Exploring adaptive capacity in mangrove social-ecological systems of rural Vietnam

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Abstract

Households highly dependent on mangroves for their livelihoods may face disproportionate burdens from mangrove loss and degradation, reducing their capacity respond to other changes. Livelihoods and social networks are vital components of adaptive capacity, and are shaped by institutional structures and processes at multiple governance levels. This research explores the distribution, recognition and procedural components of environmental justice in relation to adaptive capacity in mangrove social-ecological systems. Integrating livelihood, social network and institutional approaches, it draws on quantitative household surveys, and qualitative semi-structured interviews and focus groups, from three sites in northern Vietnam. Livelihood analysis reveals that high aquaculture activity is associated with uneven distribution of adaptive capacity. Female-headed households with high livelihood diversity, low income and less secure tenure rights face increasingly restricted access to mangrove goods and services. Social network analysis indicates that high levels of aquaculture are associated with lower adaptive capacity through the fragmentation of mangrove dependent communities, demonstrating that female-headed households are less recognised within mangrove management and decision making. Institutional and policy analysis illustrate that procedures reinforce the concentration of power and wealth among local elites, reducing mangrove entitlements and communities' capabilities to participate in mangrove management.

Multiple uses of mangroves in community livelihoods must be recognised in policies and projects, alongside the impacts of aquaculture on the most disadvantaged. The balance of network ties in mangrove governance network structures should be supported, allowing recognition of all groups in mangrove management and decision making. Finally, local governments should be more downwardly accountable to the communities they represent, through more transparent and democratic processes. Mangrove governance requires careful consideration of: the definition of community, gender issues, power relations, and the ability of communities to reorganise in response to change, if the already vulnerable, who contribute least to degradation, are not to be unduly burdened.

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List of abbreviations

EEF	Environmental Entitlements Framework
GDP	Gross Domestic Product
MARD	Ministry of Agriculture and Rural Development
MDG	Millennium Development Goals
MLG	Multi-level governance
MoNRE	Ministry of Natural Resources and Environment
MRDC	Mangrove resource dependent community
MSES	Mangrove social-ecological system
MSPG	Mangrove system provisioning goods
NRDC	Natural resource dependent community
SES	Social-ecological system
SLF	Sustainable livelihoods framework
SNA	Social network analysis

Chapter 1 - Introduction

1.1 Introduction

This research focuses on the livelihoods of mangrove dependent communities and the role of social networks and institutions therein, in order to improve our understanding of the environmental justice aspects of adaptive capacity in mangrove social-ecological systems (MSES). Quantitative and qualitative methods are integrated within a case study approach in order to provide a detailed analysis of three MSES in northern Vietnam. The research contributes to current academic debates surrounding environmental justice in natural resource management, and informs policy and the development of projects that aim to restore and sustainably manage mangroves. This chapter is structured in 6 sections. Following this introductory section, section 1.2 provides the research background. Section 1.3 provides an overview of mangroves including their functions and processes, related livelihood benefits, as well as a summary of global trends in mangrove coverage, drivers of change and restoration strategies. Section 1.4 introduces Vietnam as a case study country, outlining economic, social, environmental context and providing an overview of current mangrove related challenges. Section 1.5 presents the study's aim and objectives. Finally, section 1.6 presents the thesis structure and outline.

1.2 Research background

There is growing recognition of the contribution that ecosystem services provide to human well-being (MA, 2005). However, human activity impacts and shapes the capacity of ecosystems to generate such services (Folke et al., 2005). As human activities become increasingly interconnected and intensified through processes of globalisation, the capacity of ecosystems to support human well-being is being reduced at an alarming rate (Martin-Lopez et al., 2009). These concerns are accelerating within the context of global environmental issues such as climate change (IPCC, 2014) and rapid biodiversity loss (MEA, 2005). The environmental benefits and costs of certain human activities will not be shared equally (Adhikari, 2002). This is because social and environmental change alters the livelihoods, social relations and institutions which are the mechanism by which different groups come together to effectively deal with natural resource problems and dilemmas (Bodin and Crona, 2009), and hence form a vital component of how societies adapt to

change (Adger, 2003). In order to identify those groups that will be most affected by social and environmental change, it is important to understand how the ability to adapt is distributed across society, and to elucidate the processes that shape and maintain this distribution (Adhikari, 2002).

The trend of ecosystem degradation is particularly alarming in developing countries, where large sections of society depend on natural resources for their livelihoods and survival (Ellis, 2000). Those households that are more dependent on climate-sensitive natural resources for their livelihoods are more vulnerable to social and environmental change, which also undermines their ability to effectively respond to change in order to sustain their livelihoods (Adger, 2005). This raises issues of justice, as societal responses to change should ensure that undue and unfair burdens are not placed on those who are already vulnerable, as it is these households that most often have contributed least to the observed changes (Adger et al., 2006). Although there is growing interest in understanding how human activities are altering ecosystem service flows, little research has examined: which groups are being most affected; how and why they are being affected; and how the capacity to adapt to change is distributed within natural resource dependent communities (NRDC) (Carpenter et al., 2009). This research examines the livelihoods, social networks and institutions affecting mangrove resource dependent communities (MRDC) to understand how social and environmental change is shaping the environmental justice aspects of adaptive capacity within MSES of northern Vietnam.

Human-environment interactions operate as integrated social-ecological systems (SES) (Berkes and Folke, 1998) and cannot be fully understood if examined independently (Termeer et al., 2010). Whilst environmental management strategies increasingly attempt to restore and sustainably manage the natural resource base, the complex nature of SES presents a significant challenge and requires sustained and coordinated institutional responses by various stakeholders at multiple levels of governance (Halliday and Glaser, 2011). This is particularly important for biologically diverse systems such as mangroves, where human-environment interactions are little understood (Beitl, 2011). There is an urgent need for case study research in areas faced with the interconnected challenge of increased human activity and mangrove degradation in order to reconcile the goals of development and conservation (Carpenter et al., 2009). Understanding what these interactions mean for the environmental justice aspects of adaptive capacity within MSES

will inform mangrove management and institution building in order to support mangrove conservation, as well as the livelihoods and social networks of MRDC. In order to achieve this, this research uses an integrated and holistic approach, drawing on frameworks and methods applied to a case study setting to understand the social, political, institutional and environmental aspects driving livelihood change and shaping adaptive capacity. The livelihoods of MRDC are analysed by drawing on the sustainable livelihoods framework (SLF) (Scoones, 1998), social capital is examined using social network analysis (SNA) (Borgatti, 2003), and institutional analysis is informed by the environmental entitlements framework (EEF) (Leach et al., 1999). This approach provides insights into the human-environment interactions in three MSES on Vietnam's northern coast, and identifies implications for justice aspects of adaptive capacity that will be generalizable to natural resource management settings more broadly.

1.3 Mangrove overview

1.3.1 Mangrove functions and processes

Mangroves are found on tropical and sub-tropical coastlines, occupying muddy substrates in the harsh conditions at the boundary between land and sea. They are structurally and physiologically adapted to intertidal environments, thriving in areas where pure seawater is diluted by high regular rainfall, groundwater flows and rivers, deltas, estuaries, coastal lagoons and open coastlines (Spalding et al., 2010). Mangroves are rich in biodiversity and comprise a plethora of plant species, habitats and fauna (Gilman et al., 2008). Mangroves have high levels of biomass and productivity, providing an abundance of ecosystem goods and services, including: prevention of coastal erosion (Alongi, 2008); protection from typhoons and storm surges (Spalding et al., 2010); retention of river runoff sediments (FAO, 2007); provision of primary habitats for important intertidal seafood species (Hamilton, 2013); renewable timber and energy sources (Hamilton, 2013); and tourism and recreation (World Bank, 2011). Mangroves have also been shown to sequester carbon at higher rates than most other ecosystems, indicating the potential to serve as carbon sinks to mitigate climate change (Siikamäki et al. 2012). In addition to being rich stores of biomass and carbon, mangroves also support rich, diverse and complex communities, both inland and off-shore, through the exchange of nutrients and movement of species (Spalding et al., 2010). The ecosystem goods and services that mangroves provide contribute significantly

to global gross domestic product (GDP). Although there is variation in the estimated economic contribution of mangroves between studies and locations, Wells et al. (2006) estimate US$2,000 - 9,000 per hectare per year where there is wide mangrove coverage in close proximity to human settlements. Not only are mangroves valuable in their own right, research indicates that they often offer more economic value per unit area than alternative uses (Walton et al., 2006; Aburto-Oropeza et al., 2008), providing a powerful argument in favour of mangrove conservation and restoration (Spalding et al., 2010).

1.3.2 Mangrove coverage trends, drivers of change and restoration

In 2010, mangroves occupied approximately 150,000 km^2 of tropical and subtropical coastline worldwide. Although mangrove coverage amounts to only 1% of the total area of tropical forests, they are one of the most complex, productive and crucial ecosystems on Earth (FAO, 2007). Between 1980 and 2005 some 36,000 km^2, or 20% of the total mangrove area, was lost (Spalding et al., 2010). Although the rate of loss may be declining, it still remains three to four times higher than overall global forest loss, which was estimated at 0.22% per year in the 1990s, dropping to 0.18% per year in the five years to 2005 (FAO, 2006). It is important to recognise that alongside total mangrove loss, many remaining mangroves are highly degraded, and large areas of restored mangroves are of poor quality (Pendleton, 2012).

Although mangroves are naturally dynamic, showing considerable gains and losses with sediment flows, erosion and storm damage, such changes are insignificant in comparison to the impacts of human activity (FAO, 2007). While some communities use mangroves sustainably, pressure from commercial and high-intensity uses often result in degradation and loss, most notably from conversion to aquaculture, agriculture and urban development (Pendleton, 2012). Indeed, coastal zones, including areas with mangroves, are among the most densely populated in the world (Spalding et al., 2010). Commercial, large-scale aquaculture is typically undertaken in intertidal areas, and although highly productive during initial years, is highly dependent upon land modification and the application of fungicides, pesticides and antibiotics. Aquaculture also relies on tidal movements to facilitate water flush and exchange, and out-flowing water from aquaculture ponds can be highly polluting. When disease or pollution become too great to support high productivity levels, ponds are often abandoned and can only be recolonized by mangroves at

considerable effort and cost (Spalding et al., 2010). Cash crops (predominantly rice in Vietnam) are another major driver of the conversion of mangroves to agriculture, particularly in places where population pressure limits space. However, the low lying converted land is at high risk of flooding and saline intrusion, often leading to its abandonment when this occurs. The unplanned encroachment of populations and housing, and the building of industrial areas, ports and marinas further contribute to mangrove loss. Changing patterns of water and sediment flow from upstream building of roads, dykes, dams, irrigation channels and other agricultural practices are commonplace and have drastic impacts (Cahoon and Hensel, 2002). Degradation also results from over-extraction of timber, over-exploitation of fisheries, pollution and solid waste disposal (Pendleton, 2012).

A number of climate change impacts will affect mangrove systems, including: changes in sea-level, flooding, storminess, precipitation, temperature, atmospheric CO_2 concentration, ocean circulation patterns, health of functionally linked neighbouring ecosystems, and human responses to climate change (Gilman et al., 2008). Mangrove forests will respond both positively, for example through enhanced growth resulting from higher levels of CO_2 and temperature, as well as negatively, due to saline intrusion and coastal erosion (Adger et al., 2007). However, these impacts will differ geographically due to the diversity of mangrove types and their distinct characteristics (Erwin, 2009). Although the extent to which mangroves minimise the damage caused by natural hazards is debated, it is generally agreed that they will provide an effective natural buffer against the projected rise in storms, flooding, coastal erosion and strong wave action due to climate change (Mazda et al., 2006). However, the coastal location of mangroves links them intimately to changing sea levels, meaning projected sea-level rise poses the most significant climate change impact to mangroves. This is compounded by sediment surface elevations that are failing to replenish at a similar rate to rising sea levels, due to natural processes as well as human activities (Gillman et al., 2008; Adger et al., 2007).

1.3.3 Mangroves and livelihoods

Coastal communities in developing countries depend on the array of goods and services that mangroves provide. Mangroves are among the most important intertidal habitats for marine and coastal fisheries, and the invertebrates inhabiting these areas are of particular

value and gathered for subsistence and sale by local communities (Spalding et al., 2010). Mangroves also provide a nursery for young fish that migrate offshore when mature, therefore also supporting the income streams of offshore fisheries (Ronnback, 1999). As well as being used for fuel, the dense timber of mangroves is useful for construction, tool making, fishing gear, and boat building, due to its resistance to termite infestation and because it does not rot in saline waters (Spalding et al., 2010). Other mangrove uses include grazing for cattle which eat the leaves of the trees, and the leaves are also collected for compost. The communities that rely heavily on mangrove resources for their livelihoods will suffer disproportionately from their degradation and loss. The conditions that enable environmental justice (participation, access to information, self-organisation) are essential for livelihood security where people are highly dependent on mangrove resources. When livelihoods are sustainable, this can in turn help to conserve mangrove resources (Adhikari, 2002). Conflicts over the distribution of mangrove resources may occur among and between communities if these conditions are lacking. Hence, it is of vital importance for mangrove management and the environmental justice aspects of adaptive capacity that the roles and distribution of mangrove resources in coastal livelihoods are properly understood.

1.3.4 Strategies to combat mangrove degradation and loss

The importance of healthy mangroves is highlighted by failing aquaculture, the depletion of off-shore fishery stocks, and problems of coastal erosion. Subsequently, efforts have been made to restore, replant and sustainably manage mangroves, most recently due in part to their high potential for climate change mitigation linked to carbon storage (Pendleton, 2012). Although mangroves comprise relatively hardy plants that can rapidly colonise intertidal mudflats, restoration attempts face many challenges and can often fail. This is typically due to poor research and planning, with efforts focused on the wrong species or due to trees being planted in the wrong locations relative to tidal processes (Primavera and Esteban, 2008; Samson and Rollon, 2008). Restoration efforts are also often undermined by processes of large-scale coastal engineering, natural resource extraction and rapid economic development. Mangrove policies, legislation and management are typically developed at the national level, failing to recognise that MSES interactions occur on multiple scales, involving multiple stakeholders with various uses for mangroves (Blomquist, 2009). These issues pose a significant challenge in the design of institutions.

Indeed, it is increasingly being recognised that community involvement is critical for any management interventions for mangroves (Sudtongkong and Webb, 2008). This is because management issues can arise when local communities are denied access to the mangrove resources that they rely on for their livelihoods (Hue and Scott, 2008). Conservation efforts have a much greater chance of success if they are planned, designated and managed in collaboration with local communities, particularly if the benefits of such efforts are distributed equitably within the local community (O'Brien and Leichenko, 2003).

Sudtongkong and Webb (2008) argue that mangrove management which involved local communities was more successful in Thailand because: the resource was vital to local livelihoods and was becoming scarce; the communities enjoyed autonomous decision making and had a high degree of social capital; the forest and user groups were well defined and monitored; effective leadership was present in the villages to apply sanctions and resolve conflicts; and there was substantial assistance from an external non-governmental organization, which served as a bridge between the villages and the government. These aspects of success have clear links to environmental justice. Although environmental justice is concerned with the fair and equitable distribution of environmental goods and services, it is not limited to questions of distribution. For environmental justice in distribution to be sustained, the power structures that discriminate against certain groups must be challenged. Access to decision-making is vital in order to achieve equity in the distribution of mangrove benefits, and members of disadvantaged groups should be able to participate in the decisions that affect them (Adhikari, 2002). Vietnam is one country where all of the issues previously mentioned are apparent, where mangroves are declining, and where significant social and environmental change due to rapid economic growth has been experienced.

1.4 Vietnam

1.4.1 Economic context

In 1986, Vietnam initiated its transition from a highly centralised command economy to what the Vietnam government calls a 'socialist-orientated market economy', with far reaching political and economic reforms known as '*Đổi Mới*'. Reforms included: the devolution of land management from centralised collectives to households; the

decentralisation of land allocation decision making to lower levels of government; and increased market liberalisation. However, the Communist Party still retains control in the country through a one party political system. The equitable reallocation of agricultural land from cooperatives to farmer households in the initial stages of the on-going reform process has been one of the largest land titling programs in the world, contributing a solid foundation for rapid economic growth and poverty reduction (World Bank, 2012). From being characterised as a closed economic system prior to political and economic reform, Vietnam now operates in an international context. The economy has been increasingly integrated into the global system, particularly since joining the World Trade Organization in 2006. Economic growth has been rapid, with real growth in GDP of approximately 8% per year between 2005 and 2008, even though this has fallen to approximately 6% in recent years (World Bank, 2014). The share of agriculture in GDP declined from 44% in 1986 to 22% in 2008, while industry's share reached 40%, and services accounted for almost the same (World Bank, 2010). Income per capita has risen from below US$100 in 1986 to US$1,000 in 2010, resulting in Vietnam reaching the status of 'lower-middle-income country' in 2009. Although rapid economic growth has led to a sharp rise in headline inflation, this has fallen from a peak of 23% in August 2011 to about 5% in June 2014 (World Bank, 2014). Poverty levels have declined drastically since political and economic reforms, from almost 70% living under the poverty line ($2.25/person/day, PPP 2005) in 1986 to approximately 14% in 2012 (World Bank, 2014). However, despite Vietnam's transition fostering significant economic gains, there remains a set of intractable social and environmental issues, such as growing inequality, inflation, land use and unemployment (World Bank, 2014).

1.4.2 Social context

Vietnam has already attained five of its ten original Millennium Development Goal targets at the national level and is well on the way to attaining two more by 2015 (WHO, 2010). However, Vietnam ranks only 'medium' in the Human Development Index (HDI) with a score of 0.638 (Human Development Report, 2014), 10th lowest in the East Asia and Pacific region. The population of Vietnam is approximately 90 million, and although population growth is increasing at only slightly more than 1% a year (World Bank, 2011), rapid changes are observed in the location and employment of the population, with increasingly rapid urbanisation (Adger et al., 2002). Despite this shift, rural areas still account for three-

quarters of the total population, and agriculture remains the main livelihood strategy for more than half of the country's workforce and the vast majority of the poor (World Bank, 2011). Despite the equitable reallocation of agricultural land following reforms, Vietnam's land endowment is one of the world's lowest on a per capita basis with less than 0.3 hectares of agricultural land per person available (World Bank, 2011). However, fertile soils, high land use intensity, favourable climatic conditions and labour abundance allow Vietnam to currently achieve national food security (World Bank, 2011). Although Vietnam's rapid growth has occurred with only modest increases in official income inequality measures (Gini coefficient: 35.6 in 2012), inequality is an issue of increasing public concern, not only in financial terms but also in terms of opportunity, and public concern is also increasing over land use, corruption and environmental degradation (World Bank, 2014).

1.4.3 Environmental context

Vietnam's economic growth has been largely fuelled by intense exploitation of natural resources. Land use has intensified, water resources are increasingly exploited, natural forests are being extensively logged, capture fishery resources are over-exploited and mineral resources are increasingly extracted (World Bank, 2011). As competition for these scarce resources intensifies, the occurrence of and potential for conflict has been increasing. In addition, environmental degradation through pollution from industrial waste is a major concern. Hence, even though there have been economic benefits from political and economic reforms, many of the costs are 'hidden' in the form of reductions in environmental quality and losses of ecosystem productivity, with negative knock-on effects for human well-being adding to growing social unrest.

Vietnam has a significant natural resource base in its coastal areas which has made it an attractive area for development, attracting huge levels of investment and subsequent increases in population density (Powell et al., 2011). There has been a rapid increase in activities such as deforestation, dike and dam development, coastal transformation to agriculture, and industrial and domestic pollution, causing changes in the supply and distribution of water, sediments, and nutrients and resulting in negative impacts on the quality of the coastal marine environment (Thanh et al., 2004). Subsequently, Vietnam has lost 69% of its 269,000 ha of mangrove forests held in 1980, and it has been estimated that 77% of this loss is due to aquaculture (Hamilton, 2013). In addition to mangrove forest loss,

aquaculture has contributed to numerous other socio-economic and environmental issues such as pollution, saline water intrusion, changes in resource access, land use conflicts and changing livelihood opportunities for households within mangrove dependent communities (Lebel et al., 2002; Joffre and Schmitt, 2010; Orchard et al., 2014). Many coastal communities of Vietnam depend on the ecosystem services mangroves provide for their livelihoods, yet aquaculture can render mangrove systems unable to provide these services. While the new and changing uses of mangroves have been profitable in an economic sense, there has been as consequential increase in the unpredictability of serious coastal problems such as flooding, erosion, salt-water intrusion, and ecosystem degradation that has exacerbated vulnerability to the impacts of climate variability and change (Tri et al., 2004). It should be noted, however, that not all of these problems are solely due to actions within Vietnam, with a number of upstream nations across the south-east Asia region compounding the problem through their catchment and coastal management decisions (Thanh et al., 2004).

According to climate model projections, Vietnam will be one of the countries most severely affected by the impacts of climate change due to its extensive coastline (over 3,200 km), high dependence on agriculture, and relatively low levels of rural development (McElwee, 2010; IPCC, 2007). Since 1950, Vietnam has observed a 0.7°C rise in average temperature, higher frequency and intensity of typhoon and flooding seasons, sea-level rise of 20 cm, the occurrence of droughts in areas which had not previously experienced them, increased incidences of heavy rainfall, and storms tracking into new coastal areas (Carew-Reid, 2008). Vietnam is also particularly vulnerable to the impacts of sea-level rise, being the second most affected country in the world, and the most affected in East Asia (Dasgupta et al., 2009). For example, for a 1 m rise in sea level, 5000 km^2 of the Red River delta is projected to be flooded (IPCC, 2007). In addition, 2,500 km^2 of mangrove will be completely lost, while approximately 1,000 km^2 of cultivated farm land and sea product culturing area will become salt marshes (Tran et al., 2005). This decline has slowed in recent years due to large scale mangrove restoration and rehabilitation projects, partly in response to the devastating impact of the Asian Tsunami in 2004, and also for the natural buffer they provide against other hazardous weather events which are projected to increase with climate change (Osbeck et al., 2011). Although mangrove restoration and rehabilitation has been ongoing since 1991, the process of decline was only reversed in 2001 (Powell et al., 2011). In addition, increases of 15,000 ha of mangrove forest by 2008

are somewhat paltry when compared to the 50,000 ha that have been planted, suggesting that poor project management and encroachment into existing mangrove areas is on ongoing problem (Yu et al., 2010).

1.4.4 Building adaptive capacity

The uncertain nature of rapid MSES change, particularly the provision of mangrove goods and services that form a crucial component of MRDC livelihoods, necessitates the building of adaptive capacity to respond to such changes. MRDC adapt to MSES change through their livelihoods and social networks, which are shaped by institutional factors occurring at multiple levels of MSES governance. Hence, institutions shape the ability of different groups within communities to access the necessary resources to respond to MSES change, and also the structure and function of community networks that shape the ability of communities to self-organise in response to MSES change. Environmental justice comprises: (1) the distribution of environmental goods and bads; (2) the level of recognition certain groups command within governance structures; and, (3) the procedures that shape both distribution and recognition (Schlosberg, 2007). Hence, the distribution of mangrove goods and services among households in MRDC, and the level of recognition that certain groups have within the networks of MSES governance, is shaped by institutional processes and procedures occurring at multiple levels of MSES governance. It is vital that these issues are fully understood in order to ensure that those that are already vulnerable are not unfairly and unduly burdened with the negative impacts of MSES change. This is especially important as it is these groups that have contributed the least to such changes. Vietnam provides a highly relevant context for this research, having experienced rapid change in its MSES following political and economic reforms that will have significant implications for the environmental justice aspects of adaptive capacity within MSES.

1.5 Aim and objectives of the thesis

1.5.1 Aim

The overall aim of this thesis is to explore how MSES change has influenced the environmental justice aspects of adaptive capacity in northern Vietnam. In order to determine the distribution of and processes that shape adaptive capacity within the MSES,

an environmental justice lens is applied which considers livelihoods (the distribution of ecosystem services), social capital (the influence of social networks on recognition), and institutions (the procedures of MSES governance).

1.5.2 Objectives

The research aim is achieved through pursuit of the following objectives:

1. Analyse local livelihoods to assess the distribution of mangrove system provisioning goods (MSPG) within the MSES.
    a. *What are the key aspects of MSES change?*
    b. *What range of livelihood strategies/activities are MSES dependent households engaged in?*
    c. *Are there specific household characteristics related to differing levels of MSPG dependence?*
    d. *What factors have influenced the livelihood trajectories of MSES dependent households?*

2. Assess the impacts of key aspects of MSES change (i.e. aquaculture) on social capital.
    a. *Is there an association between different levels of aquaculture activity and livelihood characteristics at the community level?*
    b. *Is there an association between different levels of aquaculture activity and social network characteristics at the community level?*
    c. *Do livelihood characteristics influence the structure of household social networks within communities where there are differing levels of aquaculture activity?*

3. Explore how institutions and processes occurring at multiple levels of MSES governance shape local level entitlements to MSPG.
    a. *What are the current formal and informal institutions relating to MSES governance?*
    b. *What is the role of state, private sector and NGO actors in shaping household entitlements to MSPG?*
    c. *What institutional factors have influenced the capabilities of MSES dependent households?*

1.6 Thesis structure and outline

This thesis is structured in 8 chapters. Chapter 1 has provided important background context and an overview of both mangroves and the study country, Vietnam. In chapter 2, literature that informed the development of the study is unpacked. Concepts of sustainable livelihoods, institutions and social capital are discussed in relation to the key literature on

adaptive capacity that informed the research objectives. Chapter 3 presents an overview of the research design and methodology, outlining the research approach taken and the study site selection process. Data collection and analysis methods are explained, along with considerations relating to researcher positionality, ethical issues and working with interpreters. Results are presented in chapters 4 to 6. Chapter 4 presents empirical evidence linked to objective 1 and discusses the implications of political and economic transition for the livelihoods of mangrove dependent communities. The interdependencies of changes in relationships between human activity and mangrove ecosystem services are elucidated through focus on livelihood strategies and trajectories. In chapter 5, the impact of aquaculture on the social networks of mangrove dependent communities is explored, in line with objective 2. This is achieved by analysing the relationship between livelihood diversity and social network measures in the three studied communities, each with different intensities of aquaculture activity. The influence of multi-level governance processes on local level entitlements to mangrove system provisioning goods (MSPG) following political and economic reforms are discussed in chapter 6. Here, environmental entitlements are considered within the prevailing formal and informal institutional arrangements. This allows achievement of objective 3. Chapter 7 brings together the main findings from the results chapters to consider them with regards to the environmental justice aspects of adaptive capacity in MSES. In particular, it considers the distribution, recognition, and procedures that shape adaptive capacity of Vietnam's MSES, and seeks to inform mangrove policy and development projects that aim to restore and sustainably manage mangroves. Chapter 8 sets out the conclusions from the research, explores the wider applicability of the findings and the contribution made to knowledge. It discusses the implications of the findings for natural resource management more broadly, and suggests potential avenues for future research.

Chapter 2 - Literature review

2.1 Introduction

Urgent action is required not only to manage the potentially catastrophic effects of rapid SES change, but also the unavoidable effects of changes to which society and the environment are committed (Adger et al., 2006). SES changes, and responses to them, will inevitably create winners as well as losers (O'Brien and Leichenko, 2003). With regard to those communities that are highly dependent on natural resources for their livelihoods, it is crucial that responses recognise how adaptive capacity is distributed within SES, and who is already vulnerable, in order to ensure that undue and unfair burdens are not being placed on them (Schlosberg, 2013). This is especially important as these communities have often contributed least to the changes that threaten their livelihoods (Adger et al., 2006). The capacity of households and communities to adapt to SES change is nevertheless little understood, and has hitherto failed to receive significant research attention (Engle, 2011). This chapter presents a critical analysis of the main concepts and theories surrounding adaptive capacity, drawing on the natural resource management and environmental justice literatures, both of which integrate social and environmental issues. Livelihoods, social capital, and institutional approaches have been applied within these bodies of literature in order to study complex SES. These approaches are presented and integrated in order to: address some of the criticisms and limitations of each approach; inform and guide the current study; and, gain insights into current knowledge on the adaptive capacity of SES. It will be argued that integrating these approaches allows us to understand the distribution, recognition and procedural aspects of environmental justice and how these affect adaptive capacity in SES. Advancing understanding in this area is vital for ensuring that the already vulnerable are not unduly burdened with the effects of SES change. Such insights will contribute knowledge to the under-researched area of how adaptive capacity is distributed within households and communities in SES, and also considers the processes that create and maintain these distributions.

In what follows, section 2.2 provides important background information on the concepts and current state-of-the-art in the key academic areas relating to adaptive capacity. It also defines the concepts of vulnerability and resilience within SES. Section 2.3 presents a critical overview of the current knowledge base pertaining to adaptive capacity, arguing that SES are subject to multiple stressors and recognising that context shapes

adaptive capacity. Section 2.4 introduces and critiques the environmental justice literature, outlining distributive, recognition and procedural components and how they shape adaptive capacity within SES. Sections 2.5, 2.6 and 2.7 present a framework for analysing adaptive capacity through an environmental justice lens, which is then used to guide the research. Livelihoods (providing insight into distributional justice), social capital (used to shed light on recognition justice) and institutional approaches (shaping procedural justice) are integrated to provide new insight into the justice and equity of adaptive capacity. Finally, section 2.8 summarises the chapter and outlines the academic contribution of the thesis. It demonstrates that by adopting an integrative stance, it is possible to advance understanding of the processes and outcomes that underpin the justice of adaptive capacity, and so contribute to new understandings of the factors that facilitate or hinder its development.

