City

Introduction and objective of household interview

The objective of this study is to gather households' perception about the impacts of annual floods on your livelihood assets and activities, livelihood strategies, and the effect of livelihood strategies (livelihood diversification or livelihood specialization) on households' resilience during and after the annual flood events, and the existing and roles of particular social capital (formal and informal) on households' resilience during and after the flood event each year. The results of this study will be useful for identifying the adaptation strategies for living with the future flood in the Mekong River Delta.

Contact details:
Nguyen Van Kien,
PhD candidate,
Australian Demographic and Social Research Program
The Australian National University
Canberra, ACT 0200
Mobile: +61421937905
Email: nv.kien@anu.edu.au

I. Questionnaire identity (to be filled by interviewer)

Questionnaire number : ☐

Interviewer :.....

Date **Month/year** **Start Time** **Finishing Time Result**

_____ _____ _____ _____

Name of interviewee :.....

Address of interviewee :Hamlet.....Commune.....District.....

Tel: .....

Relationship of interviewee with the household:

1. household's head
2. spouse of household's head
3. parent of household's head
4. children of household's head

Sex : (0) female; (1) male Age:_____

Religion : 1. Hoa Hoa; 2. Cao Dai; 3. Buddhism; 4. Catholics; 5. Others.....

Could you classify type of your household? Please circle one following number.

1. poor household
2. near poor household
3. medium household
4. better off household

Is your household also classified as the following types? Please circle 1 or 2

Household Types	YES	NO
Policy household (veterans, revolution)	1	2
Having one disabled or chronic acute person	1	2
Relief household	1	2
Ethnic minority group	1	2

Resuit Code [Please circle the number]

1. The interview went well
2. The respondent refused to be interviewed
3. The respondent did not want to continue with the interview
4. The respondent is busy with his work so he is not available for the interview
5. Other reason please specify ----------

Please explain why the respondent refused to be interviewed ----------

---

II. Household demographics

1. Could you please tell me about how many people are in your family? [.....**People**]
2. Could you please tell me about their demographic information?

No	Q1.What is Name of each member?	Q2.What is the Sex of [Name]?	Q3.What is the relationship of [Name] to you?	Q4.How old is [Name]?	Q5.What is [Name]'s marital status?	Q6.What is [name] level of education?	Q7. What is [name]'s educational status?	Q8.What is [Name]'s religion?	Q9.What is the main occupation of [Name]?	Q10.Does [name] has a second occupation?
	Please write down the name only	female male	spouse children parents relatives others	(Years)	single married widowed divorced separate	non school primary school secondary school high school vocational college bachelor	completed continuous	Hoa Hao Cao Dai Buddhism Catholics Others	Agriculture Animal husbandry Aquaculture Off-farm labour and fishing staff technician Retired unskilled labourer unemployed	Agriculture Animal husbandry Aquaculture Off-farm labour and fishing staff technician Retired unskilled labourer unemployed
1	Respondent		xxxxxxxxxx							
2										
3										
4										
5										
6										
7										
8										
9										
10										

III. Perception/understanding about the flood

1. Is flood an annual event in this area?
   1. Yes
   2. No >>>>> skip
2. If yes, have you experienced different levels of flood in this area in the past 20 years?

Flood types	Please circle ① or ②		Depth of different floods (cm above the rice field)	Level of Frequency very frequent frequent not very frequent
	Yes	No		
High flood	1	2		
Moderate flood	1	2		
Low flood	1	2		

3. When does normally the flood occur?
From moth:.....to month:.....(lunar calendar)

4. In which months was the flood perceived as most serious? Please tick ✓ the month below [lunar calendar].

May	June	July	August	September	October	November

5. In which of the following circumstances, do you measure the flood severity or risk? **Please circle ① or ②**

No	Circumstances	Yes	No
1	By duration of inundation	1	2
2	By duration of flood	1	2
3	By flood together with strong wind	1	2
4	By sudden rising of water level during the flood	1	2
5	Others.....	1	2

6. Do you recall in the past 20 years what year was the highest flood? **[Please circle the highest flood year]**

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
2000	2001	2002	2003	2004	2005	2006	2007	2008	2009

7. Could you tell us the impacts of the biggest flood on the following indicators at the community within the past 20 years?