2.2 Social-ecological systems

Consideration of social and environmental factors as distinct entities is inadequate to steer society towards sustainable outcomes (Folke et al. 2005). For example, focussing only on socially and economically desirable outcomes can lead to over exploitation of natural resources, while concentrating only on ecological aspects in decision making can lead to socially inequitable solutions. The concept of SES illustrates the integrated nature of human-environment relations (Berkes and Folke, 1998). SES are defined as "…*a bio-geophysical unit with its associated social factors and institutions, which are complex and delimitated by spatial and functional boundaries surrounding particular ecosystems and their problem context*" (Glaser et al., 2008: 77). SES are dynamic and complex adaptive systems, operating between and among multiple levels, and displaying strong reciprocal feedbacks in their provision of goods and services to society (Folke et al. 2004; Binder et al., 2013). The environmental aspects of SES comprise distinct components, processes and uses of natural resources (Poteete, 2012). Indeed, human well-being depends on the goods and services that ecosystems provide, and are a dominant component of the livelihoods of NRDC. The harvesting of ecosystem goods such as wild food, fodder and fuel sources provides a high proportion of poor households' total income and subsistence, and is of particular importance during periods of hardship due to shortfalls in other livelihood sources (Debela et al., 2012). The harmful effects of ecosystem mismanagement and degradation threaten the livelihoods and survival of those dependent on natural resources (MEA, 2005). The relationships between ecosystem services and human well-being are

arbitrated partly through access to social capital in ways that remain contested and little understood (Adger, 2003). Social capital, in the form of networks, facilitates the ability of communities to organise and manage ecosystem services, both exploiting them and protecting them from degradation. Social capital also underpins social relationships of trust and shared understandings of environmental issues that are required to sustain local livelihoods (Pelling and High, 2005; Pretty and Ward, 2005). Hence, SES operating between and among multiple levels include mutually-interacting human and biophysical components.

Social, economic and environmental changes pose significant challenges to the management of SES (Colding et al., 1998). Changes can occur in the form of shocks and/or stresses (Gallopin, 2006); both of which are considered in this research. Shocks are major spikes in pressures (e.g. extreme weather events, earthquakes, disease outbreaks, social unrest, economic volatility) that typically originate externally to a system and breach the normal range of variability within which a system operates. Stresses are continuous or slowly increasing pressures (e.g. natural resource degradation, erosion of yields due to degradation, urbanisation, demographic change, climate change, political and economic change and instability) commonly originating within a system. For simplicity, the term SES change is employed throughout this thesis to denote both the shocks and stresses that interact with SES with the potential of inducing harm to the system, be it slow or sudden. The ability of a SES to respond to change is shaped by both its vulnerability and resilience. The MSES of Vietnam present an ideal opportunity to study a SES that forms a vital component of coastal livelihoods, and which has undergone rapid change in recent decades.

2.2.1 Vulnerability

The vulnerability of any system is a function of its exposure to disturbance, its sensitivity to that disturbance, and its capacity to respond (Gallopin, 2006). Exposure refers to the degree, duration and/or extent that the system is in contact with, or subject to, the disturbance. Sensitivity is an attribute separate to exposure that exists prior to disturbance, and refers to the susceptibility of a system to experience harm through the degree to which the system is modified or affected by disturbance. Capacity to respond also exists prior to disturbance and refers to the system's ability to adjust to a disturbance, moderate

potential damage, take advantage of opportunities, and cope with the consequences (Gallopin, 2006).

Assessments of vulnerability suggest that it is unevenly distributed across society due to political, economic and social processes (Ayers and Dodman, 2010), and that groups that are already marginalised will bear the greatest burden of SES change (Leary et al., 2008). Furthermore, socio-economic, demographic, cultural, political and institutional processes can exacerbate vulnerability (Adger, 1998; Cutter et al., 2003). For example, recent research from the Limpopo Basin, Botswana, has shown how ill-informed social, economic and political policies can erode social capital and consequently amplify vulnerability through reduced recognition and alienation of certain groups from decision making. This generated dependency on the state, increased poverty, and reduced capacity to adapt (Dube and Sekhwela, 2008). Past social, ecological, economic and political aspects shape the current vulnerability of particular groups of people. Analysing how people have managed past SES change, particularly through their livelihoods, helps us better understand the construction of vulnerability in preparing for the future (Garcia-Acosta, 2002; Hilhorst and Bankoff, 2004). A large proportion of the rural population in Vietnam live on the coast that exhibit: exposure to highly variable environmental conditions including storms and sea-level rise; and relatively low levels of development and high dependence on climate sensitive natural resources. The combination of exposure, sensitivity and low capacity to respond make these communities particularly vulnerable to SES change.

There are a number of critiques of the vulnerability approach that are worthy of exploration. There may be negative consequences when researchers and practitioners label people or communities as vulnerable, rather than focussing on their adaptive capacity and capabilities. The demeaning nature of highlighting negative attributes has been argued to lower motivations to develop sustainably (Engle, 2011). Further limitations of how vulnerability is understood, particularly concerning livelihood approaches and their concern for vulnerability to poverty, include a neglect of power relations and the links between social and environmental dynamics, and a narrow focus on the short-term and local scale (de Haan and Zoomers 2005; Scoones 2009). Household responses to SES change are made in the context of competing social, economic and environmental objectives, opportunities and limitations that change over time. The resources required to reduce household

vulnerability (physical, financial, social, natural and human assets) are bound by power relations that play a major role in inducing poverty and inequalities in the distribution of resources. This highlights the close link between a household's vulnerability and its history that is often overlooked in vulnerability research. Most vulnerability studies pay scant attention to these more structural features and focus on material issues (Scoones, 2009). The snap-shot view can also overlook long-run, slow variables that structure the dynamics of the SES and operate at larger spatio-temporal scales (e.g. long-standing institutions, or values within a system) (Plummer and Armitage, 2007). Concerns also arise when vulnerability research focusses on poverty reduction for present populations, with less recognition given to future generations and longer-term social and environmental considerations. The resilience literature goes some way to addressing these limitations. Resilience recognises the interdependence of social and ecological systems, acknowledging the interactions between slow and fast moving variables that occur between and among scales (Folke et al., 2002). The central concern of resilience is with sustaining and building life support systems, and the capacity for natural systems to provide for livelihoods into the future (Scoones, 2009). Resilience is further examined in the next section.

2.2.2 Resilience

The concept of resilience originates in ecology (Folke, 2006). After studying the relationships between species, Holling (1973) concluded that ecosystems do not operate in an equilibrium state. Instead, species and ecosystems are complex systems pursuing multiple patterns within theoretical boundaries (or domains of attraction) that, once breached, can tip systems into a different state. Therefore, ecosystem resilience can be said to represent the ability of a system to fluctuate within the domain of attraction, and the magnitude of disturbance that can be absorbed without the system being tipped outside this domain, changing the structure, variables and processes that control its behaviour (Gunderson, 2000). The idea of multiple stable states in ecosystem resilience presents ecosystems as constantly stressed and changing systems (Engle, 2011). This understanding of resilience diverges from engineering resilience, where the term is used to describe the ability of and time taken by materials to bounce back after shocks and resume a certain original state (Pimm, 1984). The focus in engineering resilience is on efficiency, control and predictability, while ecological resilience considers adaptiveness, variability and unpredictability (Nyamwanza, 2012). More recently, resilience research has increasingly incorporated social dimensions and acknowledges the urgent challenges facing SES

resulting from increased human activity (Carpenter and Brock, 2008; Pahl-Wostl, 2009). In light of recent recognition and integration of social dimensions, resilience is defined in this study as *"….the capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation*" (IPCC, 2014). The SES literature considers adaptive capacity to be a positive component of SES resilience, referring to the capacities of actors in the system to manage and influence resilience through interactions between human and environmental components of the system (Walker et al., 2006). Hence, the greater the adaptive capacity of a system, the greater likelihood the system will be resilient (Engle, 2011).

The institutions and processes through which SES are managed influence household level resilience by shaping access to the resources required to buffer and respond to disturbance (Walker et al., 2006). Institutions and processes are linked across and within levels, and the dynamics of a system at one level cannot be fully understood without due consideration of the dynamics of other levels in which it is embedded (Gunderson and Holling, 2002). It is necessary to understand these dynamics within SES in order to understand how resilience is built and eroded (Turner et al., 2003). This is also important when considering how institutions and processes, occurring at higher levels of governance, shape household resilience to disturbance through the distribution of adaptive capacity (e.g. via access to the ecosystem services used to respond and buffer households from SES change). Governance processes must be flexible enough to manage these challenges (Garmestani and Benson, 2013). Flexibility is important because it can accommodate the uncertainties of complex SES dynamics by: reducing the fragile rigidities associated with systems that focus on economic growth and efficiency; and providing SES with a wider range of options to buffer, absorb and self-organise in response to change (Garmestani and Benson, 2013). Governance institutions can manage SES and interactions in such a way that either maintains the system's state (status quo), or facilitates transitions and transformations (Folke et al., 2006). Transitions represent incremental SES changes within the existing domain of attraction, while transformation describes a move to a new system state when the current state becomes undesirable (Pelling, 2011). Vietnam has a long history of preparedness for, and active response to, natural disasters. Early warning systems, extensive dike and sea walls systems, effective house construction, land use

planning and mangrove planting are all evidence that citizens and leaders over the centuries have recognized the country's vulnerability to the consequences of typhoons and other tropical storms. However, the rapid rate of MSES change threatens to reduce resilience, as mangrove systems that buffer coastal communities from climatic events and provide provisioning goods to respond to MSES change are degraded and lost at an alarming rate.

Criticisms of the resilience concept argue that more attention has been paid to the ecological components of SES (Fraser, 2003), overlooking issues of power (Armitage and Johnson 2006; Nadasdy 2007; Duit, Eckerberg et al. 2010). This is important because power is a vital aspect regarding the processes that shape environmental justice and the distribution of adaptive capacity within SES (Ernstson, 2013). The resilience literature also often fails to consider that a resilient SES does not always equate with a socially-preferred ecological or socio-economic state; nor does it give explicit recognition to the power dynamics of who gets to decide what the desirable state is (Armitage, Béné et al. 2012). For example, in Vietnam, the transformation from a command and control economy to a more market-orientated system has been implemented in such a way that the state retains control in deciding the desirable state. This will have implications for the resilience of Vietnam's SES and the distribution of adaptive capacity at the local level. Furthermore, the resilience of a particular resource within a SES may be desirable, but lead to a loss of general resilience of the whole SES in which the resource is only one part (Folke et al., 2010). These conceptual challenges raise two key issues (Armitage et al., 2012): (1) resilience is often interpreted as a "good" thing when it is merely a concept; (2) lack of acknowledgement of social values that determine a desirable SES state leads to an uneasy fit with the social world. These issues are grappled with in this research which integrates livelihood, social network and institutional analysis to support a richer and more balanced understanding of vulnerability and resilience in the analysis of adaptive capacity in SES. By engaging with power dynamics it introduces a justice lens to the analysis of SES change and adaptive capacity.

Vulnerability and resilience are often depicted as being opposite sides of the same coin, but this is not often the case. Although a resilient system will be less vulnerable overall, a resilient system may still contain vulnerable components, and a vulnerable system may or may not be resilient (Gallopin, 2006). This is partly because, unlike

vulnerability, resilience does not explicitly consider exposure, but rather refers to the response of the system when it is exposed to change. Holling (1973) suggests that a history of past exposures may be important in building system resilience, while Levin et al (1998) state that "…*every natural system is subject to regular disturbance; those that have survived, indeed must have built up some degree of resilience*" (p228). For example, a household's livelihood may have low vulnerability due to a coastal dike providing protection and reduced levels of exposure and sensitivity to change, but at the same time they may lack experience in responding to and learning from change. Therefore the household may have limited flexibility and diversity of options to respond when the thresholds of the dike are breached.

Vulnerability approaches typically assess the effects on society of a particular disturbance at a single spatial scale (Vincent, 2007), providing a 'snapshot' in time (Engle, 2011). Conversely, resilience approaches tend to focus on multiple disturbances and their interactions, processes and feedbacks that influence SES (Nelson et al., 2007). Hence, when applied independently, vulnerability and resilience frameworks are inadequate for analysing changes and responses. Consequently, in this research, focus is instead placed on adaptive capacity. Adaptive capacity incorporates considerations of both vulnerability and resilience, being a key positive system attribute within both (i.e. increased adaptive capacity will both reduce vulnerability and increase resilience) (Gupta et al., 2010; Engle, 2011; Berman et al., 2012). Harnessing vulnerability and resilience perspectives through studies of adaptive capacity provides the opportunity to consider both more socially focussed, short-term issues at the local level, and broader, longer-term ecosystem processes. Doing so provides a deeper and richer analysis of SES, the shocks and stresses they face, and the responses that are taken in order to deal with change.

2.3 Adaptive capacity

2.3.1 Current state of knowledge on adaptive capacity

This research takes as its starting point two main aspects regarding adaptive capacity. First, adaptive capacity refers to the ability of a SES to mobilise resources in order to manage disturbance (Engle, 2011; Stringer et al., 2009). Second, the potential for NRDC to access the resources necessary to manage disturbance is shaped by the distribution of adaptive capacity within SES (Smit and Wandel, 2006). It is important to understand the factors that

affect resource access and the distribution of adaptive capacity within SES (Adger et al., 2009; Engle, 2011), such that communities can manage, and even harness benefits from changes, and ultimately reduce their vulnerability and enhance their resilience. This is crucial when considering that the burden of SES changes and responses to those changes should not be unduly placed on those who are already vulnerable (Schlosberg, 2013).

Much debate surrounds the precise definition and practical application of the term adaptive capacity (Jones et al., 2010). The Intergovernmental Panel on Climate Change 4th Assessment Report (IPCC, 2007: 869) defines adaptive capacity as: "…*the ability of a system to adjust to climate change (including variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences*". However, the focus on climate change in much of the adaptive capacity literature has been criticised for being too restrictive. In managing wider problems concerning the dynamics of SES, broader social, political, economic and environmental drivers of change need to be considered (Gallopin, 2006). It is not only climate change but rather, multiple stressors that are impacting SES. Hence, adaptive capacity from a SES perspective concerns *"…the ability of a SES to cope with novel situations without losing options for the future*" (Folke et al., 2002: 17). However, it is important at this point to distinguish between adaptive capacity and coping capacity, as the two concepts differ significantly and can have serious repercussions for vulnerability and resilience. Coping capacity refers to the ability of actors to draw on available skills, resources and experiences as an immediate response to disturbance (i.e. short-term survival) which can erode resources and increase vulnerability to future disturbances. Adaptive capacity, on the other hand, refers to the ability of actors to prepare in advance for disturbance and to adjust, respond and adapt to the effects (i.e. long-term sustainable adjustments) that can increase resilience to future disturbance (Engle, 2011; Berman et al, 2012). Hence, this research explores the distribution of household and community adaptive capacity within SES in order to ascertain whether already vulnerable households possess the ability to adapt to change, or if they will be forced to draw on the limited resources available to them in order to cope with disturbance in a way that will amplify their vulnerability. In doing so, it not only provides insights into who does and does not possess adaptive capacity and how the distributions of adaptive capacity at the time of the research emerged, but also seeks to advance understanding of the processes that led to those distributions.

Adaptive capacity is considered a function of socio-economic factors that shape wealth, technology, education, information, skills, infrastructure, access to resources, social networks and management capabilities (McCarthy et al., 2001: Smit and Wandel, 2006). Hence, there are clear links between analysis of the adaptive capacity of a particular SES and the wider development context and processes within which it is embedded (Jones et al., 2010). It has been argued that the broad factors that shape adaptive capacity are not substitutable, and a system will only display as much adaptive capacity as its 'weakest link' (Yohe and Tol, 2002). Therefore, adaptive capacity will vary between different contexts and systems. Many commentators argue that adaptive capacity is unevenly distributed among and within societies due to the institutions and processes of SES governance (Smit and Wandel, 2006; Adger et al., 2007). This highlights the importance of understanding the roles of governance and institutions in determining the balance of winners and losers. As such, it is important that research focuses on a range of different development contexts across the world to better understand distributions of adaptive capacity but also the processes that shape those distributions. The present research focuses on Vietnam, providing insights into adaptive capacity in the context of a rapidly growing and changing economy; a context with which few other studies of adaptive capacity have engaged.

Plummer and Armitage (2010: 6) extend the concept of adaptive capacity to integrate considerations of the institutional dynamics of SES governance, stating "…*adaptive capacity is determined by the suite of resources (technical, financial, social, institutional, political) held, and the social processes and structures through which they are employed and mediated (i.e., governance)"*. The socio-economic and institutional factors that shape adaptive capacity (outlined above) should not be thought of as operating independently of one another (Adger, 2006). It is the institutions that shape the interaction of these spatially and temporally dynamic determinants, operating at various scales and levels, and functioning differently in a given context, that generate adaptive capacity (Smit and Wandel, 2006). For example, national level measurements may be of use in determining broad and generic indicators of adaptive capacity (e.g. wealth, health, education etc.). However, focus on the national level can mask sub-national inequities and fail to capture many of the processes and contextual factors that influence a household's or individual's adaptive capacity (e.g. gender, property rights, wealth etc) (Eriksen and Kelly, 2007). This study addresses this issue by providing a multi-level analysis of the institutions and processes of mangrove SES governance in Vietnam that shape the distribution of adaptive

capacity at the local level. Focus on the local context is important because it is the site at which adaptation will largely take place (Eriksen and Kelly, 2007).

Two limitations of current conceptualisations of adaptive capacity have been identified in the literature. First, the latent nature of adaptive capacity makes it challenging to observe and measure until it is realised through concrete adaptations (Lemos, 2007). Adaptation and adaptive capacity are not interchangeable concepts: adaptations are specific manifestations of inherent adaptive capacity (Smit and Wandel, 2006). This research assesses the current livelihood context of households, and analyses the livelihood responses of households to past SES change, and the outcomes of these, in order to better understand the processes that shape the environmental justice aspects of adaptive capacity in MSES. Second, assessing the distribution of adaptive capacity between and among different locations is difficult, especially considering its latent nature. This limits the comparability of studies across different locations. The literature tends to rely on aggregate indices of the theoretical determinants of adaptive capacity for its assessment (Brooks et al., 2005). This is because aggregate, quantitative assessments of adaptive capacity provide a helpful and easy way to apply and translate findings and recommendations to policy makers (Nelson et al., 2007). However, these studies fail to consider the context specific and dynamic nature of adaptive capacity that is not easily generalizable (Engle, 2011). This research uses livelihoods, social capital and institutional approaches to assess adaptive capacity within the context of MSES of northern Vietnam. Not only does this contribute local level analyses of adaptive capacity in an understudied context of a rapidly growing economy undergoing significant change, it addresses a gap in the adaptive capacity literature concerning the distribution of adaptive capacity within SES, who has/does not have adaptive capacity, and the institutions and processes that shape those distributions of adaptive capacity. To do this, it examines adaptive capacity through an environmental justice lens, which includes consideration of recognition and procedural justice in order to understand the distribution of adaptive capacity in SES.

Integrating analyses of livelihoods linked to distributional justice, social capital linked to recognition justice, and institutions linked to procedural justice allows us to understand the different components of the environmental justice aspects of adaptive capacity that can apply to any SES (Figure 2.1).

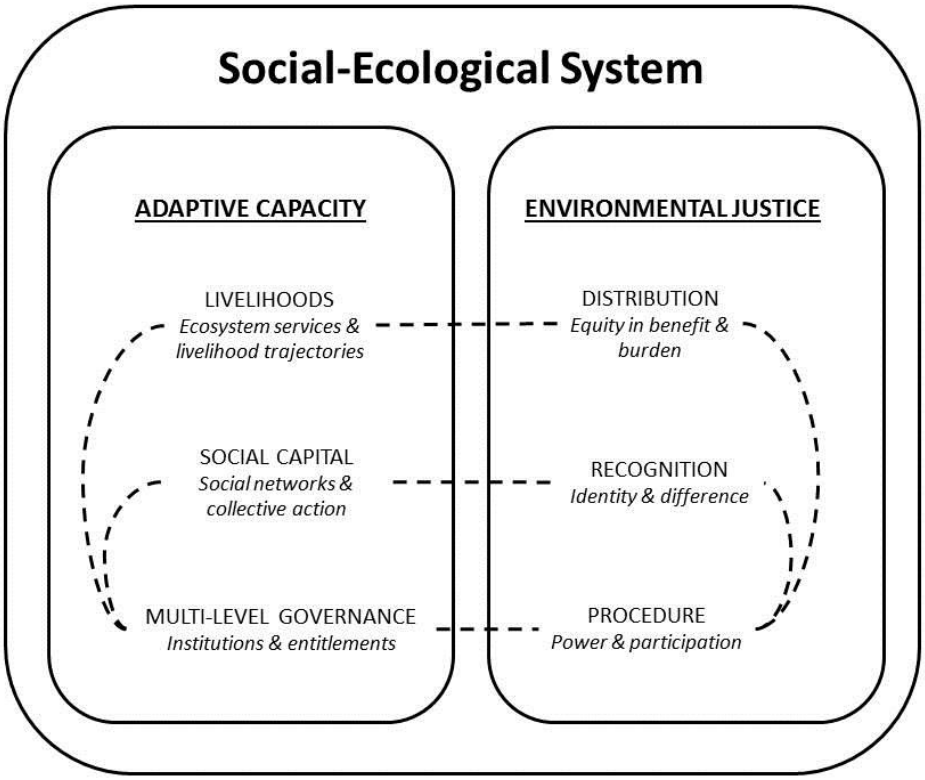

Figure 2.1: Framework for analysing the social component of social-ecological systems

Livelihoods form a crucial component of adaptive capacity. NRDC rely on ecosystem goods to support their livelihoods and respond to change, and the ability of households to access ecosystem goods shapes their adaptive capacity. SES change alters household access to ecosystem goods and the distribution of adaptive capacity. Those already lacking access to the resources necessary to respond to SES change will be unduly burdened with the negative effects of SES change. This links to the distributional component of environmental justice which is concerned with the equity of benefit and burden sharing of environmental change. Using ecosystem service and livelihood trajectory approaches to assess the effects of SES change provides insights into distributional justice and what this means for adaptive capacity.

Social capital is a crucial component of adaptive capacity through the features of social networks that facilitate collective action. NRDC rely on social networks to access information regarding the mangrove system resources necessary to support their livelihoods in response to change. Those more affiliated to MSES governance networks are more able to access information, shaping the distribution of adaptive capacity. Changing networks alters the affiliation of different groups within governance networks. This links

with the recognition component of environmental justice, concerned with the affiliation of certain groups based on identity and difference. Using social network analysis to assess the impact of SES change on social networks provides insights into recognition justice and what this means for adaptive capacity.

Governance encapsulates livelihoods and social capital, and constitutes the institutional structures and processes within societies that distribute adaptive capacity. Governance decisions and actions interact with environmental processes, and are shaped by institutions at multiple levels. Institutions structure and differentiate ecosystem system entitlements, i.e. the ability of households to gain legitimate access to the ecosystem goods necessary to support livelihoods and to respond to SES change. This links to the procedural component of environmental justice, which is concerned with participation in the institutional processes that allocate resources in order to achieve equitable distribution and recognition. Using institution and entitlement approaches to assess the effects of SES change provides insights into the procedural component of environmental justice and what this means for adaptive capacity.

2.4 Environmental justice

2.4.1 Background to environmental justice

The environmental justice movement can be traced back to the 1982 protests in the USA against the disposal of toxic waste in the poor, majority African-American, community of Warren County, North Carolina (Lee, 1992). This highlighted a concern that minority and low income groups were facing disproportionately higher environmental risks than other more well-off groups, and that this was linked to other social and economic injustices that marginalised communities face (Schlosberg, 2003). This 'first-generation' of environmental justice research challenged conventional conceptions of environmentalism (Martin et al., 2013). It highlighted the limitations of conceiving the environment as 'wilderness', or nature detached from everyday life (Schlosberg and Collins, 2014), by defining the environment much more broadly as where we live, work, and play (Novotny, 2000). This expanded environmentalism into concerns about the relationship between the conditions of everyday life and the natural world (Schlosberg and Collins, 2014). In recent decades environmental justice has extended its influence not only globally in terms of new places and spatial analysis from local to global (Sze and London, 2008), but also into a growing

range of environmental issues such as land use, access to natural resources, food security and climate change (Schlosberg, 2013). Attention has been increasingly given to other forms of social difference, including poverty, age, disability and gender (Walker, 2009). Schlosberg (2013) goes even further by extending the discourse of environmental justice beyond individual human beings and into considerations of community-level justice, as well as justice beyond the human and into the non-human realm. These recent developments have broadened the scope and understanding of what environmental justice constitutes (Walker and Bulkeley, 2006), and provide a useful grounding to the study of SES because of the inherent links between social and ecological aspects.

Alongside the broadening scope of the environmental component of environmental justice has been a reflection on our understanding of what constitutes justice (Schlosberg, 2013). Walker (2009) argues that much "first-generation" environmental justice research has been too narrowly focused on the distributional aspects of environmental risk. Schlosberg (2003) claims this to be problematic as it can mask the structural causes of inequities in distribution. A broadened understanding of environmental justice in different contexts means that simplistic, distributional analyses are insufficient and inadequate (Martin et al., 2013). What is required is a move away from simply describing and documenting inequity, into a richer, multidimensional understanding of the underlying processes that shape, sustain and reproduce inequalities (Schlosberg, 2007). Walker (2009) integrates theoretical perspectives of justice to demonstrate how distribution, recognition and procedure are core components of environmental justice and can help us to understand the processes underlying distribution. Each of these components will now be discussed to demonstrate how they represent a move away from simple descriptions of inequity into a thorough analysis of the underlying reasons for that injustice (Schlosberg, 2013). Analysing adaptive capacity through an environmental justice lens allows us not only to uncover the processes that shape the distribution of adaptive capacity, but also to understand who, how and why some people gain from SES change while others lose.

2.4.2 Distributive justice and adaptive capacity

Distributive justice is concerned with benefit and burden sharing, i.e. who gets what and who has to live with what (Walker 2012). In political theory, justice is almost entirely a question of equity in the distribution of social goods (Schlosberg, 2003). For example, Rawls

(1971) refers to justice as "*…a standard whereby the distributive aspects of the basic structure of society are to be assessed….defining the appropriate division of social advantages*" (p9). In this sense, justice as distribution focusses on socio-economic factors and argues for a universal principle of social equity. Walzer (1983) moves away from universal principles to consider the history and culture of specific places, arguing that different individuals have different sets of values, and that the very criteria for distribution will differ according to these values. Miller (2001) proposes a pluralist account of social justice, arguing that there can be no single measure of justice, and presents three principles of distributive justice, namely: need, desert, and equality. Need is a claim that basic necessities must be met so that individuals or groups are free from the danger of harm and that their capacity to function is not impeded. Desert is the claim that reward should be based on an individual or group's contribution, that superior contributions should attract superior rewards. Equality is an ideal that society regards and treats its citizens as equals, and that benefits such as certain rights should be distributed equally. Although this approach to justice considers the complexities of the real world, it still remains tied to the concept of justice as purely distributional (Schlosberg, 2003).

Distributional justice raises a number of concerns relating to the spatial and temporal distribution of adaptive capacity (Jamieson, 1994). First, it has been noted that adaptive capacity is unevenly distributed among and within societies (Smit and Wandel, 2006). This can lead to marginalised sections of society being disproportionately burdened with the costs of SES change, while groups with more adaptive capacity secure the benefits (McDermott et al., 2013). Research suggests that SES changes can reduce the vulnerability of the wealthy and vested interests at the expense of the marginalised, with reactive responses in particular reinforcing inequality (Adger et al., 2006). Second, poor households in NRDC often rely on the collection of ecosystem provisioning goods as a strategy for responding to and coping with disturbance (Kabala et al., 2013). Hence, alterations in the access to and distribution of these provisioning goods due to SES change can negatively impact the adaptive capacity of those with greatest dependence on natural resources. Third, the unequal distribution of the costs of SES change raises concerns for sustainability and intergenerational justice, with the degradation and over exploitation of natural resources negatively impacting the distribution of adaptive capacity for future generations (Dobson, 2007). Any assessment of adaptive capacity therefore requires the identification and recognition of all groups and how and why adaptive capacity is distributed between

them the way that it is at different points in time. In Vietnam, far reaching political and economic reform has resulted in the appropriation and exploitation of natural resources by powerful actors, and subsequent high concentration of wealth among these actors. This study analyses whether such changes have altered how mangrove goods and services are distributed in MRDC in order to understand the environmental justice aspects of adaptive capacity in MSES.

2.4.3 Recognition justice and adaptive capacity

Recognition as a form of justice has its origins in the work of Young (1990) who suggested that injustice is not solely an issue of inequitable distribution, but also involves a lack of recognition of group identity and difference. Young built on the traditional theory of distributive justice by directing attention to institutionalised dominance and oppression, particularly of those who represent "difference" in race, gender and sexuality. Young argues that "…*where social group differences exist and some groups are privileged while others are oppressed, social justice requires explicitly acknowledging and attending to those group differences in order to undermine oppression*" (p3). Misrecognition through insults, degradation and devaluation represents injustice not only because it constrains and harms people, but also because it impairs people's understandings of themselves, which is equally as detrimental as a lack of adequate distribution of goods (Schlosberg, 2003). Honneth (1995) poses disrespect as a form of injustice whereby an individual or group may be the subject to structural, institutional or cultural exclusion from the possession of certain rights within society and the denial of self-esteem. A lack of recognition can also cause resentment to grow not just within individuals, but throughout society (Connelly, 1993). Hence, a lack of recognition is a structural and institutional form of injustice that requires institutional analysis and change (Schlosberg, 2003).

Recognition justice reflects the social, economic and political disenfranchisement that is embedded within the larger struggles of different groups against oppression and discrimination (Schlosberg, 2013). Central to environmental justice is an engagement of issues relating to recognition through cultural meaning and identity (Whyte, 2011). Identity is the amalgamation of cultures, perceptions and ways of life that are connected to the physical environment (Figueroa, 2010) and encompasses values, practices and places (Whyte, 2010). There are often considerable differences in culture and identity between natural resource stakeholders and views of what constitutes just distribution (de Jong,

2011). Hence, recognition in environmental justice is about being reflexive regarding whose culture is privileged and respected (Walker, 2012), and provides an approach to resolving tensions between social and ecological values (Martin et al., 2013). If this does not happen it could result in the exclusion and erosion of potentially valuable alternative social and ecological perspectives, and a subsequent reduction in the cultural diversity that some argue is positively correlated with biodiversity (Maffi, 2001). A lack of recognition can result in reduced levels of adaptive capacity for certain groups who are less connected to certain social networks. In this respect, recognition is related to capability approaches (Sen, 2007) that focus on the variety of activities that people need in order to fully flourish, such as social affiliation (Schlosberg, 2007). Nussbaum (2006) presents affiliation as the opportunity for individuals and groups to form attachments, bonds and relationships, build social capital and live in a society that respects and treats them as dignified beings. Hence, more affiliated individuals and groups have greater recognition and opportunity to draw on these social networks in times of shock or stress. Failure to be recognised as being legitimately affiliated or recognised within certain networks leads to further exclusion and less network access that effectively limits adaptive capacity. In Vietnam, rapid MSES change resulting from far reaching political and economic reform, particularly integration into domestic and international markets, will impact the social networks of MRDC. This study analyses recognition by examining the association between different levels of aquaculture activity and social network structure in order to understand the environmental justice aspect of adaptive capacity within MSES.

2.4.4 Procedural justice and adaptive capacity

Distribution and recognition are two crucial components of justice. A third critical component is procedural justice (Schlosberg, 2007). Procedural justice relates to how decisions are made and who is included in these processes, encompassing issues such as participation and power (Paavola, 2006). Participation provides a way to address power and the role of social and cultural institutions with regard to both distributional equity and political recognition (Schlosberg, 2007). Hence, procedural justice, and its demand for broader and more authentic public participation, is often seen as a tool to achieve both distributional equity and political recognition (Fraser, 2009). Young (1990) suggests that the concept of justice must focus on the elimination of institutionalised domination and oppression by focusing on political process to address distributional and recognition injustices. For Young, the central focus in addressing these two components of injustice

should be on decision-making structures, arguing for "…*democratic decision-making procedures as an element and condition of social justice*" (p23). Honneth (1992) articulates the link between a lack of recognition and reduced participation, whilst Gould (1996) proposes that participation should be increased in a variety of social and cultural institutions, as well as the more specific context of politics and government. Analysis of procedural justice, then, incorporates different notions of justices into one approach.

With regard to adaptive capacity in SES, procedural justice refers to participation in the institutions and processes that allocate resources and resolve disputes (McDermott et al., 2013). Matters relating to procedure typically occur in environmental policy documents as commitments to local community consultation, participation and in securing informed consent (Martin et al., 2013). However, criticism has been levelled at such procedures as they tend to favour economic concerns and existing hierarchies and power structures that can serve to exacerbate underlying inequalities in natural resource distribution (McAfee and Shapiro, 2010) and in recognition. Therefore, equity in the context of adaptive capacity to SES change is about more than simply ensuring that the most vulnerable are treated fairly and buffered from disturbance. Thomas and Twyman (2005) suggest that it should also incorporate a wide range of issues, including: decision-making processes, who decides, who responds; frameworks for taking and facilitating actions on natural resource issues; and the link between the impacts of SES change and the factors that shape the distribution of livelihood opportunities. Hence, equity in the context of SES change has a strong procedural dimension regarding the institutions and processes that shape the distribution of adaptive capacity (Paavola and Adger, 2002). Vietnam is a country undergoing significant change: moving from a 'command-and-control' economy, to a 'socialist-oriented market' economy; and the devolution of land management from central government to households, and decentralisation of land allocation authority to local government. This study will analyse how these changes have shaped procedural processes and the level of community participation in natural resource management in order to understand the environmental justice aspect of adaptive capacity in MSES. Integrating analyses of livelihoods (distribution), social capital (recognition) and institutions (procedure) allows us to understand the different components of the environmental justice aspects of adaptive capacity in MSES. This is further unpacked in the following sections.

2.5 Sustainable livelihoods, ecosystem services and livelihood trajectories

NRDC respond to SES change partly through their livelihoods. Ecosystem services, particularly provisioning goods, form a vital component of NRDC and household livelihoods, the access to and distribution of which helps to shape a household's ability to respond to SES change. Hence, livelihoods are linked to the distribution of adaptive capacity partly through the ecosystem services necessary to respond to SES disturbance. Exploring the use of ecosystem services in MRDC livelihoods can provide insights into the environmental justice aspects of adaptive capacity.

2.5.1 Sustainable Livelihoods Framework

A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living (Chambers and Conway 1992). Assets are the tangible and intangible resources, categorised by Scoones (1998) as natural, social, financial, physical and human capitals, which households draw upon to make a living. The mix of assets and activities a household selects denotes the livelihood strategy (e.g. subsistence production, market production, off-farm waged labour) (Scoones 1998). Livelihoods are shaped by the changing natural environment and form within complex social, economic and political contexts; the shocks and stresses of which combine to determine the livelihood vulnerability context (Chambers and Conway, 1992; Scoones, 1998) and force adaptations in response to changing circumstances (Adger, 2000). For vulnerable households, disturbances are often intractable and relate to underlying socio-economic factors such as income level and dependency on and access to natural resources (Chambers, 1989; Shackleton and Shackleton, 2006). Scoones (1998: 2) states that "…*a livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base*". This clearly resonates with adaptive capacity by its consideration of sustainable livelihood responses to SES change. The sustainable livelihoods framework (SLF) (Figure 2.2) incorporates analysis of the contextual factors of people's lives (i.e. socio-economic, technological, demographic, and political); their access to and stocks of financial, physical, human, social and natural assets and their ability to employ these for productive use; the institutions, policies and organisations that shape household access to

assets; and the problems and priorities people themselves identify, and the strategies they employ to meet these priorities (Ashley and Carney, 1999). Higher levels of adaptive capacity will reduce vulnerability and increase resilience of livelihoods to disturbance by enabling greater resource access, bundling, and sustainable application of assets, and provide flexibility through diversity of potential response options (Nyamwanza, 2012). This has implications for environmental justice as inequitable distribution of resources will mean those who are already vulnerable will lack access to the resources necessary to respond to SES change, and may therefore be unduly burdened with negative effects.

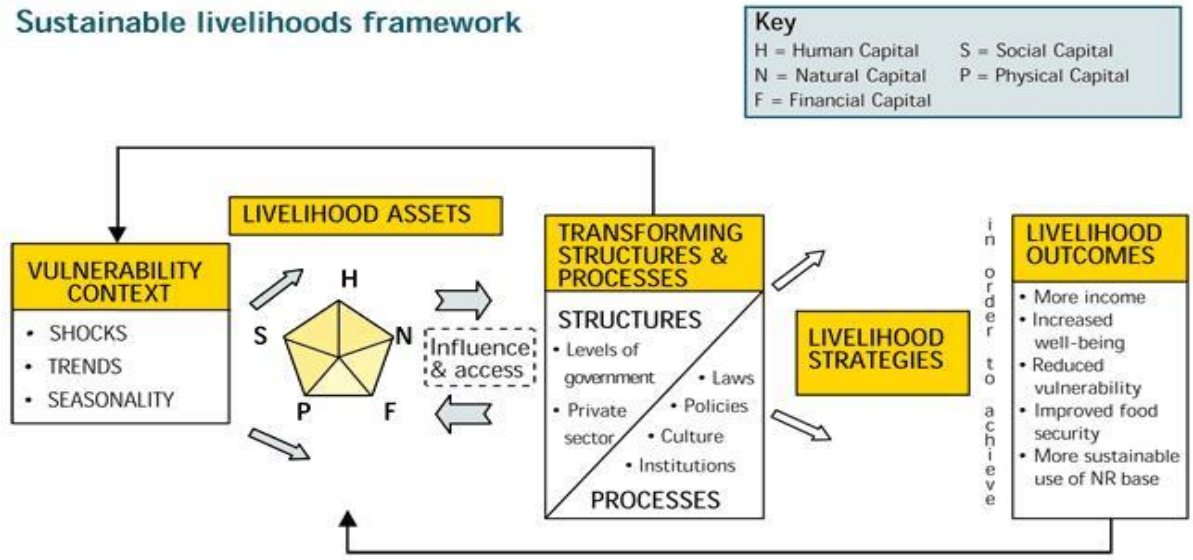

Figure 2.2: The Sustainable Livelihoods Framework. *Source: DFID (1999)*

Limitations of the livelihood approach include: neglect of power relations; neglect of the dynamics of social and environmental interactions; too narrow focus on the local scale; and a lack of consideration of networks, linkages and connections between and among levels of governance (de Haan and Zoomers 2005; Scoones 2009). These limitations are particularly important as they link to vital components of recognition and procedural justice (i.e. processes occurring at multiple levels of governance that exclude certain groups and exacerbate inequities in the distribution of adaptive capacity). The coastal communities of Vietnam exhibit relatively low levels of development, and the households living within these communities are engaged in a range of primarily natural resource based livelihoods, relying heavily on the goods and services that mangroves provide. Coastal development is severely impacting mangroves and the livelihoods of coastal communities, particularly the rapid growth of aquaculture. This can cause a significant divergence in the livelihood opportunities available to households within these communities (Orchard et al.,

2014). Applying an integrated ecosystem service and livelihood trajectory approach to a study of MSES in Vietnam addresses the limitations of the SLF through consideration of the broad and dynamic social, political, economic and environmental processes that have shaped the current livelihood context of mangrove dependent households. This approach also contributes to our understanding of the distributional component of environmental justice aspects of adaptive capacity within MSES.

2.5.2 Ecosystem services

A large proportion of global ecosystem service flows originate within forests (Patterson and Coelho, 2009). Forest ecosystem services include provisioning goods (timber and non-timber forest products), regulating services (watersheds, carbon storage and sequestration), cultural services (spiritual, recreational and religious), and supporting services that underpin the delivery of all ecosystem services. Provisioning goods are "*…services supplying tangible goods, finite though renewable, that can be appropriated by people, quantified and traded*" (Maass et al., 2005: 7), and support many rural livelihoods (Shackleton and Shackleton, 2004). Households in NRDC often rely on the delivery of provisioning goods in order to sustain their livelihoods, and will often increase their use of ecosystem services in order to respond to SES change (Shackleton and Shackleton, 2012). Hence, the distribution of ecosystem services within a NRDC will partly determine a household's adaptive capacity (Birkman et al., 2009). Understanding how the use and sale of provisioning goods is differentiated by socio-economic factors within NRDC can contribute to our understanding of the environmental justice aspects of adaptive capacity through analysing the equity in distribution of ecosystem services between and among NRDC livelihoods. This is an important contribution to knowledge because little research has studied the implications of socio-economic differentiation for the use of ecosystem services in NRDC (Carpenter et al., 2009), in particular regarding environmental justice aspects of adaptive capacity.

Limitations of the ecosystem service concept refer to its focus on current ecosystem benefits, and a failure to consider the complex interactions and dynamics of SES (Norgaaed, 2010). In addition, the value of ecosystem services to rural livelihoods is socially constructed and contested (Kepe, 2008). Focusing on measuring the economic value of ecosystems fails to recognise the political and social aspects of ecosystem service use (Brauman et al., 2007). Using a trajectories approach, as taken in this thesis, to analyse

household livelihoods, can help to address these limitations by: providing a time dimension to ecosystem service distribution between and among MRDC; understanding ecosystem service use in response to MSES change; and aiding our understanding of how and why adaptive capacity is distributed the way it is within MSES.

2.5.3 Livelihood trajectories

Research suggests that the impacts of SES change are unevenly distributed, and concerns of equity dominate current debates about the positive and negative changes to ecosystem services (Kofinas and Chapin, 2009). Local equity may be undermined, or existing inequalities may be worsened, as SES change alters the distribution of ecosystem services (McDermott et al., 2013). Thomas et al (2002) have found that in southern Africa, households and communities are recognising new natural-resource use and livelihood opportunities in response to SES change, but that this can contribute to growing polarisation within NRDC due to the uneven distribution of ecosystem services. Linking a trajectory approach with the SLF provides a broader approach to the assessment of the distribution of ecosystem services and the environmental justice of adaptive capacity, as the ultimate success of societal responses to change will often depend on adaptive livelihoods (Nyamwanza, 2012). Much resilience research has shown the importance of learning from past exposure and responses to shocks and stresses in order to identify areas for current and future policy support (Carpenter et al. 2001; Fazey et al. 2007; Dixon et al. 2014). De Haan and Zoomers (2005) question the term 'livelihood strategy' for imposing an ex-post label on behaviours that are seldom intentional. They suggest 'livelihood pathways' to indicate the broader socio-political patterns of livelihood activities, acknowledging that livelihoods emerge not as rational responses to future certainties, but as incremental outcomes of behaviour embedded in a historical repertoire of possibilities through influence of other actors and structural constraints (Ansell et al., 2014). Analysing livelihood trajectories can help to understand how alterations in household access to ecosystem services due to SES change can influence livelihood options and the distribution of adaptive capacity over time, and the equity implications of this distribution for adaptive capacity.

A livelihood trajectory is defined as "…*the consequences of the changing way in which individuals construct a livelihood over time*" (Bagchi et al. 1998: p457). Trajectories rarely exhibit one-off decisions, and are more often a culmination of actions with greater or lesser strategic intent (Ansell et al., 2014). For example, NRDC may engage in multiple

livelihood activities and strategies simultaneously, strategically or unplanned, in response to intertwined present and future needs and aspirations and shaped by wider social, cultural, political and economic factors operating at multiple scales. Acknowledgement is also given to relational aspects as these impose demands, expectations, desires and duties that mediate opportunities and the nature and trajectory of livelihood actions (van Dijk, 2010). A livelihood trajectory approach is applied here to explore life histories of individual households and their changing livelihoods in relation to specific needs contextualised in relation to local power dynamics (cf. Sallu et al. 2010). Hence, a livelihood trajectory approach allows close examination of the political, socio-economic and environmental aspects underpinning ecosystem service provision (Vilardy et al., 2011), and how the equity of ecosystem service distribution affects livelihood responses to SES change, which, in turn, creates winners and losers. Considering the distribution of adaptive capacity as a process helps to capture the dynamics that link the ability of households to respond and recover from disturbance in order to re-establish their livelihoods (Nyamwanza, 2012). This also feeds into the important and growing application of the livelihood trajectory approach (Murray 2001; de Haan and Zoomers 2005). Using ecosystem service and livelihood trajectory approaches to assess the effects of SES change on NRDC livelihoods allows us to understand the distribution of ecosystem services and what this means for adaptive capacity. The next section will outline the social capital aspects of adaptive capacity, and how social network analysis can increase our understanding of the recognition aspect of environmental justice.

2.6 Social capital and social networks

Social capital encompasses relations of trust, reciprocity, common rules, norms and sanctions, and connectedness in institutions that encourage productive activities (Coleman, 1990; Woolcock and Narayan, 2000; Pretty and Ward, 2005). Social capital also influences the ability of NRDC to act collectively (Adger, 2003). Social networks are a component of social capital and are social structures made up of a set of actors (e.g. individuals, households or organizations) and a set of the ties between these actors (Wasserman and Faust, 1994). Extending our understanding of the institutional dynamics surrounding SES allows us to explore the interdependence of NRDC networks which are crucial to their livelihoods (Pretty and Ward, 2005). This clearly links with the recognition component of environmental justice as those households more affiliated to influential networks can be assumed to have greater access to livelihood resources necessary to respond positively to

SES change. Historically, NRDC have acted collectively to develop institutions that manage disturbances to the resource base on which their livelihoods depend, and social networks shape access to these livelihood supporting institutions (Adger, 2003). Hence, aspects of adaptive capacity reside in the networks of NRDC (Adger, 2003). The social network component of social capital can reduce the vulnerability of NRDC to disturbance by promoting access to resources that can promote sustainable livelihoods (Bebbington, 1999), particularly in the absence of state support (Adger, 2003). Social networks can also facilitate resilience, particularly in the context of NRDCs' livelihoods, by reference to their interactions with natural resources and social connectedness that increases the ability of NRDC to act collectively (Crona and Bodin, 2010).

Community networks have long been central to household responses to MSES change in Vietnam, being used to pool risk and promote security and stability (Luong, 2003). However, the processes of political and economic reform undergone in Vietnam will alter the balance of social capital within MRDC. Networks have become increasingly integrated into domestic and international markets, particularly for aquaculture goods, which can alter the ways in which communities interact with one another and the wider world. In addition, growing inequalities in income, livelihood opportunities, power relations, and access to resources have the potential to fragment community networks. Applying social network analysis to a study of MSES in Vietnam allows consideration of how the changing structures of community networks influence the resilience of MRDC through alterations to the internal and external connections a community and household has. This will also have implications for environmental justice, as changing networks will alter the recognition of different groups with the networks of MSES governance that shape distribution of adaptive capacity.

2.6.1 Social capital

Figure 2.3 depicts bonding and bridging social capital as arrows, which represent contacts among households in a community. Contacts within a defined community, as illustrated in the left panel, represent bonding social capital, and are based on relational contacts to others within the same community. By contrast, the right panel illustrates bridging social capital which is made up of economic and other contacts that lie outside the community. While bonding capital is based on community contacts usually comprising friendship and kinship, bridging capital is based on weaker bonds of trust and reciprocity (Adger, 2003).

Hence, bridging capital tends to rely on legal and formal institutions rather than the rules of enforcement and sanction of informal collective action synonymous with bonding capital. Neoclassical economics assumes that social relations are deviations from the rational allocation of resources, a notion that has long been questioned in the study of rural societies (Scott, 1976). These non-economic aspects of social structure and organization act as resources for individuals to spread risk (Ribot, 1996; Pelling, 1998), while also making them less likely to engage in unfettered private actions that result in negative impacts such as resource degradation (Pretty and Ward, 2001). Regarding the benefits of social capital, Putnam (1995) defines the concept as "*the features of social life—networks, norms and trust—that enable participants to act together more effectively to pursue shared objectives*" (p 664). Hence, communities endowed with social capital will have greater potential to self-organize and work together towards understanding and tackling common challenges (Kithiia, 2010).

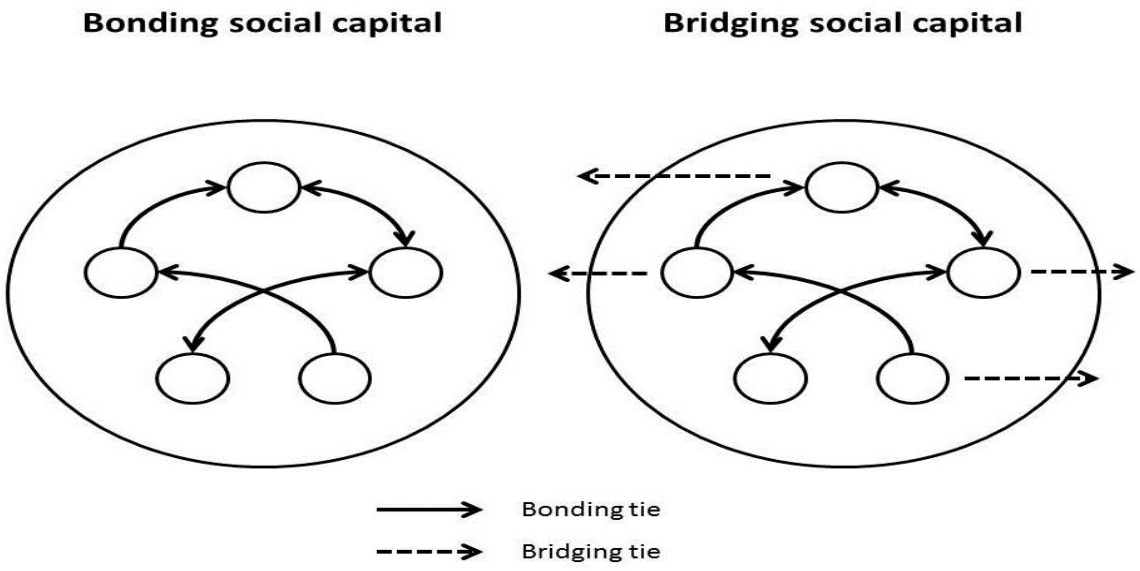

Figure 2.3: Bonding and bridging social capital. *Adapted from Adger (2003)*

Recent studies point to a number of negative effects of social capital: (1) bonding capital can cause distrust of outsiders (Portes, 1998); (2) reciprocity can cause a strong sense of obligation and isolate members of a community (Woodcock and Narayan, 2000); (3) shared norms can constrain innovative behaviours of individuals (Portes, 1998); and (4) powerful actors may enforce shared norms as a form of social control (Coleman, 1988). In addition, limitations of the concept of social capital state that social capital can depoliticise debates and place the blame for social decline on the shoulders of people rather than on

socio-economic and political factors (Boggs, 2001); while amalgamation of the terms 'social' and 'capital' undermines and dehumanises people's relationships, and perpetuates the dominant neoclassical 'rational economic actor' worldview (Fine, 2002).

Nevertheless, social capital has been closely linked to adaptive capacity through the features of social organisation that facilitate collaboration and cooperation for mutual benefit (Pelling and High, 2005). As an emergent property of social systems, adaptive capacity to SES change is continually being reshaped through social relationships (Petty and Ward, 2005). Social networks, norms, and social trust shape social capital and the adaptive capacity of NRDC through the ability to act collectively (Adger, 2003). The ability to act collectively also depends on shared understandings and a common vision (Ostrom 2005). These characteristics influence the capacity for managing change (Adger, 2003, Pelling and High, 2005). Social capital has been recognised to facilitate collective action thereby increasing the ability of communities to resolve land use conflict and effectively manage natural resources (Sanginga et al., 2007). For example, Nkhata et al. (2009) state that, historically, high levels of social capital in a fishery on the Rovuma River that forms the border between Mozambique and Tanzania allowed communities to regulate access to and use of the commons. However, pressures from colonialism, land reform and market liberalisation have undermined social capital due to locally inappropriate state regulation, land use conflict and individualistic behaviours. Hence, natural resource management can be effectively implemented if there is due consideration given to supporting or reconstructing social capital, and links between both local and non-local actors to deal with issues relating to natural resource management and change (Nkhata et al., 2009; Adger, 2003). This has important implications for the environmental justice aspects of adaptive capacity in that the distribution of social capital among NRDC will affect the recognition households have within governance processes.

2.6.2 Social networks

Social networks are constituent of two or more actors (households) that are connected through one or more relations (Abbasi et al., 2012). The structure and function of social networks influence the creation of norms, trust and reciprocity that forms a crucial part of social capital (Pretty and Ward, 2005). Social networks influence social capital as they can enable/constrain the behaviour of individuals and shape the flow and transfer of resources (Wasserman and Faust, 1999). Social network analysis is conducted using either

sociocentric (i.e. whole population network) or egocentric (i.e. individual/household network) approaches. While sociocentric approaches can tell us something about entire populations and/or sub-populations, they do not tell us much about the opportunities and constraints facing individuals. An ego is an individual focal node, in this case an individual household. Egocentric networks help us understand the variation across individuals in the way they are embedded in local social structures (Hanneman et al., 2005). Various egocentric network characteristics deliver different kinds of social capital (Crowe, 2007). Although there has been some research studying whole social networks of NRDC, little research to date has analysed the networks of individual households. Such an approach can help us understand the distribution of adaptive capacity in SES and processes underpinning those distributions by understanding how individual households are embedded in local social structures, and the opportunities and constraints facing individuals as a result of recognition.

Resilience is influenced by a SES's internal and external connectivity which is activated through various social networks (Fazey and Mortan, 2002; Cassidy and Barnes, 2012). Gunderson and Holling (2002: p50) define connectedness as "*…the strength of internal connections that mediate the influences between inside processes and the outside world*." Networks can promote adaptive capacity by facilitating access to resources in order to buffer disturbances (Smit and Wandel, 2006). In times of rapid change, social networks can facilitate individual and collective change (Rayner and Malone 2001) and provide arenas for novelty, innovation and enhanced flexibility (Gunderson et al. 1995). The vitality of social networks is largely the product of political, legal and institutional factors (Woolcock and Narayan, 2000). The social capital that emanates from effective social networks also contributes to the building of effective and accountable institutions, which lower the transaction costs associated with collective action (Pretty and Ward, 2005). Increasing the diversity of social network connections also builds adaptive capacity (Bodin et al., 2006). For instance, NRDC with diverse social networks will be able to access a greater range of options to resolve disputes and take advantage of new opportunities (Woolcock and Narayan, 2000). Hence, the distribution of recognition within NRDC will influence who wins and who loses from SES change. Greater affiliation to the social networks that shape SES governance will increase access to the resources necessary to respond, having implications for the environmental justice aspects of adaptive capacity.

By focussing on productive capacity rather than adaptive capacity in social networks, resilience can be compromised by a narrow focus on efficiencies (Walker et al., 2006). Increasing network efficiency results in a loss of redundancy, which represents buffering capacity in the case of loss (i.e. if one or more actors are weakened or lost, others can fill the position and continue to perform the management function (Janssen et al. 2006). Hence, social networks based purely on a productive capacity standpoint optimise efficiency by having low or no redundancy, but in terms of adaptive capacity the system requires redundancy so that the network does not fragment if a household leaves. Analysis of network governance in SES is required in order to understand how networks can contribute to more effective and sustainable management (Henry and Dietz, 2011). Tompkins and Adger (2004) suggest that networks can increase adaptive capacity by building social resilience. Nevertheless, social networks can also negatively affect adaptive capacity if they fail to challenge or reinforce pre-existing power relations, support existing injustices, and become brittle and unresponsive (Newman and Dale, 2005). A more in-depth analysis of the nature of the relationships and communication patterns in such networks is required to assess how they affect the adaptive capacity of SES (Brockhaus et al., 2012). Regarding environmental justice, social network analysis allows us to understand recognition justice and what this means for adaptive capacity of SES. Examining the structure of the social networks of different NRDC allows us to explore levels of affiliation, and hence recognition, to the networks of SES governance. This influences the distribution of adaptive capacity within SES as those groups with greater affiliation are likely to have greater recognition and opportunity to draw on governance networks in order to manage SES change.

2.7 Multi-level governance, institutions and environmental entitlements

2.7.1 Multi-level governance

SES involve interactions between and within multiple levels (Berkes 2008; Blomquist 2009). The connectivity and functional interdependencies of SES presents a significant challenge for environmental management which requires multi-level governance (Brondizio et al. 2009), something that is not comprehensively dealt with through the SLF, ecosystem services and livelihood trajectory framework presented above. Governance is a key component of adaptive capacity (Eakin et al., 2011), constituting the structures and

processes within societies that distribute power and shape individual and collective actions (Young, 1992). This links to the procedural aspects of environmental justice, and the institutions and processes that shape the distribution of adaptive capacity in SES. Multi-level governance refers to different levels (i.e. international, regional, national, provincial, district, local) of SES governance (Van Kersbergen and Van Waarden, 2004). Implicit is the assumption that the dispersion of governance across multiple jurisdictions is both more effective and normatively more desirable compared to central state government (Termeer et al., 2010). This is because matching levels of administration to the scales of ecological systems is deemed to be unachievable. For example, global environmental changes such as climate change cause global and local effects simultaneously, requiring interplay between global and local authorities. Hence, multi-level governance has the potential to tackle complex multi-scale challenges due to its focus on cross-level interactions (Termeer et al., 2010). In addition, the blurring of boundaries between nation states, the private sector and the public has been argued to be a vital prerequisite for democracy in complex multi-layered societies (Sorensen and Torfing, 2005). Multi-level governance has found traction within the resilience literature through its recognition of properties relating to cross-scale dynamics, feedbacks, and self-organisation in SES (Armitage, 2008).

Analysing the dynamics of such multi-level and complex governance systems provides a considerable challenge. The major conceptual frameworks in the social sciences relating to natural resource governance (i.e. regime theory in political sciences, game theory, new institutional economics) are weak in their ability to analyse the complex, context dependent dynamics of governance regimes (Harrison, 2006; Young, 2007). Most governance analyses focus on static descriptions and embrace only a part of the processes of importance (Ostrom, 2008). Furthermore, in contrast to traditional notions of government, the analytical distinction between those actors who govern and those who are governed is not valid anymore, which adds an additional layer of complexity (Mayntz, 2006). The evolution in the discourse from ‘‘government’’ to ‘‘governance’’ implies a change in thinking about policy processes. The notion of government as the single decision-making authority, where state authorities exert sovereign control over the people and groups making up civil society, has been widened by the notion of multi-level, polycentric governance where many actors in different institutional settings contribute to policy development and implementation (Mayntz, 2006). Governance encompasses coordination and steering processes by state and non-state actors to influence behaviour by formal and

informal institutions (Scharpf, 1997). Governance regimes are thus characterized by self-organization, emergence and diverse leadership. However, there is little understanding of what the processes and outcomes of governance implies for diffuse, complex and multi-level networks (Pahl-Wostl, 2009).

Concerns with multi-level approaches arise when considering the coordination of multiple actors across multiple levels (Hooghe and Marks, 2003). The inclusion of numerous government, private sector and civil society actors can increase administrative 'fuss', causing fragmentation or inconsequential compromises (Termeer et al., 2010). There are also concerns regarding the dispersion of government authority, specifically: deconcentration, where government authority is simply allocated to local authorities who are upwardly accountable to the central government (Ribot, 2002); and a hollow state (Rhodes, 1997) which has the appearance of a properly functioning democratic nation or state, but actually lacks transparency and democracy (Jordan, 2001) and supports the interests of autocracies, dictators, oligopolies, special interest groups and kleptocracies (Milward and Provan, 2000). These are important considerations that have significant implications for nations such as Vietnam that are undergoing far-reaching political and economic change, such as decentralisation and market liberalisation.