No	Impacts of floods	Level of impacts very good good not good both good and not good no impact
1	Housing	
2	Winter-spring rice crop	
3	Summer rice crop	
4	Upland crop	
5	Fruit	
6	Fish pond and prawn farm	
7	Fishing, netting	
8	Small business	
9	Non-skilled labour	
10	Animal husbandry (ducks and chickens)	
11	Animal husbandry (cows, water buffaloes and pigs)	
12	Water sources on river and cannel	
13	Local transportation	
14	Health of local people	
15	Educational attainment	
16	Handicraft activities	
17	Others.....	

8. In the highest flood year, was your household negatively affected by the flood?
   1. yes
   2. no >>>> **skip to Q 10**

9. If yes, what kinds of negative impacts your household has experienced during big flood events? **Please circle ① or ②**

No	Negative impacts of big flood events	Yes	No
1	Submerged houses	1	2
2	Anxiety about the floods	1	2
3	Shortage of rice to eat during the floods	1	2
4	Loss of jobs during the floods	1	2
5	Destroyed houses	1	2
6	Educational disruption	1	2
7	Crop loss	1	2
8	Job seeking in areas far from home	1	2
9	Reduced income from fishing	1	2
10	Temporary evacuation to other places	1	2
11	Houses totally damaged	1	2
12	Animal deaths	1	2
13	Effects on fish ponds and prawn farms	1	2
14	Others	1	2

10. Besides the costs, were there any benefits from flood to your household livelihoods in that year?
    1. yes
    2. no >>>>>>> **skip to Q12**

11. If say yes (1), what were the benefits? **Please circle ① or ②**

No	Benefits of big flood events	Yes	No
1	Reduction in rats and mosquitoes during floods	1	2
2	Higher yields in the winter-spring rice crop	1	2
3	Reduced input costs for the winter-spring rice crop	1	2
4	Captured good fish yields during floods	1	2
5	Taking leisure time during floods	1	2
6	Collecting snails and crabs during floods	1	2
7	Farming fish and prawns during floods	1	2
8	Farming ducks during floods	1	2
9	Others	1	2

12. Do you think the floods are overall getting higher or smaller from 2000?
    a. Higher
    b. Smaller
    c. No change

13. How do you know about that trend? **Please circle ① or ②**

No	Sources of information	Yes	No
1	from my experience	1	2
2	from my neighbours/friends	1	2
3	from government staff	1	2
4	from Television/radio	1	2
5	Others.....	1	2

14. Were there any negative impacts of the moderate flood events on your household livelihoods within the past 20 years?

    1. yes
    2. no >>>>>>> **skip to Q16**

15. If yes, what kinds of negative impacts your household has experienced during moderate flood events? **Please circle ① or ②**

No	Negative impacts of moderate flood	Yes	No
1	Submerged houses	1	2
2	Anxiety about the floods	1	2
3	Shortage of rice to eat during the floods	1	2
4	Loss of jobs during the floods	1	2
5	Destroyed houses	1	2
6	Educational disruption	1	2
7	Crop loss	1	2
8	Job seeking in areas far from home	1	2
9	Reduced income from fishing	1	2
10	Temporary evacuation to other places	1	2
11	Houses totally damaged	1	2
12	Animal deaths	1	2
13	Effects on fish ponds and prawn farms	1	2
14	Others	1	2

16. Were there any benefits from moderate flood to your household's livelihood?

    1. yes
    2. no >>>>>>> **skip to Q18**

17. If say yes (1), what were the benefits? **Please circle ① or ②**

No	Benefits of moderate flood	Yes	No
1	Reduction in rats and mosquitoes during floods	1	2
2	Higher yields in the winter-spring rice crop	1	2
3	Reduced input costs for the winter-spring rice crop	1	2
4	Captured good fish yields during floods	1	2
5	Taking leisure time during floods	1	2
6	Collecting snails and crabs during floods	1	2
7	Farming fish and prawns during floods	1	2
8	Farming ducks during floods	1	2
9	Others	1	2

18. Were there any negative impacts of the small flood events on your household livelihoods within the past 20 years?

    1. yes
    2. no >>>>>>> **skip to Q20**

19. If yes, what kinds of negative impacts your household has experienced during small flood events? **Please circle ① or ②**

No	Negative impacts of small flood events	Yes	No
1	More rats during floods	1	2
2	More mosquitoes during floods	1	2
3	More costs for the winter rice crop	1	2
4	More pests for the winter rice crop	1	2
5	Reduced income from off-farm fishing	1	2
6	Reduced yield of the winter-spring rice crop	1	2
7	Migration to seek jobs in other areas	1	2
8	Not good for fish and prawn farming	1	2
9	Others.....	1	2

20. Were there any benefits from small flood events to your household livelihoods?
    1. yes
    2. no >>>>>>> **skip to Q22**

21. If say yes (1), what were the benefits? **Please circle ① or ②**

No	Benefits from small floods events	Yes	No
1	Not affect house	1	2
2	Convenience for transportation	1	2
3	Convenience for going to school	1	2
4	Not worried about collapsed house	1	2
5	Good for animal raising	1	2
6	Others.....	1	2

22. Referring to highest flood in the last 20 years, what coping strategies did you employ to respond to the impacts during that flood? **Please circle ① or ②**

No	Coping behaviours during the flood	Big flood events		Moderate flood events		Small flood events	
		Yes	No	Yes	No	Yes	No
1	Moving to the high ground, safe places (school, pagodas)	1	2	1	2	1	2
2	Do not go fishing	1	2	1	2	1	2
3	Stay at home to take care children	1	2	1	2	1	2
4	Send children to mobile kindergarten	1	2	1	2	1	2
5	Borrow money and rice from neighbours	1	2	1	2	1	2
6	Borrow money from informal credit providers	1	2	1	2	1	2
7	Borrow money from formal credit providers	1	2	1	2	1	2
8	Wait for public relief	1	2	1	2	1	2
9	Reduce the normal meal	1	2	1	2	1	2
10	Seasonal migration	1	2	1	2	1	2
11	Go to nearby pagodas or religious sites to pray or worship	1	2	1	2	1	2
12	Pray at home	1	2	1	2	1	2
13	Strengthen the house before the flood	1	2	1	2	1	2
14	Upgrade the floor above the flood	1	2	1	2	1	2
15	Upgrade the floor above the annual flood level	1	2	1	2	1	2
16	Others.....	1	2	1	2	1	2

23. Could you please tell us the status of your house at current time? **Please circle ① or ②**

No	Housing status	Yes	No
1	Permanent house on cement ground	1	2
2	Permanent house on concrete stilts	1	2
3	Semi- permanent house on ground	1	2
4	Semi- permanent house on concrete stilts	1	2
5	Temporary house on ground	1	2
6	Temporary house on temporary wooden stilts	1	2

24. Could you please tell us the location of your house at current time? **Please circle ① or ②**

No	Location of the house	Yes	No
1	In the residential cluster	1	2
2	Along the road/dikes (inside)	1	2
3	Along the cannel/river which is subjected to flooding	1	2

25. Was the flood negatively affected your household in the flood 2009?
    1. yes
    2. no >>>>>>> **skip to Q28**

26. **If yes,** could you please tell us the negative impacts of the 2009 flood on your household? **Please circle ① or ②**

No	Negative impacts of low flood	Yes	No
1	Increase input cost for the winter rice crop	1	2
2	Reduce yield of the winter rice crop	1	2
3	Increase pests for the winter rice crop	1	2
4	More rats during flood	1	2
5	More mosquitoes during flood	1	2
6	Reduce income from off farm fishing	1	2
7	Must migrate to others for seeking jobs	1	2
8	Not good for fish and prawn farming during the flood	1	2
9	Others	1	2

27. In your opinion, which other types of households are most beneficial from different flood types? Please circle **① or ②**

No	Types of household (key income)	High		Moderate		Low	
		Yes	No	Yes	No	Yes	No
1	Rice farmers	1	2	1	2	1	2
2	Vegetable farmers	1	2	1	2	1	2
3	Fishers	1	2	1	2	1	2
4	Labourer	1	2	1	2	1	2
5	Small business	1	2	1	2	1	2
6	Construction	1	2	1	2	1	2
7	Animal husbandry	1	2	1	2	1	2
8	Aquaculture	1	2	1	2	1	2
9	Transportation	1	2	1	2	1	2
10	Officials	1	2	1	2	1	2

28. What are the best strategies to enhance the natural benefits from the annual flood while mitigating the possible costs to your households?