2.7.2 Institutions

Responses to SES change are formed partly through institutions that shape relations among and between multiple levels of governance (Goldman and Riosmena, 2013). Institutions are core components of environmental governance (Biermann et al., 2010). Institutions are defined by North (1990: 97) as "…*humanly devised constraints that structure political, economic and social interactions*", and can be both formal and informal. As described by Helmke and Levitsky (2004: p727), "…*formal institutions are openly codified, in the sense that they are established and communicated through channels that are widely accepted as official…informal institutions are socially shared rules, usually unwritten, that are created, communicated, and enforced outside of officially sanctioned channels*". Informal institutions tend to be more persistent than formal rules (North 2005). Although formal organisations (e.g. political parties or unions) may be distinguished from formal institutions, informal rules may be embedded within these organisations. Whilst informal organisations (clans, mafias) may be distinguished from informal institutions, formal institutions will not govern their behaviour, but they are usefully incorporated into informal

institutional analysis (Helmke and Livitsky, 2004).Institutions tend to be conservative, reacting incrementally to disturbances through cultural practices and ideological premises (Gupta and Dellapenna, 2009). Despite institutions providing a level of stability and predictability for the development of collective action (Scharpf, 1997), it is important to consider that they emanate from agreements and debates occurring over time and hence carry a bias from these previous negotiations, perceptions and power relations (Klijn and Koppenjan, 2006). This process is referred to as 'institutionalisation' (Garud et al., 2007). Subsequently, institutions comprise a degree of resistance to change which can constrain adaptive capacity. But although institutions shape social actions, they can also be re-constituted through these same actions (Giddens, 1984). This has important implications for the environmental justice aspects of the distribution of adaptive capacity as pre-existing inequities due to a lack of recognition of certain groups can be sustained through institutional inertia, leading to those already vulnerable being unduly burdened with the negative effects of SES change.

Governance decisions and actions at multiple levels interact with environmental processes, and are channelled through and influenced by institutions at and across various levels (Cash et al. 2006). Failure to appreciate institutional processes between and within levels can lead to ineffective management decisions with negative social and environmental consequences (Kok and Veldkamp 2011; Poteete 2012). Whilst institutions enable and maintain the involvement of certain actors and practices, they can also exclude or constrain others, demonstrating a clear link to the recognition aspects of environmental justice. Subsequently, the way individuals within a community behave and interact, combined with the policies and processes that are determined by external agents, will influence environmental justice through the distribution of adaptive capacity that shapes how individuals are able to respond to SES change (Berman et al., 2012). In order to ensure sustainable outcomes in the management of SES, it is important to identify and understand the institutional factors that facilitate or restrict adaptive capacity (Brockhaus et al., 2012). The environmental justice literature suggests that participation in the governance procedures for natural resource management can facilitate more equitable distribution of adaptive capacity, but requires actors that are informed, motivated and able to access decision making processes (Poteete and Ribot, 2011).

Many of the systems in developing countries from which ecosystem service benefits and livelihoods are derived are regarded as common property (Wallace 2007; Nkhata et al., 2012). Many governments are struggling with the growing gap between the rich and poor and seek to develop and implement policies that seek to ensure fair and equitable sharing of the ecosystem service benefits from these systems (Suneetha and Pisupati 2009). This is because the collective use of common resources makes them susceptible to market, government and property failures, posing significant challenges for their equitable governance (Ostrom 1999). Despite growing acknowledgement of the importance of governance processes for the distribution of ecosystem services, it remains understudied (Nkhata et al., 2012). Ostrom (1990) argues that as awareness of the complexity and interconnectedness of natural resource management challenges increases, the institutions relating to common property will play a vital role in the success of management solutions. This is increasingly salient as rural communities become further integrated into global processes and networks involving state, private sector and civil society actors with differing interests, claims and influence (Mwangi and Wardell, 2012). These actors represent institutions that are relevant to local adaptive capacity (Adger et al., 2008) as they act as a link between levels of governance (Adger et al., 2008), and shape how households and communities are affected by and respond to change (Agrawal, 2008). In order for institutions to generate the necessary levels of adaptive capacity for societies to anticipate and respond to change, they will need to: respond at the same rate at which the magnitude of SES change is likely to occur (Brondizio et al., 2009); allow actors to learn from new insights and experiences in order to flexibly and creatively manage uncertainty; and maintain a degree of identity (Gupta et al., 2010). This will involve the incorporation of new information regarding the changes taking place, and proactive responses through planned management, while also supporting autonomous actions and institutional redesign (Gupta et al., 2010). Little attention has been given to the dynamics of common property institutions and processes in the equitable distribution of ecosystem services, and the implications of this for the environmental justice aspects of adaptive capacity, particularly in the context of developing countries. This research applies an environmental entitlements approach to provide a framework for understanding how institutions and processes at multiple levels of SES governance shape household access and use of SES commons.

2.7.3 Entitlements

Both vulnerability and resilience approaches identify governance and institutions as critical variables affecting adaptive capacity and positive SES outcomes (Engle, 2011). However, the entitlements approach is most commonly used to discuss vulnerability, with adaptive capacity being a component of vulnerability best explained by entitlement approaches (Goldman and Riosmena, 2014). As discussed in previous sections, households with more secure livelihood assets are likely to have higher adaptive capacity and enhanced ability to manage change. In order to identify the conditions under which institutions stimulate adaptive capacity in SES, it is vital to understand how institutions at multiple levels of governance structure household entitlements to ecosystem services (Gupta et al., 2010). Entitlements are "…*the set of alternative commodity bundles that a person can command in a society using the totality of rights and opportunities that he or she faces*" (Sen, 1984: 497). This includes livestock and other forms of wealth; farmland, grazing areas, tenure rights; gender norms, education, knowledge, and reciprocal relations enabling access to resources (Goldman and Riosmena, 2013). Entitlements refer to the social, political and economic processes that institutionalise resource rights, access and distribution in ways that are often path-dependent, creating differentiated adaptive capacities within and between NRDC (Goldman and Riosmena, 2013).

Entitlements approaches have been criticised for being ahistorical, with priority given to economic factors at the expense of socio-political factors (Devereux, 2001). Rights or claims over resources that are held collectively (by groups of people, or institutions) have been argued to be incompatible with the entitlement approach, which is conceptually grounded in private property regimes, where resources are commoditized and owned by individuals. However, rights can also be exercised at varying levels, from ownership (the strongest form, including rights of disposal) to access and usufruct rights (the weakest form, where ownership and use are often separated). Given that the entitlements component of adaptive capacity is socially differentiated along the lines of age, ethnicity, class, religion and gender (Adger et al., 2007: 730), the institutions that ensure equitable opportunities to access resources are likely to facilitate the adaptive capacity of certain groups (Jones et al., 2010). Groups more affiliated to the networks of SES governance will be able to influence the distribution of adaptive capacity and increase their resilience to SES change, while those less affiliated will remain vulnerable through lower access to resources. Yet institutions cannot be measured based merely on asset distribution. Socio-political dimensions such as participation and the informal institutional arrangements that

govern society's responses to disturbance must also be considered when assessing adaptive capacity (Jones et al., 2010). Hence, the entitlement approach may be inadequate in contexts where the relationship between individuals and resources is mediated by non-market institutions. Analysis is required that recognizes the importance of non-market institutions in determining entitlements (Devereux, 2001). Environmental entitlements is used in this research to address this challenge by considering how institutional and governance processes at multiple scales differentiate the command of NRDC over the environmental goods and services that are instrumental to their well-being (Leach et al., 1999).

The environmental entitlements framework presented by Leach et al. (1999) provides a multi-level approach for studying the role of diverse and dynamic institutions operating at macro, meso and micro levels of SES. Environmental entitlements refer to "…*alternative sets of utilities derived from environmental goods…over which social actors have legitimate effective command and which are instrumental in achieving well-being*" (Leach et al. 1999: p233). These entitlements, in turn, enhance people's capabilities, which are "…*what people can do or be with their entitlements*" (ibid: p233). Figure 2.4 illustrates the environmental entitlements framework, where an undifferentiated "environment" is disaggregated into specific environmental goods and the relations between and within a given "community" is made up of differentiated social actors. Social actors obtain capabilities by acquiring legitimate, effective command over resources through processes of endowment mapping. The framework centres on the dynamic mapping processes that underlie each of the static endowment, entitlement and capability sets, which are themselves mediated by numerous types of institution occurring at micro to macro level. The relationships among institutions across and within levels are a salient influence on which actors gain access to and control over natural resources, and whose actions cumulatively change and shape the landscape over time (represented by feedback loops).

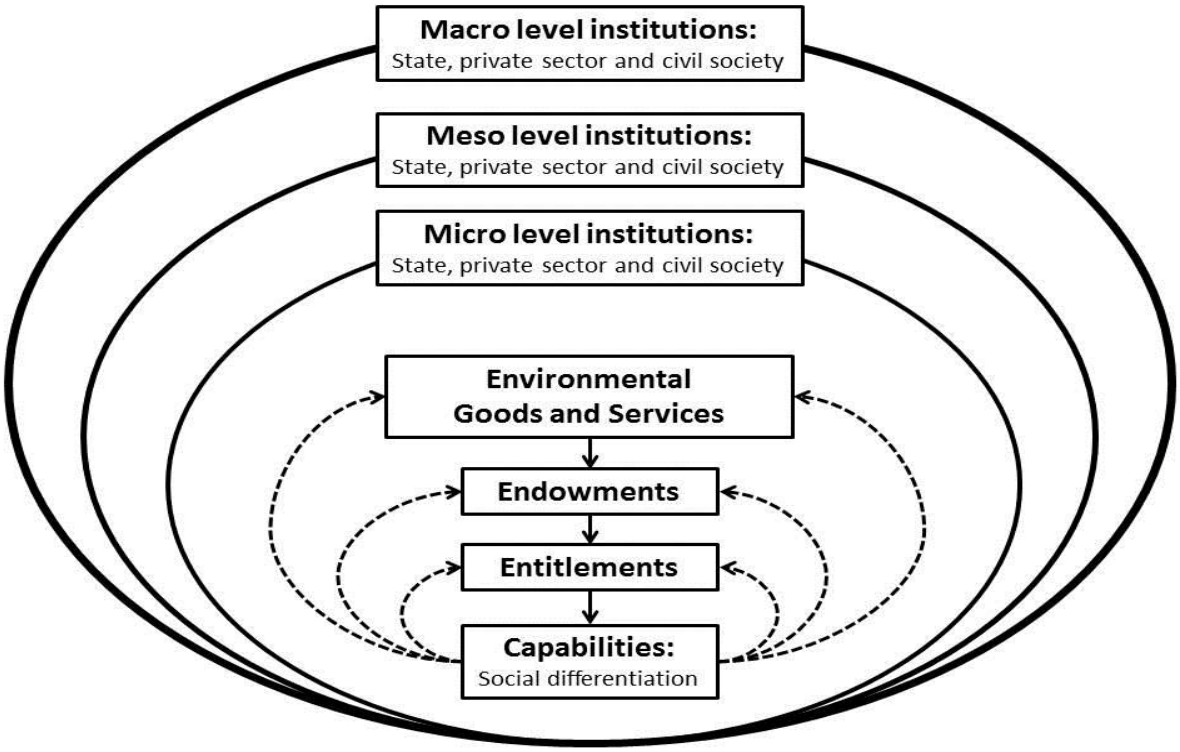

Figure 2.4: The Environmental Entitlements Framework. *Adapted from Leach et al. (1999)*

Applying an environmental entitlements approach to explore the procedural dimension of environmental justice provides the opportunity to better understand the institutions and processes occurring at multiple levels of SES governance that shape the distribution of adaptive capacity in SES. This is because a household's resilience in light of SES change is shaped through their environmental entitlements, i.e. the ability of households to gain legitimate (i.e. recognition) control, access and use of the ecosystem services required to sustain their livelihoods and to respond to SES change without increasing their vulnerability.

2.8 Academic contribution

Much research fails to consider the full ensemble of process and feedbacks required to fully understand complex and dynamic SES (Carpenter et al., 2009). Despite growing attention given to the adaptive capacity of SES to change, analysis of the processes that shape the distribution of adaptive capacity within SES, and the implications for environmental justice, remain understudied. This chapter has reviewed the literature and identified approaches to analyse the environmental justice aspects of adaptive capacity in SES setting out a novel, integrated framework. It draws on these approaches to analyse case studies of mangrove

SES in northern Vietnam, which itself presents an understudied development context of a rapidly growing transition economy. The contribution of each research objective is now discussed in turn.

2.8.1 Objective 1: Analyse local livelihoods to assess the distribution of mangrove system provisioning goods (MSPG) within MSES

A large proportion of the population in Vietnam live on the extensive coastline, with highly variable environmental conditions and exposure to storms and sea-level rise. These coastal communities exhibit relatively low levels of development and households living within these communities are engaged in a range of primarily natural resource based livelihoods, relying heavily on the goods and services that mangroves provide. Coastal development is severely impacting mangroves and the livelihoods of coastal communities, particularly the rapid growth of aquaculture. This can cause a significant divergence in the livelihood opportunities available to households within these communities (Orchard et al., 2014). The combination of exposure to environmental variability and the sensitivity of local livelihoods make these communities vulnerable to change.

Regarding objective 1 of this research, chapter 4 integrates ecosystem service and livelihood trajectory approaches. Livelihoods are an important component of adaptive capacity as NRDC respond to SES change through their livelihoods, shaped partly through their ability to access natural resources. However, little research has assessed the use of ecosystem provisioning goods in NRDC livelihoods, and the drivers shaping their use in response to past SES change, in order to understand the distributional component of environmental justice, and what this means for adaptive capacity within SES. Extending the SLF, ecosystem service and livelihood trajectory frameworks are integrated in order to: determine the current use of MSPG in MRDC livelihoods; provide a time dimension to understand the drivers shaping past livelihood responses to MSES change; and understand the distribution component of environmental justice, and what this means for adaptive capacity within MSES.

2.8.2 Objective 2: Assess the impacts of key aspects of MSES change on social capital

Social networks have long been central to household responses to MSES change in Vietnam, being used to pool risk and promote security and stability (Luong, 2003). The

processes of political and economic reform undergone in Vietnam will alter the levels of social capital within MRDC. These networks have become increasingly integrated into domestic and international markets, particularly for aquaculture goods, which alter the ways in which communities interact with one another and the wider world. In addition, growing inequalities in income, livelihood opportunities, power relations, and access to resources have the potential to fragment community networks. The changing structures of social networks will influence the resilience of MRDC through alterations in the balance of bonding and bridging social capital, and the level of redundancy in household network ties. This will also have implications for environmental justice, as changing networks will alter the recognition of different groups with the networks of MSES governance that shape distribution of adaptive capacity.

Regarding objective 2 of this research, chapter 5 employs social network analysis to examine social capital in MRDC. Social capital is a crucial component of adaptive capacity, and the ability of NRDC to respond to SES change is embedded within and available to them through social networks. However, little research has studied how SES change impacts the structure of NRDC social networks in order to understand the recognition component of environmental justice, and what this means for adaptive capacity within SES. Analysing the association between different levels of aquaculture activity and social network structures provides valuable insights into the levels of social capital in MRDC, the implications for the recognition component of environmental justice, and what this means for adaptive capacity within MSES.

2.8.3 Objective 3: Explore how institutions and processes occurring at multiple levels of MSES governance are shaping local level entitlements to MSPG

Until recently Vietnam was a command and control economy, which has implications for the way current development interventions are designed and implemented, and the extent to which communities are involved. MSES are managed by a set of formal and informal institutions which have undergone significant and rapid change in Vietnam. Traditionally, these were based on patriarchal family systems that were heavily influenced by Confucian and Buddhist principles. More recently, the transition from a centrally planned to an increasingly market orientated economy has facilitated the integration of Vietnam into the international community. Furthermore, the devolution of land management and decentralisation of land allocation decision making authority has increased the involvement

of actors all the way down to the local level. Economic growth subsequent to transition has been fuelled by exploitation of natural resources, particularly the development of the aquaculture industry at the expense of mangrove areas, and has the potential to fuel land use conflicts. Not only will these issues alter the role and influence of state, private sector, civil society and household actors at various levels, but also the distribution of MSPG entitlements and livelihoods of MRDCs – all of which are required to manage multiple disturbances. In order to identify the conditions under which institutions stimulate adaptive capacity, it is vital to understand the procedural justice aspects of how institutions at multiple levels of governance structure the distribution of household entitlements to MSPG.

In relation to objective 3, chapter 6 applies the environmental entitlements approach to provide a holistic understanding of changing relationships subsequent to political and economic reform that shape the governance of mangrove SES in Vietnam (chapter 6). Institutions are an important component of adaptive capacity because they shape the rules that govern behaviour and the response of NRDCs to SES change. However, there remains a lack of understanding of how institutional processes occurring at multiple levels of SES governance shape the procedural component of environmental justice, and what this means for adaptive capacity within SES. The environmental entitlements framework is applied in order to: explore how institutional processes at multiple levels of MSES governance shape household environmental entitlements; and understand the procedural component of environmental justice, and what this means for adaptive capacity within MSES.

The overarching approach of this research provides a contribution to the natural resource management and environmental justice literatures by demonstrating the influence of MSES change on the environmental justice aspects of adaptive capacity within MSES. In addition to improving understanding of complex MSES, this is vitally important for understanding how adaptive capacity can be built so that the most vulnerable are not unduly or unfairly burdened by MSES change, as they are the groups which have contributed least to such change. The following chapter draws on the relevant aspects of the approaches set out here and presents the research design and methods employed to fulfil the thesis aim and objectives.

Chapter 3 - Research design and methodology

3.1 Introduction

This chapter outlines the research design and methodological process employed to achieve the thesis aim and objectives set out in chapter 1. The literature review of the previous chapter presents three theoretical propositions and related methodological issues that informed the methodological approach taken for assessing the adaptive capacity of MSES. First, the Sustainable Livelihoods Framework (SLF) is employed with the theoretical proposition that households with greater natural resource dependency are more vulnerable to SES change due to unequal distributions in adaptive capacity, and faces methodological issues such as an overly narrow focus on the local level and lack of power and time dimension. Second, social network analysis (SNA) provides the theoretical proposition that economic development effects the social relations and adaptive capacity in NRDC through differing levels of recognition among households, with methodological issues also regarding power and time dimensions. Finally, the Environmental Entitlements Framework (EEF) (Leach et al., 1999) provides the theoretical proposition that institutional procedures and processes occurring at multiple levels of governance shape the adaptive capacity of NRDC. Such an approach helps address the methodological issues of the former theoretical propositions by providing the opportunity to assess power and time dynamics between and among levels. This chapter will demonstrate how the methodological approach builds from these theoretical propositions, and how employing a multiple-case study with mixed methods and grounded theory provides an effective research design: first, to address the methodological limitations of the theoretical approaches outlined in chapter 2; and second, for analysing how governance processes at multiple-levels influence the adaptive capacity of MSES at the local level. This chapter also explores and justifies the various methods that were employed, linking them to elements of theory outlined in chapter 2. Issues relating to researcher reflexivity, positionality, and the challenges of conducting research that requires the use of translators are also addressed.

As described in chapter 1, the overall aim of this thesis is to explore how MSES change has influenced adaptive capacity in northern Vietnam. In order to determine the distribution of and processes that shape adaptive capacity within the MSES, an environmental justice lens is applied which considers livelihoods (the distribution of ecosystem services), social capital (the influence of social networks on recognition), and

institutions (the procedures of MSES governance). The following objectives were developed to achieve the aim:

1. Analyse local livelihoods to assess the distribution of MSPG within the MSES
2. Assess the impacts of key aspects of MSES change (i.e. aquaculture) on social capital
3. Explore how institutions and processes occurring at multiple levels of MSES governance are shaping local level entitlements

This chapter is structured into 9 sections. Section 3.2 outlines the research approach which comprises case studies, mixed methods and grounded theory. Section 3.3 provides details of the scoping visit conducted during April and May, 2011. Section 3.4 describes the process of study site selection, followed by section 3.5 which details the methods of data collection employed. Sections 3.6, 3.7 and 3.8 consider researcher positionality, foreign language research and research ethics respectively. Section 3.9 briefly explains the data analysis process, and section 3.10 concludes the research design and methodology chapter.

3.2 Research approach

3.2.1 Research paradigm

Research paradigms are theoretical and methodological ideas that provide intellectual context to research, guiding researchers with a basic system or worldview and ontological and epistemological assumptions (Guba and Lincoln, 1994). This research is grounded within the complexity theory paradigm (Byrne, 1998), defined by Blaikie (2010) as a way of offering:

> "*…explanatory accounts based on limited and contextual knowledge, open and unpredictable systems, and complex, non-linear interaction between elements that leads to emergent properties and self-organising structures and processes. This non-linear analysis places emphasis on interaction and feedback loops. The influence between components in a system can go in both directions at different times, and feedback iterations can change the whole system over time*" (p104).

Hence, this paradigm provides a novel scientific ontology, rejecting the epistemological traditions of positivistic science which is grounded in ideas of universal knowledge, experimental control, determinism and linear logic of causal explanation (Blaikie, 2010). Complexity theory also rejects social constructivism by contending that explanation of phenomena is indeed possible (Byrne, 1998). This resonates clearly with the recent shift away from the world-view of nature and society as systems operating at near equilibrium, to a more dynamic view of SES presented by Folke et al. (2002), which "…*emphasises complex non-linear relations between entities under continuous change. These systems face discontinuities and uncertainty from various stresses and shocks, and are self-organising to create systems far from equilibrium and characterised by multiple feedbacks and possible outcomes of management*" (p438). By considering systems as integrated wholes, complexity theory can be complemented by a case study design in order to understand emerging patterns and dynamics of SES (Anderson et al., 2005).

3.2.2 Case-study approach

For the purpose of this study, the local scale (i.e. community and households) was selected as the unit of analysis considering that the aim of this research is to explore how MSES change has influenced the environmental justice aspects of adaptive capacity in northern Vietnam. The case study approach is widely applied in social science research to explore the dynamics present within specific cases (Yin, 2014), allowing in-depth analysis of research objectives by providing more accurate and detailed data in comparison to larger scale studies (Mansuri and Rao, 2004). Hence, a case study approach was selected as it allows for comprehensive contextual analysis of events, conditions and their interactions within the broader setting (Soy, 1996) in order to understand the environmental justice aspects of adaptive capacity within MSES. The approach provided flexibility in data collection and facilitated an iterative analysis, aiding reflection and revisions in the tools employed and objectives developed as new data and issues emerged (Eisenhardt and Graebner, 2007).

Acknowledgement was given to the dangers of case studies resulting in excessively complex and context specific theory (Eisenhardt and Graebner, 2007) by drawing out generalisations across three case study sites. A multiple-level, multiple-case design (i.e. three study sites, and three study households from differing socio-economic groups in each study site) was selected for this research to provide rich data (Blaike, 2010). Despite the

context specificity of each case, commonalities can be explained across cases through analytic generalisations (Yin, 2014). These analytic generalisations were developed from the theoretical propositions that went into the initial case study design (Hay, 2010). In standard statistical analysis, generalisations are derived by conducting sample surveys and applying findings to a larger population (Fowler, 1988). However, using a case study approach meant that the case studies themselves could not be considered as sampling units as they represented too small a sample themselves to be generalizable, even with the statistical analysis undertaken. Rather, the case studies were used to shed empirical light on theoretical concepts (Hay, 2010), i.e. the analytical generalisations that go beyond the specific cases. Yin (2014) states that analytical generalisations are based on either: (1) theory that informs the initial design of the case study approach, with case study findings empirically enhancing theory (i.e. corroborating, modifying rejecting, or advancing theory); (2) a new generalisation or concept emerges from case study findings. The generalisations in research are based on the latter, by providing new generalisations regarding the environmental justice aspects of adaptive capacity. These generalisations will be at a conceptual level higher than that of the specific case and may potentially apply to a variety of situations far beyond the particular study site (cf. Blaikie, 2010). This way, it is hoped that the findings from this research on adaptive capacity of MSES in Vietnam can be of value to natural resource management dilemmas in other places and SES worldwide.

3.2.3 Mixed methods

The case study approach provides the flexibility to combine various data collection techniques. This research applied a mixed method approach to data collection in order to allow a more comprehensive set of research questions and collect a richer and stronger array of evidence than is possible using single methods (Yin, 2014). This approach enabled the collection and analysis of quantitative data in order to: establish current livelihood activities and characteristics of MRDC households in order to assess the distribution component of environmental justice regarding adaptive capacity within MSES (objective 1); develop a set of social network measures and scores of MRDC households to gain insights into the recognition component of environmental justice regarding adaptive capacity within MSES (objective 2). Qualitative analysis provided: a time dimension to household livelihoods through livelihood trajectory analysis, and an understanding of the pathways that led to the current distribution of adaptive capacity within MSES (objective 1); an understanding of the institutional processes occurring at multiple levels of governance that

shape livelihood trajectories, providing insights into the procedural component of environmental justice regarding adaptive capacity within MSES (objective 3). The added time dimension from integration of these methods provides an opportunity to analyse the extent to which social and environmental change is influencing MSES, and the processes shaping environmental justice issues and the current distribution of adaptive capacity. For example, mixed methods provided an opportunity to collect quantitative data through a household survey (section 3.5.3) to provide a snap-shot of household livelihood activities (objective 1) and social networks (objective 2) to gain insights into the distribution and recognition components of environmental justice in adaptive capacity. Qualitative data collected via transect walks (section 3.5.2), semi-structured interviews (section 3.5.4), focus groups (section 3.5.5) and secondary data (section 3.5.6) provided a time dimension relating to the livelihood trajectories (objective 1) of economically representative households, and the institutional processes shaping these trajectories and the procedural component of environmental justice in adaptive capacity (objective 3). As well as permitting the collection of diverse data and development of rich insights into MSES (Bryman and Bell, 2007), the triangulation of data sources was also possible (McKendrick, 1999).

Aspects of Participatory Rural Appraisal (PRA) were used to provide a qualitative, holistic account of MSES governance from the viewpoint of those actually engaged with and dependent on mangrove resources for their livelihoods (Zuryak et al., 2001). PRA is also conducive to the local level focus of this research, and therefore useful to MRDC as well as development practitioners, policy makers and academics (Mosse, 1994). The utilisation of transect walks, semi-structured interviews and focus groups, aimed to engage local communities and households who are the primary users of mangrove system goods and services, are highly dependent on them for their livelihoods (Carpenter et al., 2009), and hence highly knowledgeable about their characteristics and dynamics (Folke et al., 2005). Furthermore, Arce and Long (1992) state that development of such knowledge is a social process and the outcome of various struggles and interactions between social actors. Hence, PRA was applied here because embedded within such knowledge are insights into the institutional processes and procedures shaping the distribution and recognition components of environmental justice with regards to adaptive capacity within MSES.

The PRA process may nevertheless still be extractive rather than participatory (Mosse, 1994) if academics, environment and development practitioners and government bodies collect large and detailed data from communities for their own interests. This data can be a powerful source of knowledge and control. To reduce the extractive nature of the research, ongoing dialogue and feedback from the communities ensured the ownership and appropriate use of the information that the communities themselves provided. In addition, the small sample size and subjective nature of PRA leads many to consider the data obtained from PRA too fragmented to develop any generalizable conclusions or meaningful policy recommendations (Martin and Sherington, 1997). To overcome this and to avoid misinterpretation of the links between environment, livelihoods and policy, PRA was not used exclusively as a research approach but combined with others (Neefjes, 2002). Consideration was given to the variety of methodological options available before deciding to: employ a mixed methods approach to determine baseline statistical data through structured surveys; identify the opinions, perceptions and knowledge of households through transect walks and semi-structured interviews; and use focus groups to verify findings and maintain participation and ongoing dialogue with research participants (Parfitt, 1997).

3.2.4 Grounded theory

Grounded Theory recognises that theory evolves through the interplay between data analysis and collection (Hall and Callery, 2001; Eaves, 2001). Elements of grounded theory were integrated into this research (as described below) in order for the research process to be guided by themes emanating from the data and to contribute to the building of theory (Strauss and Corbin, 1990). At the beginning of the research process a comprehensive literature review was carried out in order to provide context to the research and guide the identification of theoretical propositions (Dunne, 2011). This was done using the Web of Knowledge database and using key words such as: Vietnam, adaptive capacity, livelihood, institution, social network, environmental justice, natural resource management, sustainable development, deforestation, mangroves, wetlands, coastal. Following this, fieldwork was split into three phases to allow an iterative process of data collection, summarised in Figure 3.1. The scoping phase, from April to May 2011, informed the research design used in later field visits through the identification and categorisation of key issues and themes relating to local livelihood contexts. The main data collection phase, from January to September 2012, consisted of the main data collection period and

explored the emergence of prominent themes identified by the communities themselves, namely, the effect of a rapidly developing aquaculture industry on the environmental justice aspects of adaptive capacity within MSES. The validation phase, from May to August 2013, consisted of focus groups and seasonal calendars to validate initial findings emanating from the research, and to maintain dialogue and ownership of the research by the communities themselves. Conducting fieldwork over three phases permitted an iterative process whereby data collection and analysis progressed simultaneously and lines of enquiry evolved as themes emanated from the data (Corbin and Strauss, 1990). The research therefore focused on and was directed by the priorities of the mangrove system users themselves in each study site.