IV. Households' livelihood activities within 12 months

29. What are your households' livelihood activities during the last 12 months? Please tick ✓ in the column.

No	Livelihood activities	Please tick ✓ if appropriate		
		Dry season	Flood season	Round year
A	**On Farm income activities**			
1	Sumer-autumn rice crop			
2	Winter-spring rice crop			
3	Autumn-winter rice crop			
4	Vegetable crop (*Neptunia prostrate*)			
5	Vegetable crop (.....			
6	Vegetable crop (.....			
7	Fish			
8	Prawn			
9	Pig			
10	Cow, buffaloes			
11	Chicken			
12	Ducks			
13	Others			

B	**Off-farm income activities**			
1	Capture fish			
2	Collecting snails, crabs and wild products			
3	Agricultural labours			
4	Others.....			
C	**Non-farm income**			
1	Working for local industry (rice mills, fishery factories			
2	Working in non-farm sectors in HCM city			
3	Own business in local areas			
4	Others.....			
D	**Income sources other than farm, off-farm and non-farm**			
1	Remittance from relatives in oversee			
2	Remittance from family members working in HCM city			
3	Selling own property (land, Jewellery, other assets)			
4	Interest from the bank			
5	Interest from informal credit borrower			
6	Others			

30. Could you please roughly estimate the income of each selected source during the last 12 months?

No	Income Sources	Unit	Investment Cost 1000 VND	Total harvest (kg)	Total sold (Kg)	Total used (Kg)	Total values 1000 VND
A	**Farm income**						
1		ha					
2		ha					
3		No					
4		no					
5		no					
6							
7							
8							
9							
B	**Off-farm income**	Unit	Estimated cost/day 1000 VND	Estimated Income/day 1000 VND	Estimated Income/month 1000 VND	How many months did you work/year?	Estimated income/year 1000 VND
1		days					
2							
3							
4							
5							
C	**Non-farm income**	Unit		Estimated Income/day 1000 VND	Estimated Income/month 1000 VND		Estimated income/year 1000 VND
1							
2							
3							
4							
5							
D	**Other income**	Unit					Total estimated income/year 1000 VND
1	Remittance						
2	Selling land						
3	Selling Jewry						
4							
5							
6							

31. Could you roughly estimate the total households' income from the last 12 months?
    a. Less than 5 million VND per year
    b. From 5 million to less than 10 million VND per year
    c. From 10 million to less than 20 million VND per year
    d. From 20 million VND to less than 40 million VND/year
    e. Over 40 million VND per year, specify.....

32. What is the best season for your household's income?
    a. dry season
    b. low flood season
    c. moderate flood season
    d. high flood season
    e. Do not know

33. Which livelihood strategy has your household adapted to floods in the past 10 years?

No	Livelihood strategies	Please circle ① or ②		How effective was your coping behaviour? 1. very effective 2. effective 3. not effective
		Yes	No	
1	Growing vegetables during the floods	1	2	
2	Culture fish/prawn during the floods	1	2	
3	Fishing during the floods	1	2	
4	Go to other areas to do labour	1	2	
5	Raising pigs and cows during the floods	1	2	
6	Raising chickens and ducks during the floods	1	2	
7	Provide informal credit at a high interest rate during the floods	1	2	
8	Others.....	1	2	

34. During the last 10 years, did your household change livelihood activities to cope with floods?
    1. Yes
    2. No >>>>> **skip to Q 37**

35. If yes, could you please tell us what livelihood activities did you change and in what year?

No	Livelihood changes	Year of changes	Reasons for changes
1			
2			
3			
4			

36. Will your household change livelihood strategies in the future?
    1. Yes
    2. No >>>>> skip to section V

37. If yes, what activities do you think are most suitable to the flood season? **Please list two most suitable activities.**

V. Social capital and resilience to floods

Three types of social capital will be taken into account: 1. Neighbourhood attachment; 2 social networks; 3: participation in group and associations. For the first two types of social capital, both attitudinal and behavioural statements will be investigated, using a five Likert scales. The questionnaires are adopted from Li et al. 2005.

Firstly, could you tell us about your level of agreement about your neighbourhood attachment?

A. Neighbourhood attachment

Items	Neighbourhood attachment	Level of agreement 1. Strong agree 2. Agree 3. Do not know 4. Disagree 5. Strong disagree
1	Neighbors in my neighborhood mean a lot to me	
2	Advice is available from my neighbors when I face difficulties	
3	I regularly have coffee/tea with my neighbors	
4	I help my neighbors when they are sick	
5	I discuss with neighbors ways of living with the flood season	
6	I regularly participate in recreational (leisure) activities in the neighborhood	
7	I regularly participate in cultural and religious activities in the neighborhood	
8	I regularly participate in hamlet meetings to discuss ways to cope with flood	
9	I assist my neighbors to recover if they are affected by floods	
10	I help my neighbors with money or rice when they are affected by extreme floods	
11	I am regularly invited to attend parties (weddings, birthday…)	
12	I am regularly invited to participate in important events in the neighborhood such as conflict resolution	

Secondly, could please tell us about your social network and in case of coping with floods?

B	Social networks	1. Yes 2. No	Who are they? [Please tick ✓ appropriate column]				
			Friends	Family members	Acquaintance	Government staff	Religious groups
1	If you need 1,000,000 VND urgently, can you borrow immediately?						
2	Is there anyone who believes you when you seek advice from them?						
3	Is there anyone who helps you out when you have financial difficulty?						
4	Is there anyone to help you to learn new skills for exploiting the benefits of floods?						
5	Is there anyone to lend you money or rice during the flood season if you need it urgently?						
6	Is there anyone to lend you a boat during the flood season if you need it?						
7	Is there anyone to help you to access public relief/assistance *(cứu trợ lũ lụt)* from Government, NGOs, and local religious groups if you need it?						
8	Is there anyone to help you to move to residential cluster *(cụm dân cư vượt lũ)* if you want to move?						

Finally, could you please tell us is anyone in your household a member of following groups and associations?

C. Associational activities

No	Groups/ Associations	Tick ✓	No	Groups/ Associations	Tick ✓
1	Farmers' associations		10	Flood response rescue team	
2	Women's associations		11	Agricultural cooperatives	
3	Youth union		12	Religious groups	
4	Father front		13	Fishery associations	
5	Retired soldiers		14	Recreational and art clubs	
6	Red Cross		15	Snail collecting group	
7	Aged people's associations		16	Hamlet security group/unit	
8	Farmers' clubs		17	Local authority	
9	Loan saving groups				

VI. Household's resilience to annual flood events

Could you tell us about the level of agreement on the following statement?

Items	Statements	Level of agreement 1. Strong agree 2. Agree 3. Do not know 4. Disagree 5. Strong disagree
1	I can replace my house quickly when it is affected by floods.	
2	I am confident that my household has enough rice to eat during the flood season.	
3	I am confident that my household will not need to borrow rice or money from informal sources during the flood season.	
4	I am confident that my household can find a safe place to evacuate to if there is an extreme flood event in the future.	
5	I am confident that the health of my family members will not be negatively affected by the flood.	
6	I am confident that my house will not be submerged by the highest floods in the last 20 years.	
7	I am confident that my house will not collapse or be swept away by the highest floods in the last 20 years.	
8	I want to learn new farming practices to cope with floods, such as fishing, prawn farming.	
9	I have used new farming practices to cope with floods such as fish, prawn farming	

VII. Gender roles and coping with flood season

38. Could you please tell us about what men and women in your family do during the flood season?

No	List of activities	**Who is most participated in this job?** [Please circle only one number] 1. head 2. spouse 3. children upper 15 years of age 4. children under 15 years of age 5. parents upper 60 years of age						**Gender** 1. Male 2. female **[Please circle ① or ②]**		How many hours did she/he work each day?	How many days did she/he work each month?	How many months did she/he work each year?
1	Taking care of kids or aged people	1	2	3	4	5	6	1	2			
2	Fishing	1	2	3	4	5	6	1	2			
	Collecting crabs, snails											
3	Collecting wild vegetables	1	2	3	4	5	6	1	2			
4	Labouring in local industry	1	2	3	4	5	6	1	2			
5	Seasonal migrating to HCM for working in non-farm activates	1	2	3	4	5	6	1	2			
6	Sell off-farm fishing	1	2	3	4	5	6	1	2			
7	Housekeeping	1	2	3	4	5	6	1	2			
8	Working in handicraft	1	2	3	4	5	6	1	2			
9	Raise animals	1	2	3	4	5	6	1	2			
10	Work in aquaculture	1	2	3	4	5	6	1	2			
11	Voluntarily helps neighbours to prepare to flood	1	2	3	4	5	6	1	2			
12	Participate in flood rescue team	1	2	3	4	5	6	1	2			
13	Small business											

39. In flood season, which member of your household seeks income outside the households?

No	Household's member	Please circle ① or ②		If yes, what activities did they do? 1. go fishing, 2. collect snails, vegetables 3. agricultural labour 4. non-farm labour	Where did they do this activity? 1. in the village 2. in other districts 3. in other province
		Yes	No		
1	Head	1	2		
2	Spouse	1	2		
3	Male children	1	2		
4	Female children	1	2		
5	Parents	1	2		

40. Who often make decision on ways to live with flood in your household?
    1. spouse
    2. husband
    3. children
    4. parents
    5. Others.....