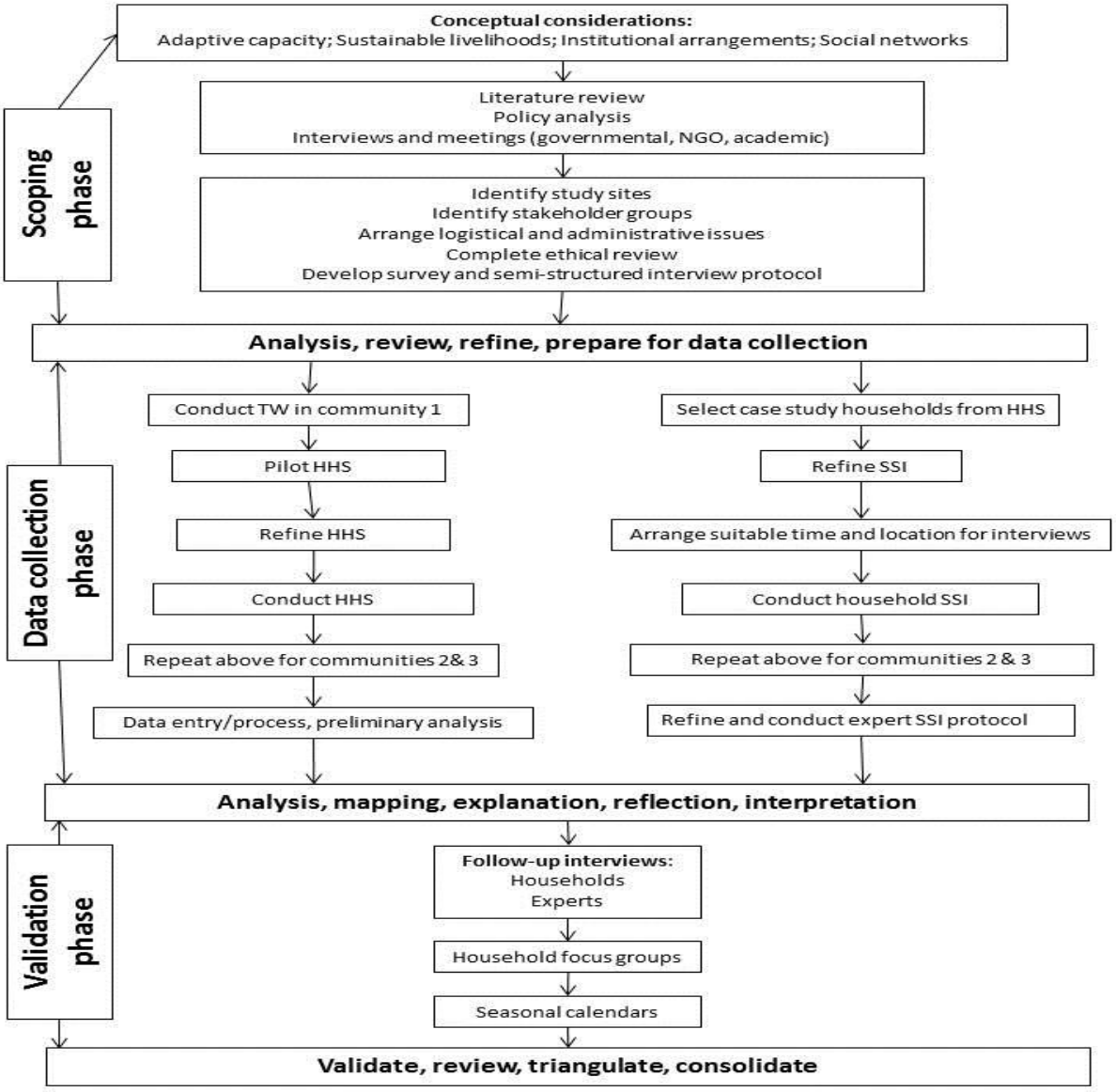

Figure 3.1: Flow chart illustrating three stage of the fieldwork plan. *Adapted from Stringer (2004)*
HHS = household survey, SSI = semi-structured interview

3.3 Scoping visit

The scoping phase (April and May 2011) facilitated contextualisation of the research and a scoping study undertaken at this time enabled a deeper general understanding to be gained of natural resource governance and the environmental justice issues facing coastal communities in Vietnam. Furthermore, it was crucial in order to gain familiarisation with and to acclimatise to the local culture, customs and conventions. A list of experts including practitioners, NGO staff, academics and government representatives working on environment and development issues in Vietnam was generated through internet searches prior to the scoping visit. Potential experts were contacted via email, with appointments made and meetings conducted with all those willing and available. The goals of these meetings were to develop the research aims, objectives and methodology by exploring the research context and issues, to identify potential study sites, to identify useful sources of secondary data, and to become acquainted with the study area and people. The meetings proved to be greatly informative with regard to current issues relating to mangrove governance. The networks of contacts developed during the scoping visit played a vital role in securing collaboration and support for future fieldwork (Table 3.1). Detailed notes were taken throughout the meetings and typed up immediately (Parfitt, 1997).

Table 3-1: Scoping study contacts and useful outcomes for the data collection phase (shaded)

Stakeholder group	Organisation	Outcome
Donor	UNDP	Secondary data, semi-structured interview respondent
	AusAid	Secondary data
Government	Department of Meteorology, Hydrology and Climate Change (Ministry of Natural Resource and Environment)	Secondary data, further state contacts
	National Institute for Science and Technology Policy and Strategy Studies (Ministry of Science, Technology and Environment)	Secondary data, further state contacts
Academic	Centre for Natural Resource and Environmental Studies (CRES)	Key collaborator, secondary data, semi-structured interview respondent
	Centre for Environmental Research and Education (CERE)	Key collaborator, secondary data, semi-structured interview respondent
	Centre for Rural Development (CRD)	Secondary data, field visit

INGO	Cooperative for Assistance and Relief Everywhere (CARE)	Key collaborator, field visit, secondary data, semi-structured interview respondent
	Netherlands Development Organisation (SNV)	Secondary data, further contacts provided
	Save the Children	Secondary data, further contacts provided
	World Vision	Secondary data
VNGO	Marinelife Conservation and Community Development (MCD)	Key collaborator, secondary data, field visit, further contacts, semi-structured interview respondent
	Sustainable Rural Development (SRD)	Secondary data, field visit
	Live and Learn	Secondary data, further contacts

Initial analysis facilitated the generation of more specific questions, ensuring that data collection concurred with an iterative process and allowing research participants to be part of the research as it developed. These initial insights were then followed up and informed the main data collection phase. This enabled a more detailed and relevant outline of the research to be developed and presented to subsequent participants in order to gain consent for their participation in the research (see section 3.8). Key informants led to further helpful contacts and professional opinions on the research too. Themes emanating from these meetings were issues relating to the reliability of official data and statistics, especially as they move between government levels and departments, a lack of civil society and community participation in management and policy decisions, inequality and environmental degradation caused by rapid economic growth, and a lack of capacity evident among state and NGO bodies at all levels.

Key collaborators for this study were established during the scoping visit, including: CARE international; Marinelife Conservation and Community Development (MCD); the Centre for Natural Resource and Environment Studies (CRES), National University of Hanoi; and the Centre for Environmental Research and Education (CERE), National University of Vietnam. All are involved with mangrove rehabilitation interventions, and CARE, MCD and CRES assisted in gaining access and the necessary formal permission to conduct research in the selected study sites. In addition, MCD and CERE provided access to working space and secondary data during the main data collection phase. The scoping visit also enabled attendance at monthly meetings with the Climate Change Working Group (CCWG), at the NGO resource centre in Hanoi. Listening to the various presentations and updates from its

members greatly increased my understanding of the Vietnamese context while also leading to a number of other useful contacts. The scoping visit also helped identify four stakeholder groups in mangrove governance who were interviewed during the main data collection phase of the research (see section 3.4.4 for further details): natural resource users, the third sector, the state, and mass organisations (Table 3.2).

Table 3-2: Stakeholder groups identified during scoping study

Stakeholder group	Description
Natural resource users	Households within communities that depend in some way on goods and services provided by mangrove systems
Donors	Primarily international organisations providing financial aid to support economic, environmental, social, and political development
The third sector	Primarily NGOs, but also including other organisations operating outside the formal state or public sphere that are not trading commercially for profit.
The state	Formal state authorities and representatives related to mangrove management at commune, district, provincial and national scales.
Mass organisations	Vietnam Fatherland Front (national level), Farmers' association, Women's Union, Youth Union, and Vietnam General Confederation of Labour

3.4 Study site selection

A number of potential study sites were identified following meetings, discussions and field visits during the scoping study (section 3.4.1). Visits to potential study sites were arranged by NGOs and university departments who assisted with obtaining permission from commune Chairpersons to visit. A shortlist of potential study sites was identified and appropriate sites were selected based on: their relevance to the theoretical propositions; and predetermined selection criteria (Table 3.3) against which each community was scored. These were reviewed, assessed and reconsidered as the scoping study evolved. Some sites were eliminated for logistical reasons as they were spread out over large areas, making research logistically unfeasible. Others were found to be unsuitable in terms of the research approach when considering mangrove coverage, aquaculture development, geography, demography, livelihoods, and climatic aspects. Sites were also selected using information-oriented sampling, whereby sites were selected that were intellectually appealing and exhibiting different but unique circumstances (i.e. different levels of aquaculture activity) (Flyvberg, 2006; Guerra, 2013). Sites representative of average

circumstances will seldom produce rich insights even if they could be identified. The selected communities were located on the north coast of Vietnam and were: Giao Xuan commune (Nam Dinh province; high aquaculture activity); Da Loc commune (Thanh Hoa province; medium aquaculture activity); and Dong Rui commune (Quang Ninh province; low aquaculture activity) (Figure 3.2).

Table 3-3: Study site selection criteria (commune names provided) (NB: Scores are 1 = low, 5 = high)

	Dong Rui	Hai Phong	Long Hoa	Giao Xuan	Thanh Hai	Da Loc	Dat Mui
Mangrove coverage	4	4	4	5	5	4	5
Aquaculture development	1	4	-	5	-	3	-
Rehabilitation projects	5	4	4	5	5	5	4
Livelihood activities	5	5	4	5	4	5	4
Climate change impacts	3	4	5	5	5	5	5
Existing data	3	4	3	5	4	3	3
Location/accessibility	5	5	0	5	0	5	0
Permission	5	1	1	5	1	5	1
Contacts in area	2	1	1	3	1	2	1
Total:	**35**	**32**	**22**	**43**	**25**	**37**	**23**

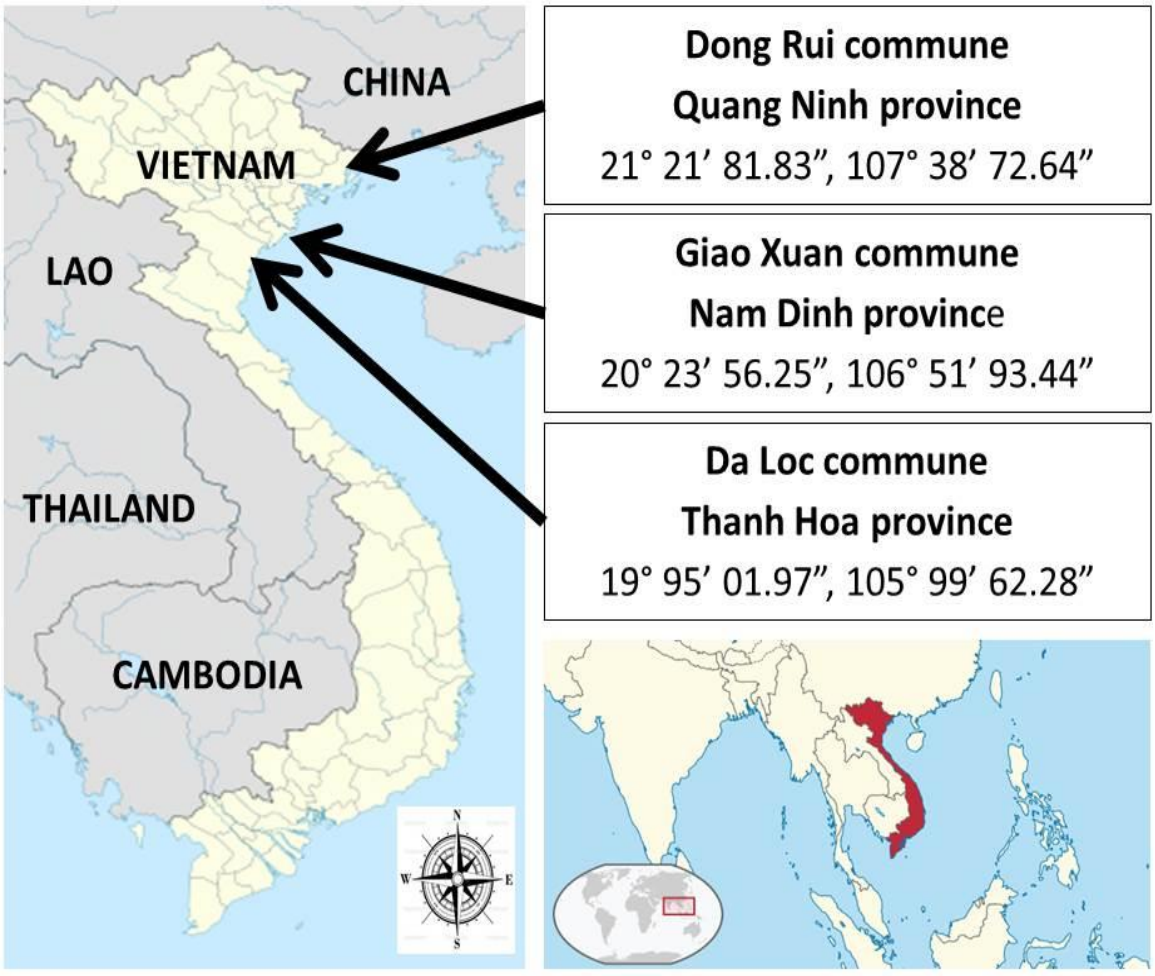

Figure 3.2: Study site locations and coordinates. *Source: Wikipedia (2014)*

During the scoping visit aquaculture was identified as a major aspect of MSES change in Vietnam. This contributed to the development of the research aims and objectives. This was also a consideration in the selection of study sites, and throughout this research each community is used to examine the impacts of different levels of aquaculture activity on environmental justice aspects of adaptive capacity within MSES. Each component of environmental justice (i.e. distribution, recognition and procedure) are related to research objectives 1, 2 and 3 (i.e. livelihoods, social capital and institutions) respectively. Giao Xuan has a highly developed clam aquaculture sector which was established in the early 1990s. The sector was facilitated and supported by emerging trading connections between local households and aquaculture investors from China following market liberalisation (1986). Giao Xuan is now one of the largest producers of clams in Vietnam supplying both domestic and international markets. Aquaculture farms are situated in the mudflat area located beyond the mangrove forest and covering the full extent of the coastline adjacent to the community. In Da Loc the clam aquaculture sector is in the initial stages of development, having been started in 2010 by local households who observed the success of neighbouring communities' clam aquaculture ventures. They have little experience, knowledge or support but productivity is rising quickly and domestic markets are rapidly growing. As with Giao Xuan, the aquaculture farms are situated in the mudflat area located beyond the mangrove forest and cover the full extent of coastline adjacent to the community. Dong Rui is situated on an island archipelago. The area experienced large scale, intense and highly productive commercial shrimp and fish aquaculture growth during the late 1980s and early 1990s, in adjacent areas surrounding the community on all sides. These ventures were carried out by investors external to the local area, who brought their own labour force to work in the fields. Following an initial 2-3 years of high productivity, the sector collapsed due to mismanagement. This resulted in severe environmental damage and the abandonment of aquaculture fields. Considering the minor impact on community livelihood opportunities and social networks, and also the time elapsed since the collapse of the sector, aquaculture is considered to be at a low level in this community.

The formal administrative levels in Vietnam are: province, district and commune levels. Provinces are centrally controlled by the national government and subdivided into districts, while districts are divided into communes. For the purpose of this research, a

community is considered a sub-set of a commune, and is defined as a socio-economic impact area of a given mangrove system (Glaser 2003). Community is used here to mean some definable aggregation of households, interconnected in some way, and with a limited spatial extent, analgous to Coombes et al.'s (1988) use of the term ''locality'' (Smit and Wandel, 2006). By studying mangroves this research focuses on the brackish shoreline at river estuaries comprised of intertidal wetlands, mudflats and mangroves. All three study sites were located on intertidal wetlands, comprising the interdependent components of trees and mudflat areas from which communities acquire provisioning goods. For the purpose of this research, MSPG refer to the collection of wild fish, clam, shrimp, crab and other shoreline animals from mangrove system areas held in common. Residents in all study sites had some degree of access to surrounding mangrove systems and used them to varying degrees as part of their livelihood portfolio.

3.5 Data collection

This research combines multiple methods to address the weakness and intrinsic biases that can emanate from single method approaches (Bogdan and Biklen, 2006). Sampling biases may lead to a distortion in the results obtained during the process of data collection (Varkevisser et al., 2003), so triangulation was used to facilitate the validation of data through cross verification from alternative sources. Developing a toolkit of methods for this research involved an initial literature search to compile a range of methodologies employed in other studies, and to assess their relevance to help achieve the research objectives (Table 3.4). In order to gain familiarisation with the local context, history and broad issues relating to environmental justice in each MSES, transect walks with local authority and NGO representatives, engaging in local livelihood activities, and informal conversation with wider community members were conducted. Trails of household survey and semi-structured interview protocols were also conducted at the beginning of the main data collection visit to each community, to test their suitability and allow adjustments to be made before the main data collection started. This was followed by household surveys, and semi-structured interviews in the main data collection phase, and follow-up interviews and focus groups in the final validation phase. The merits and drawbacks associated with each method are discussed below. The three-phase fieldwork plan allowed the refinement of household surveys and analytical and interpretive techniques following the scoping phase in preparation for the main data collection phase, and the detailed planning of follow-up interviews and the preparation of initial feedback to take place during the validation phase.

Table 3-4: Summary of relation between research aspects, methods, stakeholder group and analysis

Research aspect	Framework	Method	Group	Analysis
1 Livelihoods and distribution of environmental justice	Sustainable Livelihoods, Resilience, Millennium Ecosystem Assessment	Transect walks, Household surveys, Household semi-structured interviews	Natural resource users (NRU)	Descriptive and inferential statistics (SPSS), content analysis (NVivo)
2 Social networks and recognition in environmental justice	Sustainable Livelihoods, Resilience, Social capital	Household surveys	NRU	Social network analysis (UCInet), descriptive and inferential statistics (SPSS)
3 Institutions and procedures of environmental justice	Environmental Entitlements, Resilience	Household and expert semi-structured interviews, Secondary data	NRU Mass Organisations State Donors Third sector	Content analysis (NVivo), policy analysis, institutional analysis

3.5.1 Transect walks

Transect walks consisted of walking with key participants through the mangrove system while observing, listening and questioning them on issues relating to vegetation, land use practices, and livelihood opportunities, following recommendations of Kinyunyu and Swantz (1996). The transect walks were carried out with local level stakeholders (e.g. state officials, NGO staff, Mass Organisation members, MRDC households) (see section 3.4.3). This process proved useful in helping participants to feel at ease with the research process, since questions about their land were easily answered. It also aided the identification of problems, opportunities and solutions related to environmental justice experienced by research participants themselves (Kalibo and Medley, 2007). Data were recorded by writing notes on notepads during the walks, which were transferred and saved to electric versions as soon as possible afterwards. Transect walks yielded much useful information on the local environment, including the extent and availability of resources and the causes and effects of relationships between natural processes and human activities in each study site.

3.5.2 Household surveys

Household surveys were conducted in each of the study sites (n=248) to identify current livelihood activities (i.e. distributional justice in adaptive capacity) and the social networks (recognition justice in adaptive capacity) of local households (objectives 1 and 2 respectively) (Giao Xuan, n=79; Da Loc, n=70; Dong Rui, n=99). In the few cases where the household head was not available, another adult member of the same household was surveyed. Household surveys were developed and recorded in English, and conducted face-to-face by two trained research assistants with the researcher present where possible. The consistency of translation was ensured through training and during the trial survey to address any issues. Following the trial, refinements were made where necessary to the household survey so that it was tailored more appropriately to the local context (Parfitt, 1997) (Appendix 1 and 2). The format was altered and key terms clarified in order to facilitate the survey processes, more detailed attention was given to livelihood activities beyond mangrove use, and both the open ended question and multiple choice sections were removed due to being particularly time consuming to complete.

Initial respondent households were selected with the help of key collaborators and local participants from the scoping visits to identify key households that used the mangrove system within their livelihoods. These key households then identified further respondents for the subsequent snowball sampling (Luttrell 2006; Pereira et al. 2005). Sampling continued in a respondent-driven way until saturation of target areas had been reached (i.e. until the same names started to reoccur in the list of names provided by respondents). Although it was recognised that this approach may miss households unconnected to the network of the initial respondents, respondent-driven sampling does permit less well-known households to be identified as those best able to access members of hidden populations are their own peers (Heckathron, 1997). Reaching saturation meant that the configuration of the total sample was fully independent from the initial key respondents, hence yielding an unbiased sample (Heckathorn, 1997). Furthermore, this approach prevented time wasting by talking to respondents that were not engaged in mangrove system use, thus permitting more focussed data collection. In addition, when approaching potential interviewees through other participants in the research, the shared contact often conferred an element of trust increasing the likelihood of a positive response (Cohen and Arieli, 2011).

Whilst household surveys restrict responses to a particular structure, surveys were a useful means of collecting baseline data on current livelihood activities and the distribution of adaptive capacity (objective 1), and social networks and recognition in adaptive capacity (objective 2) given the limited time and financial constraints (McLafferty, 2003). Nevertheless, leading questions were avoided by designing concise and focussed questions that omitted any information or suggestion of a particular answer that could influence the response given (Linden and Sheehy, 2004). Survey data were collected on general household information (age, gender, education, etc.), and all subsistence and income generating activities. To enable a rigorous assessment of the relative importance of mangrove resources to household livelihoods, specific information was collected relating to the seasonality, effort involved in collection, yield and income from mangrove goods. In order to develop the social network (objective 2), households were given a name-generator question, requesting them to identify further households that they interact and exchange information with regarding mangrove system status and condition (Prell, 2012). The list of names given also provided the basis of the snowball sample.

Initial analysis of household survey data informed the household selection and protocol themes for the semi-structured interviews, consistent with a grounded theory approach to data collection and interpretation (Corbin and Strauss, 1990). Initial descriptive statistics of household livelihood data indicated that households were differentiated in terms of socio-economic characteristics, and hence the distribution component of environmental justice in adaptive capacity. As such, it was deemed important that the selection of households for semi-structured interviews should reflect this heterogeneity: to permit distinctions in livelihood trajectories to be analysed relating to objective 1; and to analyse institutional processes and procedures shaping mangrove entitlements (and hence livelihood trajectories) relating to objective 3.

3.5.3 Semi-structured interviews

Semi-structured interviews are an informal and flexible approach that can facilitate the organic raising of issues of concern to the interviewee (Hay, 2010), providing a way to gather more detailed, context-specific information on livelihoods (Dunn, 2005). The goal of the household semi-structured interviews was to collect data on issues relating to objectives 1 and 3, i.e. livelihoods and distributional justice and institutions and procedural justice respectively. Experts were considered to be those people working for a formal

organisation or institution, i.e.: donors, international NGOs, Vietnamese NGOs, government representatives, forest guards, Mass Organisations, or universities. Table 3.5 shows a break-down of all semi-structured interviews (household and expert) carried out during fieldwork. This approach facilitated rapport and encouraged participants to talk in-depth about complex issues surrounding the role of mangroves in household livelihoods (objective 1) and the institutional factors that have influenced and shaped these (objective 3) (cf. Blaikie, 2010). Two semi-structured interview protocols were created, one for experts and another for MRDC households for each stakeholder group (Appendix 3 and 4, respectively). These highlighted the topics that needed to be covered during the interview and suggested questions which might be asked for each. Topics included local livelihoods and drivers of mangrove degradation, relevant policy issues, communication with other stakeholders, knowledge and capacity and institutional arrangements. The protocols were extremely helpful in allowing the interview to take the form of a discussion, where interesting points could be followed up without overlooking other topics (Kitchin and Tate, 2000). With regards to objective 1, the information obtained from household and expert semi-structured interviews provided a time dimension and insights into power relations shaping livelihood trajectories, and the distribution of environmental justice in adaptive capacity within MSES. With regards to objective 3, semi-structured interviews with households and experts at different levels provided, in addition to time dimension and consideration of power dynamics, rich information regarding the institutional processes occurring at multiple levels of governance that shape mangrove entitlements, and the procedural justice of adaptive capacity within MSES.

Table 3-5: Break-down of semi-structured interviews conducted

	Giao Xuan	Da Loc	Dong Rui	National	International	Total
Donor	-	-	-	-	2	**2**
International NGO	-	1	1	-	2	**4**
Vietnamese NGO	1	-	-	1	-	**2**
Government	2	2	2	2	-	**8**
Forest guard	1	1	1	-	-	**3**
Mass Organisations	1	2	1	-	-	**4**
University	-	-	-	2	-	**2**
Household	10	10	10	-	-	**30**
Total	**15**	**16**	**15**	**5**	**4**	**55**

Semi-structured interviews with households provided in-depth historical and current perspectives on livelihood strategies, related trajectories, and local formal and informal institutional arrangements (n=10 in each community; total n=30). Semi-structured interview protocols were developed and informed by the scoping study in each community

in order to identify key livelihood and institutional issues relating to mangrove change that were problematic to that community. In-depth responses that could not be ascertained from household surveys were obtained through the more favourable and flexible open questions of a semi-structured approach (Parfitt, 1997). The use of this method meant that different topics received different amounts of attention from each respondent according to their priorities (Dahlberg and Blaikie, 1999). In order to maintain focus, the first section of the interview focussed on the current state of the mangrove system area. The second section moved on to allow respondents the opportunity to postulate the possible reasons as to why and how the local environment reached its current state, providing a crucial historical time dimension to the data.

Experience gained during the scoping phase suggested that interviews with local level governmental representatives were best arranged face-to-face, through an intermediary (e.g. key collaborators) or over the phone once an introduction had been made by an intermediary. In line with local customs and conventions, commune chairpersons were visited prior to any study site visit, and interviews were arranged at a convenient time for both parties, and confirmed by a follow-up phone call closer to the time of the interview. Interviews with national level governmental representatives were best arranged through email once a formal introduction through an intermediary had taken place and the relevant documentation checks had been conducted. The majority of interviewees were very willing to participate and answer all questions. However, interviews with experts were not voice recorded as key collaborators suggested this would not be suitable and may be deemed intrusive. Expert interviews were conducted to elucidate insights into the formal and informal institutional arrangements and change, and the influence of laws, regulations and policies regarding mangrove system resources. Identification of respondents for expert interviews employed a combination of purposive and snowball sampling (Babbie, 2005; Patton, 1990) to include individuals internal and external to the communities under study, from local to international governance levels. Those internal to the communities included local government officials, mass organisation representatives (i.e. union and association heads), forest guards and NGO staff, while those external included national level government officials, international and Vietnamese NGO staff, and academics directly associated with mangrove related issues. Interviews were conducted during all three fieldwork phases.

3.5.4 Focus group discussions

Focus groups are a participatory method of data collection and have become an increasingly popular method of qualitative research in the social sciences (Burgess, 1996; Goss, 1996; Longhurst, 2003). Like other participatory methods, a key characteristic of this method is the interaction between participants, with the data obtained said to better reflect the social nature of knowledge rather than the collection of individual accounts (Goss and Leinbach, 1996). Focus groups can be used at any stage of a study, and in this research they were conducted in the validation phase in order to explore the degree of consensus between households regarding annual livelihood patterns and temporal aspects of mangrove use (objective 1), and the role and influence of formal and informal institutions regarding mangrove management (objective 3). Consideration was given to the knowledge and information generated during focus groups as it can often be a product of existing power relations and can lead to the consensus view being a reflection of the view of the most powerful (Mosse, 1994). To overcome this, care was taken to ensure effective facilitation through trained research assistants. All members had the opportunity to contribute their opinion and no individual in the group was allowed to dominate the discussions.

One focus group was conducted in each community (n=3). A list of topics was identified (based around the household semi-structured interview themes) before the start of the focus groups to ensure some structure and direction, with more emphasis given to clarifying issues which seemed unclear during earlier data collection. In addition, the constraints and institutional processes relating to mangrove use and management and corresponding to the livelihood vulnerability context were explored (Kinyunyu and Swantz, 1996). This was achieved by developing a matrix of months on one side and a list of livelihood activities on the other. A further matrix was developed indicating the level of mangrove use by households and the level of support provided by relevant formal and informal institutions throughout the year, particularly during times of hardship. Each focus group session ran for approximately 3 hours, and approximately 20 household heads were invited to participate in order to achieve attendance of between 5-12 participants, suggested as the optimal number by Hay (2010). Household heads were selected from the most mangrove resource dependent groups in each study site. This ensured a grouping of relatively homogenous households where participants were able to freely express their opinions. In addition, other household heads found to be particularly cooperative and

enthusiastic during previous data collection periods were also selected. Trained research assistants facilitated focus groups by introducing and outlining the points to be covered, carefully wording questions, topics and phrases, preparing prompts to maintain momentum and ensure that there was relatively equal participation from all participants, keeping the discussion focussed and gaining closure on questions (Coldwell and Herbst, 2004).

3.5.5 Secondary data

Secondary data were obtained from relevant government departments and ministries in addition to the primary data collected during the research. Secondary data were collected primarily for objective 3, from government ministries and departments, international and Vietnamese NGOs, and donors, purposefully selecting key formal institutions (i.e. openly codified, established and communicated through official channels) post land and market reform (i.e. 1986). Documents that were identified included policies, regulations, reports and documents relating to mangrove systems (i.e. forests, wetlands, and fisheries). The process and analysis of using secondary data is further discussed in chapter 5 (section 5.2). The collation of government policies with livelihood dimensions helped identify connections between national policies and formal and informal institutional arrangements, as well as providing baseline country and local level information where appropriate and necessary.

3.6 Positionality

Positionality refers to the social position of the researcher in relation to participants of the research process and is influenced by a number of factors including race, gender, education, class, family status, and other social identities (Merriam et al., 2001). Positionality is a particularly important consideration when conducting research in rural areas involving human subjects as it has the potential to influence or bias responses, making data unreliable (Mather, 1996; Twyman et al., 1999). Throughout this study, the researcher introduced himself as a student from the University of Leeds, UK. This association was important to local respondents' perceptions of the researcher as an academic interested in knowledge accumulation for academic purposes. Commune chairpersons were informed that the researcher was working independently of the organisations and individuals that had acted as intermediaries in gaining permission and

access to study sites. Regarding other aspects of positionality such as gender, class and race that may distinguish the researcher from research participants, extended visits to each study site, unaccompanied by representatives from formal organisations, being hosted by local families, and participating in household and community livelihood activities and social events, fostered trust between the researcher and local residents. Local residents were found to be incredibly welcoming and willing to participate and discuss various aspects of mangrove issues and community life.

With regards to the issue of being perceived an 'insider' or 'outsider' (Herod, 1999), a number of key collaborators and residents informed me that people would be more willing to discuss issues with me as I would not pose a threat or any danger to them, and that people would be appreciative of the opportunity to share their opinions with an 'outsider'. Furthermore, to ensure the fullness of responses and to reduce any hesitation that participants may have due to the researcher's positionality, participants were repeatedly reassured that their anonymity would be retained at all times throughout the research process. Although the research assistants engaged in the research process were Vietnamese and familiar with the cultural contexts in the study communities, they were briefed on the importance of their own positionality in the research and how they should explain this to respondents. Measures taken to mitigate the influence of age, class and gender aspects of positionality were: to use the experience of research assistants in dealing with these situations in their personal and professional life; and to state that research assistants were employed by the researcher from reputable Hanoi universities based on their academic credentials. The courteous, gregarious and convivial nature of the research assistants greatly enhanced their acceptance and trust within the communities.

3.7 Foreign language research

Research conducted across cultural contexts in a foreign language requires consideration of multiple meanings and realities involved in the translation and interpretation of any texts (Smith, 1996). Translators, being Vietnamese, were able to conduct household surveys themselves after training, with very few points of clarification required while conducting surveys. For household semi-structured interviews, detailed notes were taken by the researcher during the interview process, and no voice recorders were used on the advice of key collaborators. Subsequently, only data produced through the translators can be accessed and as such, interpreting meanings from data involved careful consideration of

the context that they were collected in (Smith, 1996), regarding what was already known about each study site, and discussion about the meaning of the data both during and after data collection with translators. Whilst it is inevitable that translation will produce diminished and distorted interpretations (Smith, 1996), it must be recognised that research conducted in a native language is also subject to the same limitations as data is always interpreted by the researcher to some extent, maintaining the power to select which voices are heard and which quotations are included in the research (England, 1994). Interviews with government officials, NGO staff and academics were conducted in English rather than Vietnamese.

3.8 Ethics

Before fieldwork commenced, this research was approved by the University of Leeds Ethics Review Committee (Ref. No. AREA 11-057: Appendix 5) and cleared the necessary risk assessment procedures (Appendix 6). Ethical considerations ensure the humane and non-exploitative collection of data, and were necessary to safeguard research participants, the research process and the credibility of the research findings (Flick, 2009). Broadly, two main ethical issues were considered: participants' consent and confidentiality of data. Consent was granted verbally by each participant before collecting data. The research was introduced to potential respondents by providing a short overview letter explaining the research aims, along with a consent form (Appendix 7 and 8). This highlighted that I was looking at current and historical activity surrounding mangroves and how they contribute to livelihoods in Vietnam, and that my assistant and I would like to ask them some questions about their lives and activities relating to the mangrove system. The introduction was given to every household as part of the process of gaining informed consent, and participants were provided with information sheets that explained the full nature and purpose of the study. Participants were recruited voluntarily, were not compensated, were assured that the information would be used for research purposes only (including academic publications), were given the opportunity to ask questions before providing consent, were assured of their anonymity throughout the research process, and that they had the option to withdraw from the research at any time while the researcher was in the community. To comply with confidentiality, data (both hard and electronic copies) were not shared with anyone except the researcher and research assistants. Electronic data were stored on encrypted memory sticks and password protected computers for a short period before

being transferred onto University of Leeds servers. Participants were assured that their names would always be kept anonymous.

3.9 Data analysis

Household heads were determined through analysis of survey data to represent the individual contributing the largest amount to household income. This was for two reasons. First, mangrove system livelihood activities tend to be the greatest contributor to household incomes, and hence the individual contributing the largest portion of income will be more knowledgeable about the mangrove system. Second, because these individuals will have a good sense of the household's current livelihood situation (Jansen et al., 2006). Data were collected utilising a number of different methods and were input, transcribed and processed with preliminary analysis conducted at the earliest opportunity to avoid misinterpretation of ambiguous notes. This is consistent with the grounded theory approach of allowing data collection to inform subsequent collection (Chiovitti and Piran, 2003). Data analysis was iterative and initially involved descriptive analysis to identify trends and patterns in preliminary data collected during scoping studies in each community. More detailed analysis was conducted as quantitative and qualitative data accumulated.

For objective 1 regarding issues relating to livelihoods and MSPG, statistical analysis of household surveys was conducted using SPSS (IBM SPSS 19), initially to create descriptive statistical summaries. Livelihood variables were then grouped using SPSS two-step cluster analysis (Table 3.6) and tested against the dependent variable of percentage of household income derived from MSPG (Brouwer et al. 2007) using Kruskal-Wallis and Mann-Whitney inferential tests (Ahenkan and Boon 2011; Cox et al. 2010). Qualitative data from semi-structured interviews were coded using NVivo 9 software under different 'nodes' to group data into similar emerging themes relating to livelihood resilience or vulnerability (cf: Kaplowitz and Hoehn 2001; Kaplowitz 2001). As coding progressed the themes became more detailed, permitting similarities and differences between data to be identified and relevant nodes selected. Data were continuously re-evaluated during the analysis process permitting new connections between data to be formulated. Analysing livelihood activities in this way provided insights into the distribution of adaptive capacity within MSES, as livelihoods are a crucial component of adaptive capacity that households use to respond to MSES change.

Table 3-6: Breakdown of group clusters in independent variables tested

	Giao Xuan	**Da Loc**	**Dong Rui**
Age (years)	20-29 (n=8) 30-39 (n=15) 40-49 (n=28) 50-59 (n=23) 60+ (n=5)	20-29 (n=8) 30-39 (n=15) 40-49 (n=28) 50-59 (n=23) 60+ (n=5)	20-29 (n=8) 30-39 (n=15) 40-49 (n=28) 50-59 (n=23) 60+ (n=5)
Gender	Male (n=61) Female (n=18)	Male (n=43) Female (n=27)	Male (n=68) Female (n=31)
Education	Low: secondary or lower (n=59) High: tertiary or higher (n=20)	Low: secondary or lower (n=42) High: tertiary or higher (n=26)	None (n=8) Primary (n=23) Secondary (n=50) Tertiary (n=13 University (n=5)
Years in commune (years)	Low: <25 (n=22) Middle: 25 - <50 (n=36) High: >50 (n=15)	Low: <25 (n21) Middle: 25 - <39 (n=21) High: >39 (n=21)	Low: <14 (n=25) Middle: 14 - <31 (n=24) High: >31 (n=50)
HH members	Low: <3 (n=21) Med: 3 – 4 (n=43) High: >4 (n=15)	Low: <4 (n=14) Med: 4 – 5 (n=41) High: >5 (n=15)	Low: <4 (n=70) Medium: 5-6 (n=25) High: >6 (n=4)
Livelihood diversity	Low: <2 activities (n=15) Med: 3 activities (n=31) High: >3 activities (n=33)	Low: <5 (n=22) Med: 5 (n=28) High: >5 (n=20)	Low: <3 activities (n=5) Med: 3-4 activities (n=47) High: >4 activities (n=47)
Income ($per capita)*	Low: 0-730 (n=17) Middle: >730-<1,330 (n=28) High: >1,330	Low: <350 (n=23) Middle: 350 – 800 (n=24) High: >800 (n=23)	Low: 0-572 (n=32) Middle: 573-1,156 (n=34) High: >1,156 (n=33)
Tenure rights	Low: MSPG only (n=50) Med: emp/CAC** (n=10) High: IAC*** (n=19)	Low: MSPG only (n=23) Med: emp/CAC** (n=38) High: IAC*** (n=6)	Low: MSPG only (n=99)

* US$1 = 21,000 Vietnamese Dong (VND), US$1 = £0.59, £1 = 32,000 VND

** aquaculture farm employee or partner in collective aquaculture farm venture

*** individual aquaculture farm venture

Turning to objective 2, Using SPSS v19, frequencies of livelihood characteristics (i.e. income, mangrove system dependency, tenure rights and livelihood diversity) were first explored. To represent connectivity, focus was on six key social network metrics; density, degree centrality, betweenness centrality, effectiveness, efficiency and constraint (see chapter 2: section 2.6.2). UCINET 6 software was used for social network analysis, which is the most utilized software package for this purpose (Borgatti et al., 2002). Once livelihood and connectivity measures were attained, Kruskal-Wallis and Mann-Whitney tests were conducted (Ahenkan and Boon, 2011; Cox et al., 2010), with livelihood indicators as independent variables, tested against the dependent social network structural measure

variables (Brouwer et al., 2007) in order to ascertain how livelihood characteristics have influenced household social connectivity. Analysing social capital in this way provided insights into the recognition in adaptive capacity, as social networks shape the affiliation of households with the networks of MSES governance.

For objective 3, concerning institutional processes at multiple levels of MSES governance that shape mangrove entitlements and provide insights into procedural justice, qualitative data from semi-structured interviews were analysed in the same way as objective 1. Detailed analysis was conducted as data accumulated, involving coding the interview data under themes relating to endowments, entitlements and capabilities. During analysis, themes were sub-categorised according to the influence of state, private and NGO actors, and informal institutions in determining household access to and control over MSPGs. This facilitated identification of aspects of change that had played a major role in household access to and control over MSPG. Informal institutions were identified through literature searches and by examining instances in which similar formal rules produced divergent outcomes, and where stable patterns of behaviour did not correspond with formal rules (North, 1990). This was achieved by: determining respondents' shared expectations and mutual understandings of formal rules; defining the community to which the rules apply (i.e. the socio-economic impact area of mangrove systems); and ascertaining how informal rules are enforced and managed, such as through gossip, ostracism, hostility or other displays of social disapproval (Helmke and Levitsky, 2004). Extensive time spent in each study site between April 2011 – August 2013 facilitated knowledge and understanding of the context within which informal institutions operate. Analysing institutions in this way provided insights into the procedures that shape the creation and maintenance of distribution and recognition justice of adaptive capacity within MSES.

Internet searches and secondary data from international NGOs and donors, the national state, NGOs, and academic respondents were used to purposefully select key formal institutions (i.e. openly codified, established and communicated through official channels). These included organisations, policies, regulations, reports and documents relating to mangrove system endowments and endowment mapping (i.e. forests, wetlands, and fisheries). To assess awareness of the integrated nature of mangrove SES within these formal institutional structures, key official documents and organisations were analysed

thematically (Ritchie et al. 2003) to understand the coherence and interaction of formal arrangements, as embedded within policy documents and institutional structures (Sharp and Richardson 2001).

Emerging contradictions and similarities across different data sources were exposed or validated through repetitive triangulation. Continual iterative reflections were carried out jointly with research participants as further data and results emerged to determine how and why any conflicts in information may have occurred. Any conflicts or contradictions occurring in the data were either resolved by validation with data collected from respondents across household categories and stakeholder groups, or were explored further to ascertain whether conflict or consensus was observed between or within household and stakeholder groups. This was done via continual dialogue through follow-up interviews and focus group discussions. It resulted in a cyclical process culminating in inductive interpretation and explanation of results as livelihood system data was positioned within the developing socio-economic and political context.

3.10 Conclusion

This chapter has set out the research design and methods. It highlights how the research objectives and theoretical propositions of the research informed the decision to base the research in a complex theory paradigm, using a multiple-case mixed methods design and incorporating aspects of grounded theory. Addressing the research objectives in this way provides the opportunity for developing potential intervention points for improved MSES management. This chapter has also presented three theoretical propositions that will enable generalisation of findings, and illustrated how these propositions informed the study site selection process, MSES with differing levels of aquaculture activity. The integrated mixed method approach employed for data collection in relation to each research objective has been detailed. These methods will be further elaborated in the subsequent chapters that address specific research objectives. Issues concerning researcher positionality, research conducted in a foreign language and research ethics have been addressed. The various techniques of quantitative data analysis have been illustrated, with cluster analysis and subsequent statistical and network analysis having been outlined. The methods of qualitative data analysis have also been elaborated. The next three chapters (chapters 4 to 6) present the results of this research, which were obtained during the processes described in this chapter.

Chapter 4 - Linking ecosystem service and livelihood trajectory approaches to understand mangrove use

4.1 Introduction

Southeast Asian mangroves are the most biodiverse in the world (Friess et al., 2012), and the goods and services they provide are important components of coastal rural livelihood strategies (Van Hue and Scott, 2008). However, throughout the region, rapid development has significantly altered wetlands, causing widespread degradation and mangrove loss (Seto and Fragkias, 2007; Gopal, 2013). In Vietnam, political and economic reform has facilitated rapid development and vast areas of mangroves have been converted to large scale, intensive agriculture and aquaculture (Tri et al., 1998). Degradation occurs through deliberate and inadvertent actions resulting from undervaluation of wetland functions and processes (Vilardy et al., 2011). Political, socio-economic and environmental shocks and stresses on ecosystems negatively impact the structure, function, and flow of services provided to society, causing significant impacts on human welfare (Martin-Lopez et al., 2009; MEA, 2005). Households respond to MSES change through their livelihoods, which are shaped by past livelihood decisions. This influences the trajectory of household livelihoods which can steer MSES and MRDC households down particular pathways (cf. Bagchi et al., 1998). This particularly threatens MRDC due to their reliance on these services for their survival (Dasgupta, 2007). Studying the livelihoods of MRDC in Vietnam can provide greater insights into the interdependencies of human activity and mangrove goods and services. Furthermore, as MRDC respond to MSES change through their livelihoods, analysis livelihood differentiation within MRDC provides insights into the distributional justice of adaptive capacity within MSES. By understanding the context that contributes to particular livelihood trajectories, planning can be targeted towards those most in need of support.

This chapter relates to objective 1, to analyse local livelihoods to assess the distribution of MSPG within MSES. The research questions are: (1) What are the key aspects of MSES change? (2) What range of livelihood strategies/activities are MSES dependent households engaging in? (3) Are there specific household characteristics related to differing levels of mangrove system provisioning good (MSPG) dependence? (4) What factors have influenced the livelihood trajectories of MSES dependent households? Using a

sustainable livelihood framework (SLF) and trajectory analysis provides insights into environmental justice through assessment of the current distribution of adaptive capacity within MRDC, and how this has been shaped by past livelihood decisions in response to MSES change. The ecosystem services framework provides the opportunity to categorise the goods and services that households receive from mangrove systems, and compare how past livelihood decisions have shaped current levels of mangrove use between and among MRDC. Charting changes onto specific household livelihoods over time provides the opportunity to explore how processes of change have influenced livelihood trajectories. This provides important insights into the factors that have shaped past livelihood decisions and the current distribution of adaptive capacity, which will be crucial for future mangrove system planning, allowing the identification of key livelihood vulnerabilities and the factors that cause them. It will be argued that, in the context of rapid MSES change, intensive large scale commercial aquaculture is undermining mangrove system services and creating livelihood dependency on aquaculture related activities. Those households from lower socio-economic groups, lacking the necessary resources to take advantage of the opportunities of aquaculture, find themselves increasingly marginalised and dependent on a significantly reduced and degraded mangrove commons, locking-in their livelihood trajectories characterised by vulnerability. The unequal distribution of mangrove goods and services subsequent to rapid growth in aquaculture has implications for the environmental justice aspects of adaptive capacity within MSES. This is because the negative environmental impacts have disproportionately burdened marginalised households, who have contributed least to MSES change through lack of ability to engage in aquaculture activities.

The next section briefly summarises the research process in relation to the data used in this chapter. This is followed by narratives of mangrove system dynamics within each study area, exploring the political, socio-economic and environmental aspects contributing to contemporary livelihood strategies. Quantitative analysis then offers insights into the contribution of mangrove systems to households' current livelihood portfolios. Livelihood trajectories of individual households are then examined, providing an essential temporal dimension to analysis. Lessons from such insights are then discussed with regards to household differentiation in the use of mangrove goods and services, and the implications for distribution of adaptive capacity in MSES, the understanding of which is crucial to achieve environmental justice in future mangrove planning.

4.2 Materials and methods

A mixed method approach was taken to obtain the data presented in this chapter (see section 3.2.3 for details). Household surveys were conducted with household heads to identify current livelihood strategies and resource use patterns (see section 3.5.2 for details). For the purpose of this study, household heads represent the individual contributing the largest amount to household income. Semi-structured interviews provided in-depth historical and current perspectives on livelihood strategies and related trajectories (see section 3.5.3 for details). These sought to elucidate: how households use mangrove goods and services; drivers of mangrove system change (degradation, storm damage etc.); and, the political, socio-economic and environmental factors that have shaped livelihood decisions in response to MSES change.

To answer research questions 1-3 of this objective, survey data were collected on general household information, all livelihood subsistence and income generating activities, and all activities specific to MSPG subsistence and income generating use (see section 3.5.2 for details). For details of the sampling method, see section 3.5.2. To answer research question 4, livelihood trajectory data were collected through semi-structured interviews (see section 3.5.3 for details). The time span covered by the interviews was limited to the period 1975-2012. This covers Vietnam's reunification to the present day, encapsulating the collectivised farming era and subsequent changes in economic policy, land allocation, and decentralisation of the forestry sector: significant events in setting the boundaries of the livelihood context. Employing a livelihood trajectory analysis helps to identify key aspects of change over time, and enhances understanding of the influence of mangrove system and household responses to change. Identifying current differentiation in mangrove goods and services use, and understanding the factors shaping past livelihood decisions in response to MSES change is vital for future planning. This provides the opportunity to address the gaps in the literature relating to: the limitations of SLF and ecosystem service approaches which fail to adequately consider temporal dimensions and power relations; the distribution of mangrove goods and service use and the implications for the environmental justice aspects of adaptive capacity within MSES. For details of how quantitative and qualitative data were analysed, see section 3.9.

4.3 Results

4.3.1 Key aspects of change in the mangrove system

Mangroves perform a vital role in the productivity of highly dynamic wetland ecosystems, the provision of which is largely determined by a complex set of political, socio-economic and environmental aspects. Key factors relating to mangrove change were identified by research participants during semi-structured interviews (Table 4.1). Large-scale and intensive commercial aquaculture, privatisation of land use rights, and the role of local authorities were important in all three communities, along with market liberalisation, participation and pollution in Giao Xuan, Da Loc and Dong Rui respectively. In Giao Xuan and Da Loc, the term aquaculture refers to large scale and intensive commercial clam cultivation along the shoreline, and in Dong Rui aquaculture refers to large scale and intensive commercial shrimp cultivation. The unique interaction of factors has defined the contours of the local livelihood context, creating both opportunities and threats to the portfolio of livelihood activities available to households over time. Although these factors relate to political, socio-economic and environmental aspects, they are intricately linked and frequently overlap.

Table 4-1: Factors of mangrove change. The percentage of interview respondents identifying specific factors in respective communities is provided, while (-) indicates that a factor was not identified (sample sizes: Giao Xuan, n=15; Da Loc, n=17; Dong Rui, n=15)

Factors	Giao Xuan	Da Loc	Dong Rui
Aquaculture	73%	71%	87%
Property rights	47%	29%	67%
Local authorities	53%	29%	60%
Pollution	40%	18%	54%
Markets	54%	29%	14%
Participation	-	41%	40%
Household use	40%	6%	40%
Regulation	30%	18%	30%
Awareness/education	33%	6%	27%
Ecological processes	20%	18%	-
Population	20%	23%	-
Severe weather	20%	6%	7%
Infrastructure	20%	6%	-
Finance	20%	-	-
National policy	13%	-	-
Knowledge/skills	13%	-	-
War	**7%**	**-**	**-**

MSPG played a key role in livelihoods during the collective farming era (1975-1986). During this time agricultural land was allocated to households while wetlands were considered common property, although community rules and traditions determined what people could and could not do. There were no markets for MSPG, but in all three communities, wetlands were still a core source of livelihoods, and households collected MSPG with little incentive to overexploit. The lack of formal legislation for wetlands meant that emerging regulatory frameworks struggled to keep pace with changing social, political, economic and environmental conditions facilitated by political and economic reform. This is clearly demonstrated by market liberalisation (from 1986), which fostered lucrative domestic and international markets for MSPGs. Changes to the Land Law (1993) also devolved land management from the central state to individual households.

Subsequently, during the early 1990s, aquaculture was established on the intertidal mudflat areas in Giao Xuan, with some households benefiting from strong trade links with China which facilitated entry to the lucrative clam market. Aquaculture took longer to establish in Da Loc due to a lack of trade links and relatively little knowledge of aquaculture farming and techniques. However, in the late 2000s locals observed the financial benefits gained through clam farming in neighbouring provinces and aquaculture increased. Increasing numbers of people in Giao Xuan and Da Loc claimed sections of land in mangrove areas in order to establish clam farms and this caused conflicts within communities. Local authorities intervened by dividing mangrove system areas into plots and holding auctions to redistribute land to local households, thus benefiting financially through the auction processes and subsequent land taxes. Wealthy households and those closely connected to local authorities gained disproportionately.

Following the Sino-Vietnamese War (1979), extensive mangrove areas formerly settled by ethnic Chinese groups in Dong Rui (approximately 100km from the Chinese border) were resettled by ethnic ‘Kinh’ Vietnamese from nearby Hai Phong city. Subsequent to economic reforms, huge swathes of mangrove were sold to shrimp aquaculture investors from Hai Phong city and surrounding coastal provinces, who had connections to the newly established local authorities. This was done without consulting the community, often illegally by signing land use contracts using the names of friends, family and community members to circumvent restrictions on the amount of land any one person could own.

In all three communities, in addition to poorer households having a vastly reduced area from which to collect MSPG due to the imposition of private tenure rights, the quantity and quality of MSPG has also reduced due to the environmental impact of increased aquaculture. In Giao Xuan and Da Loc there was great concern regarding disease outbreaks (i.e. infections caused by viral, bacterial and parasitic agents) from aquaculture. Fears were also raised regarding the combined ecological impact of importing vast amounts of alien clam species and associated sand varieties in order to prepare land for intensive cultivation. Alien species can outcompete and reduce the numbers of naturally occurring local species, while imported sand varieties alter the local environmental conditions that local species require to thrive. Regarding aquaculture in Dong Rui, the main apprehensions involved the cutting of mangroves and the alteration of hydrological flows that regulate and support the ecosystem. These, along with the impact of pollution from the waste discharge of the growing aquaculture industry, were the main concerns of households. This was due to the recent experiences of the community which observed the complete collapse of the aquaculture industry (which was owned by external investors) due to mismanagement by local authorities, causing severe and widespread degradation to surrounding wetland areas.

4.3.2 Current livelihood strategies of communities

In the context of the above dynamics and livelihood challenges, and considering divergent historical perspectives, each community exhibits a distinct set of livelihood strategies and corresponding activities. The current success of the aquaculture industry in Giao Xuan has resulted in rapidly increasing incomes, represented by significantly higher average annual income per capita than Da Loc, and higher average annual incomes than in Dong Rui where the aquaculture sector collapsed (Table 4.2). In Giao Xuan, although aquaculture has significantly contributed to higher incomes, especially for aquaculture farm owners, high inequality is reflected in the range of average total household incomes. Despite comparable levels of average total household income between Da Loc and Dong Rui, the almost three times greater income range in Da Loc suggests the growing aquaculture industry is increasingly impacting upon income inequality. Households with higher incomes are clam farm owners and employees. Although Giao Xuan and Da Loc have more livelihood activities available for households to engage in due to aquaculture farming and

employment, it is Dong Rui which has the highest relative number of livelihood activities engaged in per household (i.e. percent of available livelihood options engaged in). This indicates that there is lower livelihood diversity among households where there is a larger aquaculture industry. Furthermore, in Giao Xuan and Da Loc where the aquaculture industry is prevalent, households are engaged in a lower percentage of the total available livelihood activities compared to Dong Rui, where households have had more diverse livelihoods, even before aquaculture collapsed, as they were not directly involved or employed by it.

Table 4-2: Community income and livelihood diversification

	Giao Xuan	Da Loc	Dong Rui
Average total household (HH) annual income ($)	18,618	4,116	3,442
Average total HH annual income range ($)	743-714,286	157-50,000	400-16,571
Total number of livelihood activities available	10	10	8
Average number of livelihood activities per HH	3.28	4.91	4.33
% of HH livelihood activities undertaken of those available	33	49	54

In all three communities mangrove system (i.e. wetland) livelihood activities contribute a significant proportion of total income (Figure 4.1). Conversely, even though 100% of households in each community are engaged in on-farm activities, these tend to be for household consumption and contribute only a small proportion of total income. Although a smaller proportion of households are engaged in off-farm livelihood activities in all communities, income from these activities contribute a larger proportion compared to on-farm activities. Households with more income from on-farm and off-farm activities tend to have lower amounts of income from mangrove systems.

Specific livelihood activities relating to mangrove systems in all three communities are the ownership of aquaculture farms, employment on aquaculture farms, and collection of wild fish, clam, shrimp and crab from the mangroves for household consumption and/or sale (Figure 4.2). A significantly lower number of households were engaged in collecting MSPG in Giao Xuan, where aquaculture is well established, compared to Da Loc and Dong Rui ($\chi2=89.4$, $p=0.000$, $phi=0.6$). However, within Giao Xuan, households with lower income ($\chi2=14.1$, $p=0.001$, $phi=0.42$), female heads ($\chi2=7.4$, $p=0.007$, $phi=0.3$), fewer land use rights ($\chi2=21.4$, $p=0.000$, $phi=0.52$), and high livelihood diversity ($\chi2=24.9$, $p=0.000$, $phi=0.56$) were significantly more likely to collect MSPG. There was no significant association between collecting MSPG and household characteristics in Da Loc, and because all households in Dong Rui are engaged in collection of MSPG, no association was found.

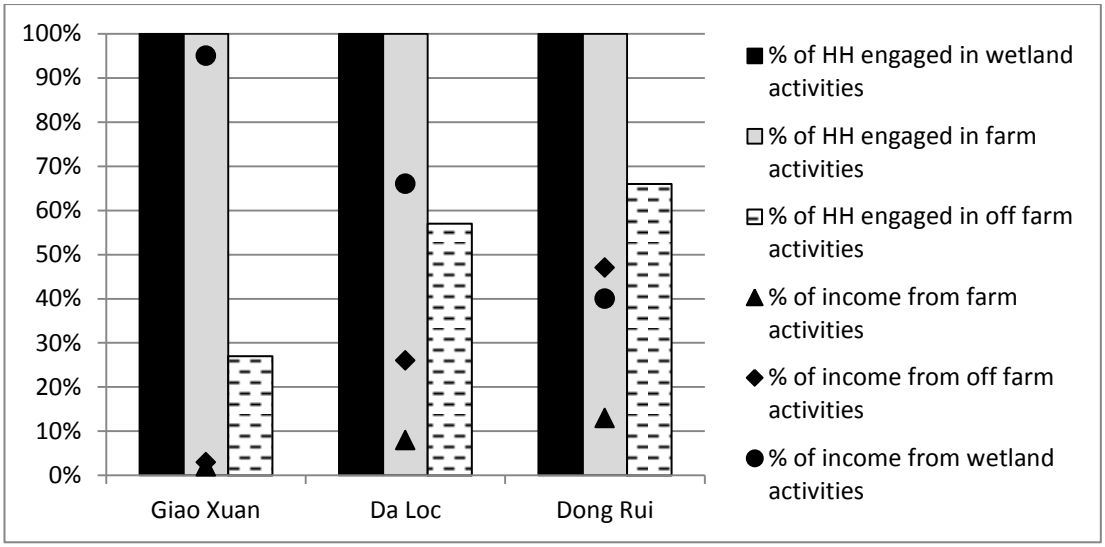

Figure 4.1: Livelihood categories (wetland, on-farm, and off-farm) and percentage contribution to total income. Wetland activities comprise aquaculture farming, aquaculture employment and wild foraging. On-farm activities comprise crop cultivation (sweet potato, peanut, maize, bean, chilli, sugar cane and fruit) and livestock tending (buffalo, pig, chicken and duck). Off-farm activities include fishing, industry, service, migration and other. Sample sizes: Giao Xuan, n=79; Da Loc, n=70; Dong Rui, n=99.