VIII. Households' assets

41. Could you please tell us about the assets that you own in your household?

No	Assets			Amount	No	Assets			Amount
		Yes	No				Yes	No	
1	Television	1	2		13	Laundry	1	2	
2	CD, DVD Disks	1	2		14	Fishing tools	1	2	
3	Mobile phone	1	2		15	Cows, buffaloes	1	2	
4	Radio	1	2		16	Pigs	1	2	
5	Motor bikes	1	2		17	Fish pond/net	1	2	
6	Bikes	1	2		18	Small business	1	2	
7	Boats	1	2		19	Pharmacy	1	2	
8	Pump machine	1	2		20	Rice dryer	1	2	
9	Rice thrashing	1	2		21	Storage	1	2	
10	Comprehensive rice trashing	1	2		22	Fan	1	2	
11	Ploughed machine	1	2		23	Electricity	1	2	
12	Fridge	1	2		24	Pipe water	1	2	

Thank you very much!

Close interview

Appendix 2. 8: An official letter from An Giang University (in Vietnamese)

This letter introduces Mr Nguyen Van Kien to local leaders of the communes, who is a permanent lecturer at Department of Rural Development and Natural Resources Management, Faculty of Agriculture and Natural Resources, An Giang University, will undertake field research at the three study sites: (1) Phu Duc commune, Tam Nong district of Dong Thap province, (2) Thanh My Tay commune, Chau Phu district of An Giang province, and (3) Trung An commune, Co Do district of Can Tho City in the Mekong River Delta.

UBND TỈNH AN GIANG
TRƯỜNG ĐẠI HỌC AN GIANG

Số: 306/12/09/GT.

CỘNG HÒA XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh phúc

Long Xuyên, ngày 14 tháng 12 năm 2009

GIẤY GIỚI THIỆU

***Kính gởi*: UBND XÃ TRUNG AN HUYỆN THỐT NỐT TP. CẦN THƠ**

TRƯỜNG ĐẠI HỌC AN GIANG GIỚI THIỆU

Đồng chí: Nguyễn Văn Kiển

Chức vụ: Giảng viên

Được cử đến: UBND xã Trung An huyện Thốt Nốt TP. Cần Thơ.

Lý do : Liên hệ thu thập số liệu phục vụ Nghiên cứu sinh.

Đề nghị quý cơ quan giúp đỡ đồng chí Nguyễn Văn Kiển hoàn thành nhiệm vụ.

TL. HIỆU TRƯỞNG
TRƯỞNG PHÒNG HCTH

TRƯỜNG ĐẠI HỌC AN GIANG

Nguyễn Công Ang

Appendix 4.1: The myth of the Water Genie and the Mountain Genie in a Vietnamese Grammar Text Book for year sixth of secondary school in Vietnam (in Vietnamese)

BỘ GIÁO DỤC VÀ ĐÀO TẠO

NGUYỄN KHẮC PHI (Tổng chủ biên) – NGUYỄN ĐÌNH CHÚ (Chủ biên phần Văn)
NGUYỄN MINH THUYẾT (Chủ biên phần Tiếng Việt) – TRẦN ĐÌNH SỬ (Chủ biên phần Tập làm văn) – BÙI MẠNH NHỊ – NGUYỄN QUANG NINH – ĐỖ NGỌC THỐNG

Ngữ văn 6

TẬP MỘT

NHÀ XUẤT BẢN GIÁO DỤC

(1)

BÀI 3

Kết quả cần đạt

- *Hiểu được nội dung, ý nghĩa, một số yếu tố nghệ thuật tiêu biểu của truyện* ***Sơn Tinh, Thuỷ Tinh****. Kể lại được câu chuyện.*
- *Hiểu thế nào là* ***nghĩa của từ*** *và nắm được một số* ***cách giải thích nghĩa của từ****.*
- *Nắm được vai trò và ý nghĩa của các yếu tố* ***sự việc và nhân vật trong văn tự sự****, chỉ ra và vận dụng các yếu tố trên khi đọc hay kể một câu chuyện.*

VĂN BẢN

SƠN TINH, THUỶ TINH[1]

(Truyền thuyết)

Hùng Vương thứ mười tám có một người con gái tên là Mị Nương, người đẹp như hoa, tính nết hiền dịu. Vua cha yêu thương nàng hết mực, muốn kén cho con một người chồng thật xứng đáng.

Một hôm có hai chàng trai đến cầu hôn[2]. Một người ở vùng núi Tản Viên[3] có tài lạ : vẫy tay về phía đông, phía đông nổi cồn bãi ; vẫy tay về phía tây, phía tây mọc lên từng dãy núi đồi. Người ta gọi chàng là Sơn Tinh. Một người ở miền biển, tài năng cũng không kém : gọi gió, gió đến ; hô mưa, mưa về. Người ta gọi chàng là Thuỷ Tinh. Một người là chúa vùng non cao, một người là chúa vùng nước thẳm, cả hai đều xứng đáng làm rể vua Hùng. Vua Hùng băn khoăn không biết nhận lời ai, từ chối ai, bèn cho mời các Lạc hầu[4] vào bàn bạc. Xong, vua phán[5] :

– Hai chàng đều vừa ý ta, nhưng ta chỉ có một người con gái, biết gả cho người nào ? Thôi thì ngày mai, ai đem sính lễ[6] đến trước, ta sẽ cho cưới con gái ta.

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(2)

Hai chàng tâu[7] hỏi đồ sính lễ cần sắm những gì, vua bảo : "Một trăm ván cơm nếp, một trăm nệp bánh chưng và voi chín ngà, gà chín cựa, ngựa chín hồng mao[8], mỗi thứ một đôi".

Hôm sau, mới tờ mờ sáng, Sơn Tinh đã đem đầy đủ lễ vật đến rước Mị Nương về núi.

Thuỷ Tinh đến sau, không lấy được vợ, đùng đùng nổi giận, đem quân đuổi theo đòi cướp Mị Nương. Thần hô mưa, gọi gió làm thành dông bão rung chuyển cả đất trời, dâng nước sông lên cuồn cuộn đánh Sơn Tinh. Nước ngập ruộng đồng, nước ngập nhà cửa, nước dâng lên lưng đồi, sườn núi, thành Phong Châu như nổi lênh bênh trên một biển nước.

Sơn Tinh không hề nao núng[9]. Thần dùng phép lạ bốc từng quả đồi, dời từng dãy núi, dựng thành luỹ đất, ngăn chặn dòng nước lũ. Nước sông dâng lên bao nhiêu, đồi núi cao lên bấy nhiêu. Hai bên đánh nhau ròng rã mấy tháng trời, cuối cùng Sơn Tinh vẫn vững vàng mà sức Thuỷ Tinh đã kiệt. Thần Nước đành rút quân.

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Từ đó, oán nặng, thù sâu, hằng năm Thuỷ Tinh làm mưa gió, bão lụt dâng nước đánh Sơn Tinh. Nhưng năm nào cũng vậy, Thần Nước đánh mỏi mệt, chán chê vẫn không thắng nổi Thần Núi để cướp Mị Nương, đành rút quân về.

(*Theo* Huỳnh Lý)

(3)

Appendix 6.1: The outcome of factor analysis for non-standardized data using SPSS soft ware

Factor matrix of household resilience, MRD, Vietnam, 2010 (five non-standardized items)

Survey items	Factor loadings			Communality
	Factor 1	Factor 2	Factor 3	
I am confident that my house will not be submerged by the highest floods in the last 20 years.	0.94			0.907
I am confident that my house will not collapse or be swept away by the highest floods in the last 20 years.	0.93			0.901
I am confident that my household has enough rice to eat during the flood season.		0.869		0.804
I am confident that my household will not need to borrow rice or money from informal sources during the flood season.		0.902		0.828
I want to learn new farming practices to cope with floods, such as fish and prawn farming.			0.999	0.999
Eigenvalues	2.33	1.10	1.00	4.43
% of variance	46.75	22.00	20.02	88.77

(1) Strongly disagree; (2) Disagree; (3) Neither agree nor disagree; (4) Agree; (5) Strongly agree.