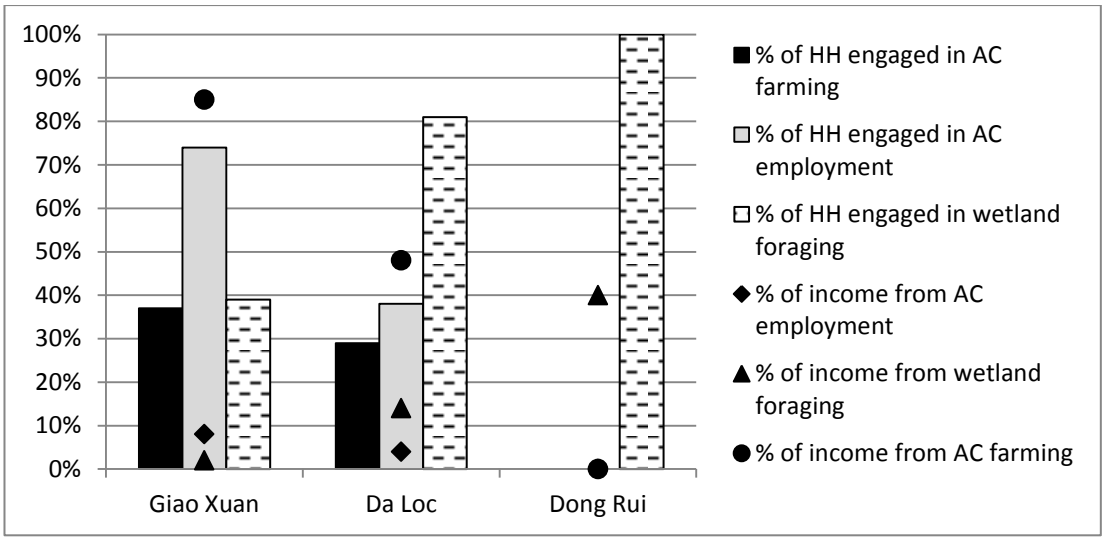

Figure 4.2: Breakdown of wetland livelihood activities (aquaculture farming, aquaculture employment and wild foraging) and per cent of total income. Sample sizes: Giao Xuan, n=79; Da Loc, n=70; Dong Rui, n=99. *NB: AC= aquaculture*.

In Giao Xuan, the percentage of households engaged in aquaculture farming (37%) represents a substantial proportion of total income for that community (85%). Although a higher percentage of households are engaged in aquaculture employment (74%), the proportion of income gained through this activity is low (8%). Even though 39% of households are engaged in foraging MSPG, it constitutes only 2% of total income. The

unequal distribution of income in Giao Xuan is further apparent because of the 95% of total income generated through mangrove system activities only 6% comes from aquaculture employment and 1% from MSPG. The remaining 88% is derived from the ownership of land use rights for enabling income through profits made on the farms.

In Da Loc, even though aquaculture farming is in its infancy, a notable portion of households are engaged in it (29%) and it represents a large portion of income (48%). As in Giao Xuan, a high proportion of households engaged in aquaculture employment (38%) represent a low proportion of total income (4%). Furthermore, over twice as many households are engaged in collecting MSPG (81%), but represent over three times the proportion of income (14%) as generated through aquaculture employment. The growing inequity of incomes described by respondents in Da Loc is apparent: of the 66% of total income generated through mangrove system activities, only 18% comes from aquaculture employment and collection of MSPG. However, a larger number of households are engaged in non-wetland related livelihood activities (i.e. on-farm and off-farm activities) than is observed in Giao Xuan. In Dong Rui, which experienced aquaculture industry collapse, no households engage in aquaculture farming or employment, and 100% engage in collecting MSPG, representing 40% of total income.

These results indicate that when the commercial aquaculture industry is strong: income tends to be unequally distributed and concentrated among the aquaculture farm owners; average household livelihood diversification is lower; and marginalised households remain dependent on collecting MSPG as a livelihood activity.

4.3.3 Characteristics of households most dependent on MSPG

In each community, a set of characteristics have been identified for those households most dependent on MSPG for their livelihoods (Tables 4.3, 4.4 and 4.5; Table 4.6 shows the breakdown of variable groups). Female headed households were more dependent on MSPG than male headed households in all three communities. In Giao Xuan and Da Loc, where aquaculture prevails, households with weak land rights were more dependent on MSPG than those with stronger rights. Where commercial aquaculture is in its infancy or collapsed, as in Da Loc and Dong Rui respectively, households with low education levels were more dependent on MSPG than those with higher education levels. In Giao Xuan,

there was more dependence on MSPG among households with high livelihood diversity, while in Dong Rui, higher MSPG dependency was found among households with low livelihood diversity. As low income households were found to be more dependent in both these communities, this indicates that low income households in Giao Xuan are using mangroves to diversify their livelihoods, while low income households in Dong Rui are not. This could be because Dong Rui does not have a commercial aquaculture industry, and hence aquaculture employment, as a livelihood option.

Table 4-3: Characteristics of households in Giao Xuan most dependent on MSPG for income

	Giao Xuan				
	Test statistic	**Degrees of freedom**	**Sig.**	**z score**	**Post-hoc r score**
Age	10.961 Ω	4	0.027**	-3.219	0.001
Gender	352 β	-	0.006***	-3.00	0.3
Education	-	-	-	-	-
Years lived in commune	-	-	-	-	-
Household members	-	-	-	-	-
Livelihood diversity	13.344 Ω	2	0.001***	-3.454	0.001
Income	5.935 Ω	2	0.05**	-2.426	0.015
Land user rights	15.416 Ω	2	0.000***	-3.603	0.000

Table 4-4: Characteristics of households in Da Loc most dependent on MSPG for their income

	Da Loc				
	Test statistic	**Degrees of freedom**	**Sig.**	**z score**	**Post-hoc r score**
Age	-	-	-	-	-
Gender	442.5 β	-	0.087*	-1.710	-0.2
Education	375 β	-	0.026**	-2.221	-0.3
Years lived in commune	5.489 Ω	2	0.064*	-2.228	0.026
Household members	-	-	-	-	-
Livelihood diversity	-	-	-	-	-
Income	-	-	-	-	-
Land user rights	10.459 Ω	2	0.005***	-3.122	0.002

Table 4-5: Characteristics of households in Dong Rui most dependent on MSPG for their income

	Dong Rui				
	Test statistic	**Degrees of freedom**	**Sig.**	**z score**	**Post-hoc r score**
Age	-	-	-	-	-
Gender	685 β	-	0.005***	-2.786	0.3
Education	18.642 Ω	4	0.001***	-2.656	0.008
Years lived in commune	13.409 Ω	2	0.001***	-3.430	0.001
Household members	7.698 Ω	2	0.021**	-2.101	0.036
Livelihood diversity	24.459 Ω	2	0.000***	-2.656	0.008
Income	11.649 Ω	2	0.003***	-3.475	0.001
Land user rights	-	-	-	-	-

* p = 0.05 to 0.1, **p = 0.049 to 0.011, ***p = 0.01 to 0
β = Mann-Whitney test
Ω = Kruskal-Wallis test

Table 4-6: Breakdown of groups in independent variables tested

	Giao Xuan	Da Loc	Dong Rui
Age (years)	20-29 (n=8) 30-39 (n=15) 40-49 (n=28) 50-59 (n=23) 60+ (n=5)	20-29 (n=8) 30-39 (n=15) 40-49 (n=28) 50-59 (n=23) 60+ (n=5)	20-29 (n=8) 30-39 (n=15) 40-49 (n=28) 50-59 (n=23) 60+ (n=5)
Gender	Male (n=61) Female (n=18)	Male (n=43) Female (n=27)	Male (n=68) Female (n=31)
Education	Low: secondary or lower (n=59) High: tertiary or higher (n=20)	Low: secondary or lower (n=42) High: tertiary or higher (n=26)	None (n=8) Primary (n=23) Secondary (n=50) Tertiary (n=13 University (n=5)
Years in commune (years)	Low: <25 (n=22) Middle: 25 - <50 (n=36) High: >50 (n=15)	Low: <25 (n21) Middle: 25 - <39 (n=21) High: >39 (n=21)	Low: <14 (n=25) Middle: 14 - <31 (n=24) High: >31 (n=50)
HH members	Low: <3 (n=21) Med: 3 – 4 (n=43) High: >4 (n=15)	Low: <4 (n=14) Med: 4 – 5 (n=41) High: >5 (n=15)	Low: <4 (n=70) Medium: 5-6 (n=25) High: >6 (n=4)
Livelihood diversity	Low: <2 activities (n=15) Med: 3 activities (n=31) High: >3 activities (n=33)	Low: <5 (n=22) Med: 5 (n=28) High: >5 (n=20)	Low: <3 activities (n=5) Med: 3-4 activities (n=47) High: >4 activities (n=47)
Income ($per capita)	Low: 0-730 (n=17) Middle: >730-<1,330 (n=28) High: >1,330	Low: <350 (n=23) Middle: 350 – 800 (n=24) High: >800 (n=23)	Low: 0-572 (n=32) Middle: 573-1,156 (n=34) High: >1,156 (n=33)
Land user rights	Low: MSPG only (n=50) Med: emp/CAC* (n=10) High: ACO (n=19)	Low: MSPG only (n=23) Med: emp/CAC* (n=38) High: ACO (n=6)	Low: MSPG only (n=99)

* aquaculture farm employment or collective ownership of aquaculture field

All three communities benefit from mangrove ecosystem services, distinguished here using the MA (2005) categorisations (Table 4.7). Cultural services were consistently ranked lowest in importance across all three communities, although Dong Rui respondents identified aesthetic qualities and heightened sense of well-being as important benefits.

Table 4-7: Categories of ecosystem services from mangroves identified by households

	Giao Xuan	Da Loc	Dong Rui
Supporting	23 (5)	21 (4)	17 (6)
Provisioning	42 (9)	34 (8)	32 (9)
Regulating	30 (6)	45 (9)	37 (8)
Cultural	5 (1)	0 (0)	14 (5)

***NB**: numbers represent per cent of total statements made referring to that category, while numbers in brackets refer to number of households that identified that category*

Supporting services were the next most identified service across all communities, particularly soil retention, nutrient cycling, oxygen production and habitat provision. Provisioning and regulating services were the most identified services among all communities, representing more direct benefits. However, perceptions differed between communities. In Giao Xuan provisioning services were identified more frequently by the highest number of households, with regulating services largely corresponding to the storm protection benefits of mangroves. In Da Loc, regulating services were identified more frequently and by more households. This could be due to recent experiences of extensive storm damage and saline intrusion, with the resulting damage to arable farm land still fresh in respondents' memories. In Dong Rui a higher percentage of statements were made regarding regulating services compared with the other communities, although several households identified provisioning services. In Dong Rui, because there has been no protective community dike, respondents highlighted that moderately intense storms can have severe negative impacts on their crops, and mangroves are seen as crucial for storm protection. With soil quality already poor due to degradation, saline intrusion resulting from storms is a significant community concern.

The MSPG differ in each community due to specific biophysical and geographic characteristics (Table 4.8). Focus groups revealed that households use diverse strategies to respond to income shocks, such as increased collecting of MSPG to sell, drawing on savings, bank loans, social and kinship networks, and selling assets and labour. Sale of MSPG was the most important safety-net against economic shocks because it meant less reliance on other people, as the extended family are usually poor so cannot offer support, and no repayments are incurred. Interviews indicated that in all three communities, households with higher dependence on MSPG rely on these goods to sell in order to cope with shocks and stresses such as crop failures, celebrations, the start of the new school year, and seasonal fluctuations in the weather. Interviews and focus groups in Giao Xuan also revealed that during August and September, when MSPG are at their lowest abundance, MSPG dependent households find it most difficult to meet their subsistence needs. In addition, interviews indicated that although prices offered for MSPG were relatively stable, this was due to wholesalers giving consistently low prices in order maximise their profits.

Table 4-8: Species and estimated effort, weight and price of MSPG

Giao Xuan				
Catch	**Season (height)**	**Est. effort (hrs)**	**Est. weight (kg)**	**Est. $/kg**
Fish	All year (March - July)	5 – 6	5 – 10	1 – 1.5
Crab	All year (March – July)	5 – 6	3 – 4	1.5
Clam	All year	5 – 6	2 – 10	1 – 3.5
Shrimp	All year (March – July)	5 – 6	5 – 30	3 – 5
Da Loc				
Fish	All year (February – April)	5 – 6	3	5
Crab	All year (January – August)	5 – 6	4 – 5	1
Clam	All year (February – May)	4 – 6	6 – 7	0.5
Dong Rui				
Fish	All year (April – June)	8	10	1 – 5
Crab	All year (March - August)	3	6 – 8	1 – 1.5
Clam	All year (May – September)	6	5 – 7	3 – 4
Worm	All year (September–February)	8	2 – 4	2 – 3
Octopus	All year (June – August)	6	0.5 – 1	20 – 50
Shrimp	All year (September – December)	6	4 – 6	5
Jellyfish	All year (February – March)	6	-	5 – 10.5

4.3.4 Livelihood trajectory analysis

Five trajectories were selected as illustrative of the wider community's experiences, encompassing all wealth groups (Table 4.9). An in-depth analysis of the livelihood trajectories of illustrative households between 1975 and 2012 was conducted to ascertain the influence of multiple and interacting key aspects of change that resulted in current livelihood strategies.

Table 4-9: Livelihood trajectories of households most reflective of the impact of SES dynamics

Case study household	**Factors leading to resilience (R) and vulnerability (V)**
Case 1 – Male, age 54, Giao Xuan	
Before economic reform there was no market for mangrove system goods, so he and others in the community foraged MSPG for household consumption. Following economic reforms in 1986 he was employed on a trading boat, which took him to China where he first became aware of the lucrative clam market. He invited a specialist from China to Giao Xuan to teach him clam aquaculture techniques to produce clams for export to China. Subsequent to the success of this, other locals were attracted to mangrove system land to cultivate clams as a commodity, and began to assert claims over sections of the land. By 1991, overexploitation resulted in the complete collapse of the native clam population. In 1992, however,	**R1. Access to natural resources** **R2. Salaried employment** **R3. Access to markets** **R4. Access to knowledge** **V1. Loss of natural capital** **R5. Draws on financial capital** **R6. Access to social networks**

he was able to draw on accumulated capital and trading links with neighbouring provinces to import clam seed varieties to cultivate before selling on to China. This was highly successful and the market peaked in 1995. By 1997, however, the imported clams began to die due to incompatibility with local environmental conditions. Many clam fields were abandoned and became available for him to buy as a result. Undeterred, he decided to search further afield, to provinces in the south of Vietnam, to find clam species more suited to local conditions. In 1999 he combined the import of new clam species with new sand varieties to accommodate them. Although there was initial scepticism due to past failures, the enterprise was a success and markets developed both domestically and internationally. Furthermore, due to the stabilising effect on the environment from mangrove restoration efforts, he no longer needs to import clam seeds from the south. Clam farming is now the major industry in Giao Xuan, which is now one of the biggest producers in Vietnam. Although the industry is more stable now, he still has to make periodic alterations to his fields in order to maintain productivity. He is aware that importing clam and sand varieties is unsustainable, and is trying to reintroduce native species.	**V2. Loss of productive capacity** **R7. Accumulates land** **R8. Draws on financial capital** **R9. Rise in demand for aquaculture products** **R10. Regulating ecosystem service** **V3. Uncertainty due to suppression of ecosystem functions and processes**
Case 2 – Female, age 51, Giao Xuan	
She has lived in Giao Xuan all her life, where she lives with her 21 year old son. When she was young her family were poor and life was difficult, often there would not be enough food to eat and they would have to rely more heavily on foraged MSPG for subsistence. There was no state support at the time, so when her family found themselves in hardship they would have to ask for loans from rich households which they had to pay back with interest. Following the birth of her son, she lost her husband and had to rely on her husband's family to support her and her new born baby. When the clam aquaculture sector began, she could not get access to any land for farming because she was not strong enough to claim land, and she was not rich enough to buy any. Even if she had the money, because she is a woman she cannot own land. When the clam aquaculture sector expanded she was young and healthy and able to find employment through family contacts. She established a reputation for being a good worker and was respected by her work colleagues, and so aquaculture owners began to ask her to manage work teams on their behalf. She has been able to develop such a wide network of contacts within the industry that she can even find employment in neighbouring districts. Her son is now old enough to contribute to household income, and he is also employed on aquaculture farms. However, clam aquaculture does not provide stable employment, particularly during the winter, so she still has to forage MSPG to supplement her income. In recent years the rains have been less predictable and this has affected her rice crop, so she has to depend heavily on foraging MSPG when this happens. She cannot make as much money from this as she did in the past, as there is less space to forage MSPG and fewer animals available to harvest, even though there are lots more animals in the aquaculture fields. She believes that clam aquaculture is eradicating the natural species, and is worried that eventually there will be no MSPG to forage.	**V1. Lack of subsistence** **V2. Lack of financial capital** **V3. Lack of state support** **R1. Access to ecosystem provisions** **V4. Debt accumulation** **V5. Loss of labour** **R2. Family support network** **V6. Lack of access to land** **R3. Salaried employment** **R4. Applied human capital** **R5. Extended social networks** **R6. Gain in human capital** **V7. Unstable income** **R7. Provisional ecosystem service** **V8. Climatic impact on crops** **V9. Loss of access to ecosystem services** **V10. Altering ecosystem causes increased livelihood uncertainty**
Case 3 – Female, age 46, Giao Xuan	
When she was young she would forage MSPG with her family for household consumption. When the mangrove system area her family had traditionally collected from was divided up and turned into clam	**R1. Access to ecosystem services** **V1. Loss of access to ecosystem services**

aquaculture fields, her husband joined a collective that pooled all their savings together to buy a field. Combined with the income she received from labouring on clam aquaculture fields, they earned enough income for food and to send their son to school. When her husband became terminally ill he could no longer work, and she had to work fewer hours to tend to him. They received no state support, and with hospital bills mounting were forced to sell everything they owned and move into a smaller house next to the dike. The land near the dike is low quality and not suitable for growing crops, and household assets, such as livestock, are often stolen by groups of thieves that target vulnerable households. The community that lives near the dike, made up largely of elderly, disabled and (often illegal) migrant households, are supportive and pool their resources together in order to help each other. In addition, due to the growing clam aquaculture industry she has been able to receive loans from rich owners (usually with interest payable). Although she feels that the rich owners look down on the dike community, they will still employ them to work on their fields, but she still relies heavily on foraged MSPG for food for subsistence. This space, however, has vastly reduced and she must travel through the clam aquaculture fields to get there, and although she can make extra income from collecting the litter thrown from the clam field watchtowers, she must be careful not to stray too close to the fields otherwise the owners will attack her. In addition, because people can make money from foraging MSPG now, they will commit more time and effort which means there are less animals to catch. Although she is aware of some livelihood opportunities available through various NGO projects, she is unable to get to the Women's Union meetings where opportunities are distributed, and she believes that she does not have the adequate level of skills and knowledge required to participate in the projects. Not only that, but these opportunities are usually shared among the families of Union leaders.

R2. Diversification of income

V2. Loss of human capital
V3. Loss of income
V4. Accumulation of debt
V5. Selling of assets
V6. Low quality land for arable crops
V7. Target of crime
R3. Social support networks
R4. Access to loans
V8. Discrimination
R5. Ecosystem service
V9. Loss of access to land

V10. Overexploitation of resources

V11. Lack of access to village meetings
V12. Lack of awareness
V13. Elite capture

Case 4 – Male, age 37, Dong Rui

In 1979 he moved to Dong Rui from Hai Phong city as part of the resettlement programme. Life was difficult in the city with little work, and resettlement offered a house with land to cultivate, and 6 months' worth of rice from the state to help with the transition. The abundance of natural resources meant that food was easy to obtain and life was good. In 1986, encouraged by the local People's Committee, he took out a substantial loan to invest in a wetland boundary pond to allow more effective capture of marine creatures. This was very productive for the first 2-3 years, but then productivity sharply declined due to the impact the ponds had on the natural flow of water and the environment. Many residents raised this as an issue at village meetings at the time but their concerns were not acted upon by the authorities. As the bank loan repayments were mounting, he took out further loans in the hope that the pond would become productive again. This did not happen and eventually he gave up on the pond. For a while he could still make a living foraging MSPG in the vast wetland area, but when huge areas started to be sold to investors from other provinces this reduced the commons area. Furthermore, pollution from the clam aquaculture fields destroyed the surrounding area, which drove him to destitution. He was the victim of unscrupulous human traffickers to whom he paid money, provided to him by his wife's family in Hai Phong, on the understanding that he would gain well paid employment in China. On arrival the hours were long, conditions terrible and the pay was very low, so he fled back to Dong Rui, putting his life in danger and swimming across dangerous waters in order to cross the border from China to Vietnam.

R1. Access to ecosystem services
R2. Access to loans

V1. Loss of ecosystem function and process

V2. Accumulating debt

V3. Loss of income
R3. Access to ecosystem service
V4. Loss of access to ecosystem service
V5. Onset of poverty
V6. Vulnerable target of human trafficking syndicates

V7. Negative climatic impact on crops
V8. Poor infrastructure
V9. Poor quality

Additionally, his rice, peanut and sweet potato crops have been impacted by rapidly changing and unpredictable weather in recent years, with the winters becoming colder and the summer hotter. The irrigation system is inadequate and the quality of local soil is sandy, salty and of poor quality, and this restricts the options for changing crops, planting times, and varieties. If people do not get enough rice they go hungry, but he is lucky that he is still strong and can sell labour to a nearby paper factory and use his earnings to buy rice.	**V10. Lack of diverse cropping options** **R4. Human capital**
Case 5 – Female, age 33, Dong Rui	
She is from the Dao ethnic minority, originally from the mountainous region of the province, and has lived in Dong Rui for 12 years since they were resettled here by the government. The Dao community were promised a better life in Dong Rui, but since arriving she has wanted to return to her home. The district authorities, however, have already converted the land they left for another purpose so she cannot return. She arrived with a small number of other Dao families, but as they did not speak Vietnamese, were not familiar with the environment and because they have different customs, beliefs and traditions to the ethnic 'kinh' Vietnamese, they struggled to integrate into the local community. They soon became isolated and were pushed into the area with lower quality land where it is difficult to grow crops. Almost all of her income comes from foraging MSPG, and this has been so since she and her family arrived, but she is given a lower price than the ethnic 'kinh' wholesaler. Some Dao go to forage MSPG in groups and have developed effective techniques for catching animals, but she is not involved in any of these groups. These groups have become rich but she remains poor. She has to pay community fees but she is unsure exactly what this is for as she is very poor but receives no state support.	**V1. Loss previous support mechanisms** **V2. Communication difficulties** **V3. Alienation from wider community** **V4. Lack of income diversity** **V5. Discrimination** **V6. Lack of skills** **V7. Lack of state support**

Three distinct types of livelihood trajectory exist across the three communities, which incorporate different elements of the factors outlined above. The first group (consolidators) are successful aquaculture farm owners whose households are characterised by high levels of income, a male head, middle aged, low livelihood diversity and high land user rights. They have typically been able to access mangrove system wetlands through land grabbing, social position and connections, and are able to prosper through a combination of access to emerging external markets, social networks and knowledge following market liberalisation. These households were typically influential during the communist era of collective farming, and have been able to leverage this position during market liberalisation to reinforce their position and increase access to land and resources. Their aquaculture ventures have been consolidated through acquisition of wetland tenure rights from struggling aquaculture farmers who lack the skills and knowledge to be successful. These households have also been able to modify the environment in response to ecosystem feedbacks which undermine aquaculture productivity, e.g. by importing alien species of shrimp or clam, and related varieties of sand

to accommodate them. Successful aquaculture farmers have also been able to form lobby groups to challenge the local authorities on decisions which impede their aquaculture activities. These households are also able to make profits from providing loans to poor households charged at interest. This trajectory of prosperity has been reinforced by some households by leveraging social influence and networks to their advantage.

The second group (accumulators) are typically employees on aquaculture farms whose households are characterised by mid- to low-level income, male or female head, mid- to low-level livelihood diversity, and moderately secure land user rights. These households are typically from poor backgrounds lacking the social influence and access to resources of the consolidator group, but have been able to improve their livelihood trajectory and gain employment mainly on aquaculture farms (as well as non-farm related employment such as construction or factory work) through a combination of human capital, social networks and forging reputations as good workers. However, as aquaculture has increased the number of livelihood strategies available to the community, these households have reduced the number of livelihood activities that they engage in, becoming more specialised in aquaculture employment. Some households have been able to either gain access to bank loans, or pool resources with family or friends in order to gain formal tenure rights and develop aquaculture farms. The local economy provides a sufficient living for these households, and they can overcome livelihood shocks and stresses by seeking alternative employment opportunities beyond the locality if they have an adequate level of human capital. Many of these households still use MSPG to either to supplement their income, for household use, or in times of livelihood shock and stress.

The third group (marginalised) are made up of households struggling to survive and characterised by low income, female head, young head, high livelihood diversity and insecure land user rights. These households lacked any social influence or access to employment opportunities and relied heavily on MSPG for income and subsistence. Usually they were unable to take advantage of the opportunities to access land and resources following political and economic reform due to lack of social networks and human capital. Increased pressure on mangrove systems from aquaculture disproportionately affects marginalised households, who are those least able to defend livelihoods or take advantage of market opportunities. Many households shifted from the accumulator group to this group following sickness or death of household members which greatly increased

livelihood vulnerability. A number of other households shifted from the accumulator group to this group subsequent to mounting debts due to failed aquaculture ventures as a result of lack of adequate skills or knowledge. Recently settled migrants lacking social networks and local knowledge also form a large proportion of this group. In order to cope with shocks these households increase livelihood diversity, rely on support from family and close friends, and increase their use of MSPG for subsistence and income. However, the impact of aquaculture means that they face reduced mangrove system commons areas from which to collect MSPG. Feedbacks from rapid economic development (i.e. aquaculture) have exacerbated negative impacts such as biodiversity loss and water cycle disruption, which has led to reductions in the quantity and quality of MSPG collected. Subsequently, marginalised households often have to rely on loans from richer households, some have pre-existing bank debt from failed aquaculture ventures, and households often resort to asset selling and moving to cheaper unproductive land. Here, households are susceptible to alienation from the community and often become targets of crime. Other households may have fallen out with local authorities who then use their power and influence to make life difficult for them, and if these households do not have sufficiently strong social networks or human capital to fall back on, they can quickly fall into this group. Households in this group are likely to experience trajectory lock-ins due to lack of access to resource, networks, and a greatly reduced and degraded mangrove system commons.

4.4 Discussion

Results indicate that a rapidly growing aquaculture industry encapsulates the key aspects of MSES change identified by communities, i.e. changes in wetland tenure arrangements, market liberalisation, and elite capture. Combined, these aspects were found to result in increased intensification and specialisation in cultivation of mangrove system land, severely undermining mangrove system functions and processes, and disproportionately affecting the livelihoods of those households most dependent on MSPG. Understanding past livelihood decisions of households in response to MSES change, and how this has shaped livelihood trajectories, is crucial for understanding the dynamics and interdependencies of mangrove systems and livelihood strategies (Trabucchi et al. 2012; Sallu et al. 2010; Bandyopadhyay et al. 2011). Analysis of the differentiation in the use of mangrove goods and services in MRDC, and the factors shaping past livelihood decisions in response to

MSES change, also provides crucial insights into environmental justice and the distribution of adaptive capacity within MSES.

4.4.1 Key aspects of social-ecological dynamics

MSES change emanating from the interaction of political, socio-economic and environmental aspects had a significant and widespread impact on the mangrove systems and MRDC communities studied. Changing tenure regimes towards privatisation further impacted marginalised groups, concurring with To et al. (2012) in Vietnam and Meinzen-Dick and Mwangi (2009) in Kenya, where formalisation of tenure rights led to elite capture. Furthermore, as reported in Nepal by Iversen et al. (2006), weak policy frameworks combined with increasing prices for wetlands and their resources created opportunities for elites to capture benefits through the lease of wetlands to external investors for commercial interest, consistent with results presented here. Formalisation of private tenure rights neglected the distinct multiple claims of poor, female, young headed households and the sick: groups least able to defend their livelihoods or establish legal tenure rights (cf. Kelly and Adger 2000; Meinzen-Dick and Mwangi 2009). Formalising tenure arrangements will only bring livelihood benefits if careful consideration of the poor is made, which findings indicate rarely happens.

Inequality resulting from changing tenure regimes can be further exacerbated by economic reform. Results show that market incentives have prompted local governments to explicitly encourage aquaculture and the clearing of mangrove forests, placing greater pressure on wetlands (cf. Van Hue and Scott, 2008). Exploiting the opportunities generated through aquaculture requires market access, secure tenure over the resource base, sufficient labour and capital to invest, the capacity to wait for investments to mature, and sufficient entrepreneurial skills; abilities that the marginalised group do not possess (cf. Sunderlin et al. 2005). The accumulator group was able to take advantage of such opportunities through high levels of human capital (i.e. labour) and access to financial capital (i.e. bank loans), but could quite easily find themselves falling into the marginalised group due to lack of access to skills, networks and markets. Results are consistent with research which indicates that since far reaching economic reform, Vietnam has witnessed increasing socioeconomic disparities among regions and within localities (Luong 2003). Supporting findings from Indonesia (Dove 1993), the benefits of economic reform have

been appropriated by wealthy, powerful and well-connected individuals. Additionally, market incentives have resulted in some households placing increasing pressure on reduced public wetland areas. The resulting intensification of competition and degradation of mangrove resources has disproportionately affected poorer households who have a greater dependence on mangroves for their livelihoods, as opposed to those interested in private commercial activity to supplement their incomes (cf. Van Hue and Scott 2008; Kelly and Adger 2000). As economic reforms have created markets for wetland goods, there remains a need to support the livelihoods of the poorest and most marginalised.

Together, changing land tenure, economic reform and elite capture can result in land use intensification and specialisation in production of wetland resources, severely undermining ecosystem functions and processes. Consistent with studies from Amazonia (Homma 1992), results show that sudden wetland commercialisation can contribute significantly to the collapse of the naturally regenerating resource base, and it is the least powerful households whose livelihoods depend highly on mangrove resources that suffer disproportionately (cf. Kelly and Adger 2000; Meinzen-Dick and Mwangi 2009). Results indicate that the quantity and quality of mangrove goods has declined as a result of rapid coastal development, particularly of the aquaculture industry. Consistent with Gunderson and Holling (2002), feedbacks from rapidly growing aquaculture exacerbated negative environmental impacts (e.g. biodiversity loss, water cycle disruption). This impinged on the livelihoods of MRDC, particularly those with high dependence on MSPG for their livelihoods. This has implications for environmental justice, as greater dependence on natural resources increases household vulnerability to MSES change, and as such they will face disproportionate burdens from the negative environmental impacts of aquaculture. Furthermore, household with greater dependency on MSPG lack the necessary access to finance, land, skills, markets and networks in order to establish aquaculture farming, and have thus contributed least to the subsequent negative impacts.