- Selected factor having Eigenvalue greater than 1.
- Select variables with factor greater than 0.3.
- Total variance is 88.77.

Appendix 6.2: The outcome of factor analysis for non-standardized data using Mplus soft ware.

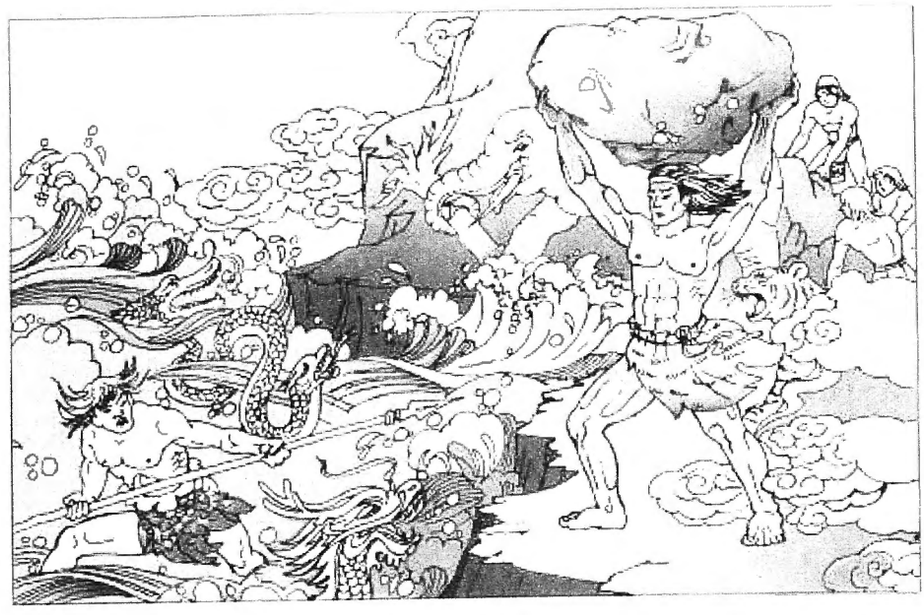
MPLUS allows conducting a factor analysis using binary variables.

TESTS OF MODEL FIT

Chi-Square Test of Model Fit

Value	48.818*
Degrees of Freedom	12
P-Value	0.0000

VARIMAX ROTATED LOADINGS			
	1	2	3
Q4201	**0.648**	0.268	0.180
Q4202	0.236	**1.129**	-0.022
Q4203	0.346	**0.702**	-0.019
Q4204	**0.952**	0.157	-0.028
Q4205	**0.871**	0.160	-0.084
Q4206	**0.356**	0.122	0.183
Q4208	**0.500**	0.193	0.180
Q4209	0.093	0.012	**0.839**
Q420100A	0.083	-0.040	**0.789**



Hai chàng tâu[7] hỏi đồ sính lễ cần sắm những gì, vua bảo : "Một trăm vản cơm nếp, một trăm nệp bánh chưng và voi chín ngà, gà chín cựa, ngựa chín hồng mao[8], mỗi thứ một đôi".

Hôm sau, mới tờ mờ sáng, Sơn Tinh đã đem đầy đủ lễ vật đến rước Mị Nương về núi.

Thuỷ Tinh đến sau, không lấy được vợ, đùng đùng nổi giận, đem quân đuổi theo đòi cướp Mị Nương. Thần hô mưa, gọi gió làm thành dông bão rung chuyển cả đất trời, dâng nước sông lên cuồn cuộn đánh Sơn Tinh. Nước ngập ruộng đồng, nước ngập nhà cửa, nước dâng lên lưng đồi, sườn núi, thành Phong Châu như nổi lênh bênh trên một biển nước.

Sơn Tinh không hề nao núng[9]. Thần dùng phép lạ bốc từng quả đồi, dời từng dãy núi, dựng thành luỹ đất, ngăn chặn dòng nước lũ. Nước sông dâng lên bao nhiêu, đồi núi cao lên bấy nhiêu. Hai bên đánh nhau tròng trã mấy tháng trời, cuối cùng Sơn Tinh vẫn vững vàng mà sức Thuỷ Tinh đã kiệt. Thần Nước đành rút quân.

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