4.4.2 Livelihood strategies and activities

Economic reform, private tenure regimes and a rapidly growing aquaculture sector have contributed to divergent livelihood strategies and activities being undertaken across all three communities. Consistent with Cinner and Bodin (2010) in east Africa, although aquaculture increases community livelihood opportunities through aquaculture farming

and employment, aggregate household data indicates that households livelihood activities become less diverse. Households in all three communities were engaged in mangrove system (i.e. wetland) related and on-farm livelihood activities to differing degrees. However, high levels of aquaculture activity are associated with unequal income distributions, with wealth concentrated among successful farm owners, and off-farm strategies being less prevalent and contributing less to total aggregate community income. This has implications for the distributional component of environmental justice as inequality and the concentration of wealth among few households reduces the resources available for less wealthy and powerful households. These households are typically more dependent on mangrove commons for their livelihoods and therefore more vulnerable to MSES change.

4.4.3 Household characteristics

Communities are heterogeneous with households exhibiting a diverse range of dependency on MSPG. Female headed households are most dependent on mangroves, and are the poorest with the least secure land use rights. In Malawi, Kamanga et al. (2009) found that female headed households with little access to land derived a high proportion of their income from forest goods, in line with results presented here. Results also support findings from Vietnam (Van Hue 2006) and Ethiopia (Asfaw and Satterfield 2010) where entrenched customary norms and patriarchal cultures constrain women's access to land, resulting in female headed households depending more on foraged natural resources. Consistent with results from Kenya (Meinzen-Dick and Mwangi, 2009), younger headed households are also more dependent on mangrove resources: they are usually too young to have acquired wetland when it was reallocated, do not have the capital to buy or rent land and pay the necessary tax, and so resort to foraging in public areas.

Non-farm livelihood opportunities and education significantly impact household dependency upon mangrove resources. In contrast to aggregate household livelihood diversification findings illustrated above, when individual households were analysed in communities where aquaculture is strong, households with greater dependence on mangroves have more diverse livelihoods. While households earning high incomes from aquaculture have less incentive to diversify, low income households diversify to reduce risk from external shocks and stresses (cf. Smucker and Wisner 2008). Conversely, when there

is no aquaculture sector (e.g. Dong Rui), those households able to access a diverse range of livelihood activities, particularly off-farm activities, have less dependence on mangroves. Hence, less pressure is placed on mangroves when greater off-farm livelihood activities are available and utilised. Where the aquaculture sector has collapsed or is in its infancy (e.g. Dong Rui and Da Loc), less well educated households have greater dependence on mangroves due to limited access to alternative livelihood activities. Where aquaculture is successful, as observed in Giao Xuan, education is not significant, suggesting that power, wealth and social connections are more important for gaining a higher proportion of the benefits emanating from mangrove regulating and supporting services. Identifying those households with greater dependency on MSPG is important for environmental justice, as results indicate that female headed-households from lower socio-economic groups (for simplicity, these groups will be referred to as marginalised from now on) have greater MSPG dependence, and are therefore more vulnerable to MSES change.

4.4.4 Ecosystem services

MRDC households rely heavily on mangrove system goods and services for their livelihoods, and use a diverse range of strategies to cope with MSES change (cf: Turner et al. 2003). Sale of mangrove products is the most important for marginalised groups. Consistent with findings in Zambia (Kalaba et al. 2013), the sale of forest products was more important than support from kinship ties due to a lack of economic prosperity among kinship networks. Foraging does not require any capital outlay. Results support others from Vietnam (Tran et al. 2010) where household perceptions of mangrove goods and services are influenced by factors including past experiences of extreme weather events and environmental conditions affecting their impact. It is crucial to integrate ecosystem services into mangrove management, and to consider the impact changes in mangroves have on household coping strategies and perceptions of mangroves (Trabucchi et al., 2012). This has implications for environmental justice, as those households that are more dependent on mangrove commons for MSPG are disproportionately impacted by the conversion of mangrove commons to aquaculture and related negative environmental impacts, while contributing least to the negative environmental impacts due to less involvement with aquaculture. In addition, greater pressure is placed on the reduced mangrove commons due to market incentives to increase MSPG collection, with negative impacts on the livelihoods of households that are more dependent on MSPG.

4.4.5 Livelihood trajectories

Although the key aspects of mangrove change identified affected each community differently, analysis of livelihood trajectories provided the opportunity to identify generic factors that increased resilience or vulnerability during 1975-2012. Uncovering how these factors have contributed to current livelihood strategies and activities is crucial to understand how SES have affected livelihood (Trabucchi et al. 2012; Sallu et al. 2010; Bandyopadhyay et al. 2011). Failure to do so will mean households face increasing vulnerability that will compromise the integrity of the MSES upon which marginalised households heavily rely on for their livelihoods and to respond to MSES change. Analysis of livelihood trajectories also elucidates how key aspects of mangrove change shape past livelihood decisions of households in response to MSES change, and how past decisions to aspects of change have shaped present environmental justice context through changes in the distribution of adaptive capacity within MSES.

4.5 Contribution to knowledge

By analysing aspects of MSES change and the factors that shape household responses, findings highlight the importance of considering how these interacting elements have shaped livelihoods in three MSES in northern Vietnam. By using a framework that provides a time dimension to the analysis of household MSPG use, this study shows how the context within which aquaculture develops, as well as the socio-economic characteristics of households, shapes the vulnerability and resilience of household livelihoods. Whilst calls for efforts to increase mangrove system conservation and restoration in order to increase livelihood resilience are welcomed, results show that MRDC do not use and respond homogenously to mangrove system change.

Findings illustrate how transition processes have altered the governance of mangrove systems through the increasing influence of market mechanisms. For example, households with access to finance, skills, networks and markets have been able to take advantage of the opportunities presented by transition to develop successful aquaculture farms and increase their livelihood resilience. However, aquaculture negatively impacts marginalised households by restricting access and degrading mangrove system resources

crucial for households with limited or no access to market opportunities. This study shows how the livelihoods of the marginalised are becoming increasingly vulnerable through: (1) income inequality and the concentration of wealth among a small number of households which diverts resources away from the most marginalised; and (2) restricted options for livelihood diversity through limited access and degradation of mangrove systems.

Findings presented here highlight important features of communities that should be considered within environmental governance more widely. For example, the increased influence of market mechanisms in mangrove system governance, income inequality, and subsequent constraints on livelihood diversity, create path-dependencies that shape future options in response to mangrove system change, locking marginalised households into vulnerable livelihood trajectories. This has implications for the distributional component of environmental justice (see Figure 2.1, page 25), as the benefits and burdens of MSES change are inequitably distributed (Figure 4.3). Households unable to take advantage of the emerging opportunities of transition to develop successful aquaculture farms are being disproportionately burdened with the negative environmental impacts. How mangrove system change affects livelihoods depends on household characteristics and local context, and will manifest differently depending on the equitable and just distribution of mangrove system resources necessary for sustainable MSES governance.

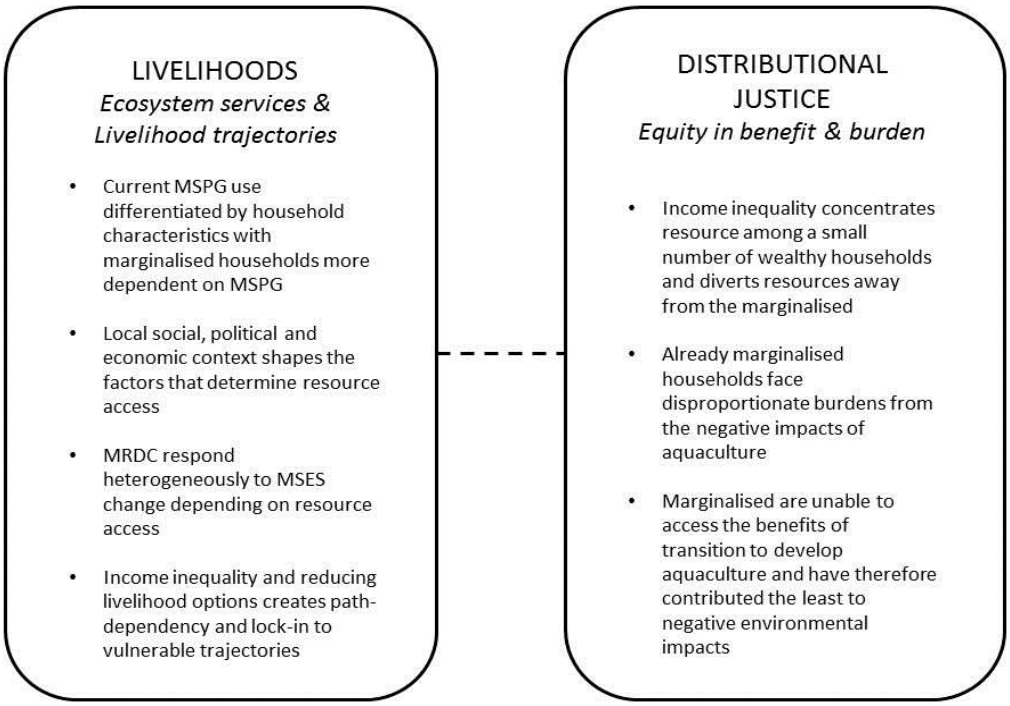

Figure 4.3: Results linking livelihoods and distributional justice in MSES

4.6 Conclusion

This chapter has explored the impact of human activity on mangrove system goods and services and MRDC livelihoods in Vietnam, drawing on sustainable livelihood and ecosystem service approaches. A mixed method approach was used to analyse MSES dynamics in three study communities to identify: key aspects of MSES change; the range of livelihood strategies and activities MRDC households are engaged in; the specific household characteristics related to differing levels of MSPG dependence; factors influencing the livelihood trajectories of MRDC households. A qualitative approach allowed consideration of the ways in which temporal dynamics have contributed to the emergence of household vulnerability and/or resilience to MSES change. The implications for environmental justice through the distribution of mangrove system goods and services (i.e. adaptive capacity) within MSES were also discussed.

In considering the objective of this chapter, results illustrate how the combined influence of changes in human activity due to economic transition and environmental change can shape the distribution of adaptive capacity within MSES through placing households on resilient or vulnerable livelihood trajectories. In the context of transition from a centrally planned to a more market oriented economy, results indicate that some households have been able to gain adaptive capacity. A rapidly growing aquaculture industry has contributed to the entrenchment of pre-existing power structures to the benefit of consolidator groups, while others (accumulator groups) have been able to increase their prosperity through a combination of factors relating to access to assets, particularly human and financial capital. However, for marginalised groups, or those from accumulator groups finding themselves falling into this category, there is a high likelihood of becoming locked-in to a livelihood trajectory characterised by low levels of adaptive capacity. Hence, path dependency and lock-in of the marginalised group's livelihood trajectory results in low adaptive capacity to future MSES change. Building on livelihood approaches to include trajectory analysis increases our understanding of the factors that create path dependency, which will enable more effective and targeted support to those who need it most. Furthermore, a trajectory analysis allows us to explore issues of environmental justice related to rapidly growing aquaculture through the subsequent

distribution of mangrove goods and services in MRDC livelihoods. Understanding environmental justice issues will be crucial if mangrove management is to be sustainable.

The implications of this research point to the challenge Vietnam faces in reconciling market-orientated land use and economic policies with the maintenance of the mangrove system functions and processes that marginalised households depend on for their survival. Results also highlight the implications for environmental justice, as the unequal distribution of access to the mangrove resources necessary to sustain MRDC livelihoods, which has been exacerbated following economic transition, has contributed to decreased adaptive capacity for marginalised households. Furthermore, continued degradation of mangrove resources through aquaculture will lock already marginalised groups into trajectories of livelihood vulnerability and low adaptive capacity. Not only do marginalised groups face disproportionate impacts from aquaculture due to their high dependence on mangrove commons, but they have contributed least through lack of involvement in aquaculture activities. MSES change will be experienced in Vietnam by an increasingly polarised society that will increase aggregate social vulnerability to these threats. MSES change and livelihood responses will also impact on the social capital within MRDC, a crucial component of adaptive capacity. This will have implications for environmental justice through the shaping of recognition among divergent socio-economic groups. Social network analysis provides the opportunity to assess the impact of different levels of aquaculture activity on MRDC livelihoods and social network structure, which will be explored in the following chapter.

Chapter 5 - Coastal livelihoods and social networks: impacts of aquaculture on mangrove systems

5.1 Introduction

Livelihood responses to MSES change, particularly the rapid growth in aquaculture, will also impact the social capital of MRDC through alterations in social network structures. Results from the previous chapter present a detailed analysis of how coastal communities in northern Vietnam use mangrove system goods and services for their livelihoods. In addition to mangrove system loss and degradation, aquaculture has contributed to numerous socio-economic issues such as changes in resource access, land use conflicts and significant changes to MRDC livelihoods (cf. Lebel et al., 2002; Joffre and Schmitt, 2010; Orchard et al., 2014). Furthermore, the ability of communities to respond to MSES change is embedded within and available to them through social interactions (see section 2.6), which will alter in the face of rapidly growing aquaculture and significantly impact the level of adaptive capacity within MRDC. Analysing the association between different levels of aquaculture activity and MRDC livelihoods and social networks can also provide valuable insights into the recognition component of environmental justice, as greater affiliation to MSES governance networks will increase a household's social capital and impact the distribution of adaptive capacity within MSES.

Following on from the findings in the previous chapter, three livelihood features that influence adaptive capacity and which have significantly altered subsequent to the rapid growth of aquaculture, are: income, natural resource dependency and livelihood diversity (Chambers and Conway, 1992; Ellis, 2000; Vincent, 2007). Income level can influence adaptive capacity through the extent to which it permits households to effectively respond to change (Fisher, 2001). For example, results from the previous chapter indicate that households with high incomes were more able to prepare for MSES change by investing in physical capital, or to purchase food in times of shortage or drought (cf. Marshall et al., 2009). Results also indicate that those with low income levels often lack access to the resources necessary to respond to MSES change, and may be reluctant to take on further risks (Fisher, 2001). Households with a large proportion of their income coming from highly uncertain and climate sensitive natural resources are often considered vulnerable to environment change (Adger, 2000). Results from the previous chapter

suggest that greater dependence on MSPG increased vulnerability through reduced and degraded mangrove commons and a subsequent inability to respond to MSES change (cf. Adger, 2000). The concept of dependency originates from a rural sociological perspective on communities and their interaction with risky resources (Chambers and Conway, 1992). Diverse livelihoods are often said to be better suited to reducing vulnerability to shocks and stresses because they allow risks to be spread across a number of income generating activities (Ellis, 2000). Hence, results from the previous chapter indicate that livelihood diversity is a source of resilience by reducing household dependence on any particular livelihood activity. Furthermore, livelihood diversity provides households with greater flexibility through a wider range of livelihood activities to respond and buffer MSES change, thus increasing adaptive capacity. This enables households to absorb shocks and adapt to new challenges without changing their fundamental structure and function (Gunderson and Holling, 2002; Cinner and Bodin, 2010).

Results from the previous chapter highlight the significant changes to MRDC livelihoods subsequent to rapid aquaculture growth. As some households are able to take advantage of the opportunities presented by aquaculture to improve their livelihoods, others have become more marginalised. The subsequent changes in MRDC livelihoods will influence the structure of social networks in MRDC, a crucial component of adaptive capacity. This may also have implications for environmental justice through alterations in the level of recognition given to different groups within MRDC. The objective of this chapter is to assess the impacts of key aspects of MSES (i.e. aquaculture) on social capital. The research questions employed to achieve this objective are: (1) Is there an association between different levels of aquaculture activity and livelihood characteristics at the community level? (2) Is there an association between different levels of aquaculture activity and social network characteristics? And, (3) Do livelihood characteristics influence the structure of household social networks within communities of differing levels of aquaculture activity? It is argued that high aquaculture activity is associated with more fractionalised communities as social networks expand beyond the local community and become more market oriented. This could be detrimental to mangrove management as due to divergent understandings of mangrove functions and processes, and may require fostering network diversity through a balancing of internal bonding and external bridging community ties. Alterations in social network structures has implications for the recognition component of environmental justice in adaptive capacity, as this influences the

affiliation households have to the networks of MSES governance and thus the distribution of adaptive capacity within MSES.

5.2 Explanation of the way in which the social network analysis is conducted

Network density is measured by calculating the number of existing contacts divided by the number of possible contacts. Density relates to bonding social capital in that it involves strong social linkages within groups of like-minded individuals characterised by localised networks (Barnes-Mauthe et al., 2013). This can lead to the creation of trust within a network and the promotion of norms for acceptable resource use (Pretty and Ward, 2001). However, density can have differing effects depending on the context (Bodin et al., 2006), and too much density can result in homogenisation which can reduce adaptive capacity (Bodin and Crona, 2009). For example, Wolfe et al. (2010) found that in the UK, elderly people felt that heat waves posed no significant threat to them and that they could cope in hot weather without changing their behaviour. They concluded that strong bonding networks were perpetuating rather than challenging perceptions about the effect of hot weather and therefore increasing rather than ameliorating vulnerability.

Degree centrality is simply the number of contacts a household has and is an important indicator of how integrated a household is within the network (Valente and Foreman, 1998). A high degree centrality for a household can indicate resilience through the high number of redundant contacts, but too many bonding contacts may constrain a household's behaviour due to homogenisation of perspectives and reduced flexibility, and hence lower capacity to adapt to SES change (Frank and Yasumoto, 1998; Bodin and Crona, 2009). Betweenness centrality has similarities to bridging social capital in that it refers to individual households connecting (or bridging) households who would otherwise not be linked (Burt, 2004). However, it does not measure bridging social capital as defined earlier because it does not differentiate between households within or outside a community. High betweenness centrality indicates that a household has a diversity of resource sources, while granting the household with the capacity to influence the flow of information between others (Bodin and Crona, 2009). However, as stated above bridging capital is characterised by weaker linkages of trust and reciprocity, and in terms of redundancy, high

levels of betweenness can make the network vulnerable to fragmentation should these households disappear (Borgatti, 2003).

To increase the productive capacity of social networks, Burt (1992) claims that simply increasing network size without due consideration of the diversity of contacts reached can result in an inefficient network. This is because having many ties of a similar nature to similar actors with similar resources (i.e. redundant ties) will not incur additional benefits. Figure 5.1 illustrates an inefficient network (A) comprising a large number of redundant contacts, compared to an efficient network (B) with low levels of redundancy. The term that Burt (1992) uses to denote effectiveness in networks is effective size. Network A has a network size of 16, but the effective size is only 4. This is because the household in question is only able to obtain benefits from four separate clusters of contacts, in each case using one of four possible contacts. Hence, the other three contacts to each of the clusters are redundant because they provide the same benefits. Network efficiency is calculated by dividing the effective size of the network by the total number of contacts, in the case of network A giving a score of 0.25 (i.e. 4/16 = 0.25). In network B we observe perfect efficiency of 1 (i.e. effective size 4/network size 4 = 1). In terms of productive capacity, the number of non-redundant contacts should increase with the number of contacts to achieve optimal efficiency (i.e. 1). Network constraint measures the degree to which a household's contacts are connected to each other and is therefore a proxy for redundancy of contacts. In terms of network productivity, if a household's potential trading partners are all connected and have one another as potential trading partners, that household is highly constrained (Hanneman et al., 2005). Research on network productivity demonstrates that high efficiency and low constraint are useful indicators of an individual's ability to 'get ahead' in terms of performance and ideas (Burt, 2004; Podolny and Baron, 1997). However, in this study too much efficiency indicates reduced redundancy and so lowers adaptive capacity.

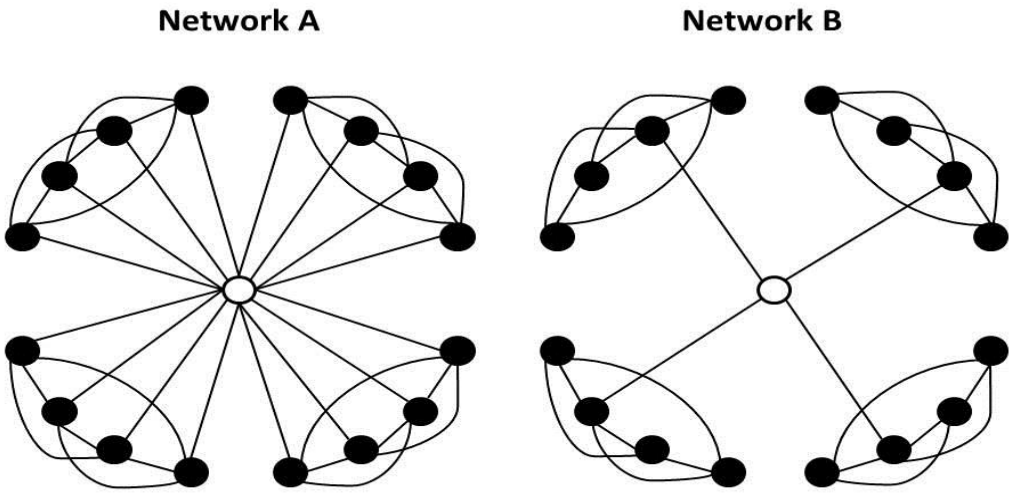

Figure 5.1: Inefficient (A) and efficient (B) networks. Adapted from Burt (1992)

5.3 Materials and methods

Each community exhibits different levels of aquaculture activity (see section 3.4 for details), influencing aspects of adaptive capacity relating to livelihoods and social networks: Giao Xuan representing a high level of aquaculture activity; Da Loc representing a medium level of aquaculture activity; and Dong Rui representing a low level of aquaculture activity. A quantitative approach using household surveys was conducted in each community in order to obtain the social network data presented in this chapter (see section 3.5.2 for more detail). Household surveys were conducted with household heads to identify: (i) livelihood characteristics regarding income, mangrove dependency (i.e. per cent of total income coming from sale of MSPG), and livelihood activity diversity; and (ii) social connectivity through name-generator questions. In order to develop the social network, households were given a name-generator question, requesting them to identify further households that they interact and exchange information with regarding mangrove system status and condition (Prell, 2012). The list of names given also provided the basis of the snowball sample (for details on sampling, see section 3.5.2). Each individual listed in the name-generator represented a communication tie of that household, and the full set of individuals on the name-generator list comprised that household's full ego-network.

Data for social network analysis were collated using quantitative methods to produce numerical data on the presence or absence of ties (Edwards, 2010). Such an approach enabled the measurement of network structure properties of density, degree and betweenness centrality, efficiency, effective size, and constraint. Although quantitative methods can overlook culture, agency and the processes through which relationships are created, maintained or reconfigured over time (Emirbayer and Goodwin, 1994), employing a quantitative approach in this study permitted the analysis of large sets of data using statistical techniques in order to identify patterns and connections in the data, which would not have been possible with qualitative information. Furthermore, the structure of networks was able to be analysed from the perspective of all actors in the network at the same time, and not just one individual perspective (Scott, 2000).

Using SPSS v19, frequencies of livelihood characteristics (i.e. income, mangrove system dependency, tenure rights and livelihood diversity) were first explored. To represent connectivity, the focus was on six key social network metrics; density, degree centrality, betweenness centrality, effectiveness, efficiency and constraint (see chapter 2: section 2.6.2). UCINET 6 software was used for social network analysis, which is the most utilized software package for this purpose (Borgatti et al., 2002). Once livelihood and connectivity measures were attained, Kruskal-Wallis and Mann-Whitney tests were conducted (Ahenkan and Boon, 2011; Cox et al., 2010). Livelihood indicators as independent variables were tested against the dependent social network structural measure variables (Brouwer et al., 2007) in order to ascertain how livelihood characteristics have influenced household social connectivity. Analysing social capital in this way provided insights into recognition in adaptive capacity, as social networks shape the affiliation of households with the networks of MSES governance.

5.4 Results

5.4.1 Comparing livelihood diversity characteristics across communities

In relation to research question 1 of this chapter, establishing a set of livelihood characteristics and values for each household allows us to explore the similarities and differences between communities (Table 5.1). A significant difference was observed in the

mean income values between Giao Xuan and both Da Loc and Dong Rui, indicating that greater levels of aquaculture activity are associated with higher incomes at the aggregate community level. The association between aquaculture activity and income inequality is illustrated by observing the distribution of data in the descriptive statistics table (Tables 5.2 and 5.3), whereby the 5% trimmed mean and income range are both considerably higher in Giao Xuan, followed by Da Loc, then Dong Rui.

Table 5-1: Livelihood characteristic measures between communities (GX = Giao Xuan, DL = Da Loc, DR = Dong Rui)

Livelihood characteristic measures			
	Test statistic	**Degrees of freedom**	**Post-hoc r score**
Income	22.97*	2	0.148 (GX-DR)
Mangrove dependency	89.25*	2	0.485 (GX-DR)
Livelihood diversity	72.2*	2	0.405 (GX-DL)

* p = 0 to 0.05

Table 5-2: Descriptive statistics for livelihood diversity measures

Community	**Descriptive**	**Income**	**MSPG**	**LH diversity**	**Education**	**MSPG dependence**
Giao Xuan	Mean	18,618	7.24	3.28	2.14	Low = 44 (56%)
	5% trimmed	5,875	5.61	3.28	2.14	Med = 16 (20%)
	St dev	84,670	13.17	1.06	0.8	High = 19 (24%)
	Range	713,543	47	5	4	
	Skewness	7.6	1.76	-0.00	-0.1	
	Kurtosis	60.9	1.88	0.520	1.4	
Da Loc	Mean	4,116	24.4	4.91	2.28	Low = 23 (33%)
	5% trimmed	2,518	22	4.92	2.27	Med = 37 (53%)
	St dev	8,479	28.36	1.07	0.86	High = 10 (14%)
	Range	49,843	99	5	4	
	Skewness	4.79	1.00	-0.26	-0	
	Kurtosis	23.37	-0.07	-0.02	-0.07	
Dong Rui	Mean	3,957	47.48	4.33	1.84	-
	5% trimmed	3,657	47.13	4.37	1.82	-
	St dev	2,874	33.145	1.01	0.93	-
	Range	16,171	100	4	4	-
	Skewness	1.89	0.35	-0.41	0.1	-
	Kurtosis	5.27	-1.24	-0.21	0.27	-

Table 5-3: Descriptive statistics for social network measures

Community	Descriptive	Density	Degree	Ego-betweenness	Effective size	Efficiency	Constraint
Giao Xuan	Mean	0.09	6.91	10.09	6.3	0.9	0.31
	5% trimmed	0.06	6.75	8.36	6.17	0.92	0.29
	St dev	0.15	3.04	12.7	2.9	0.12	0.2
	Range	1	16	62	13.51	0.58	1.06
	Skewness	3.93	0.81	2.04	0.62	-1.92	2.2
	Kurtosis	19.47	1.11	4.7	0.5	4.06	5.6
Da Loc	Mean	0.09	9.39	14.33	8.12	0.87	0.33
	5% trimmed	0.09	9.02	10.5	7.75	0.87	0.32
	St dev	0.06	4.82	25.02	4.28	0.88	0.13
	Range	0.33	26	157.5	21.08	0.46	0.71
	Skewness	1.06	1.3	3.53	1.4	-0.87	1.18
	Kurtosis	2.54	3	16.25	3.06	1.87	2.53
Dong Rui	Mean	0.12	5.85	9.31	5.06	0.87	0.38
	5% trimmed	0.1	5.64	7.6	4.86	0.89	0.37
	St dev	0.15	2.98	12.78	2.66	0.14	0.17
	Range	0.83	15	72	15.55	0.67	0.86
	Skewness	2.18	1.12	2.32	1.35	-1.38	1.2
	Kurtosis	5.82	1.63	6.64	2.77	2.1	1.53

A significant disparity occurred in the mean mangrove dependency values, suggesting an inverse association between aquaculture prevalence and mangrove dependency. The 5% trimmed mean indicates that extreme values had less influence in Dong Rui than in Giao Xuan and Da Loc. However, the lower range of mangrove dependency observed in Giao Xuan, with a well-established aquaculture industry, combined with greater skewdness and kurtosis values, suggests that greater aquaculture activity was associated with lower mangrove dependency.

A noteworthy variation was noted in the mean livelihood diversification values between Giao Xuan and both Da Loc and Dong Rui, suggesting that high aquaculture activity has an inverse association with household livelihood diversification. Although there is no notable deviation from the mean value observed in the 5% trimmed mean and range values in all three communities, with a greater range of livelihood activities available to households in Giao Xuan but a lower mean value of livelihood activities undertaken, this suggests that households have less diverse livelihoods in communities with greater levels of aquaculture activity. This is supported by the kurtosis values which suggest that households cluster around the mean in Giao Xuan, with a flatter distribution found in Da Loc and Dong

Rui. Hence, in communities with high levels of aquaculture activity, household livelihood activities are lower and concentrated into that industry.

5.4.2 Comparing social network characteristics across communities

Establishing a set of social network measures and values for each household allowed for a comparison of social capital and recognition across communities (research question 2). Table 5.4 shows the network measure values and mean rank after data normalisation for each community, while Table 5.5 shows the results of statistical analysis comparing network values across the three study sites.

Table 5-4: Network measure values and mean rank (mr) for each community

	Degree (value/mr)	**Density** (value/mr)	**Betweenness** (value/mr)	**Effective size** (value/mr)	**Efficiency** (value/mr)	**Constraint** (value/mr)
Giao Xuan	6.91/125	0.09/106	10.09/127	6.29/130	0.9/141	0.31/101
Da Loc	9.39/162	0.09/140	14.33/125	8.12/158	0.87/106	0.33/125
Dong Rui	5.85/98	0.12/129	9.3/122	5.06/96	0.87/124	0.38/143

Table 5-5: Difference in social network measures between communities

	Social network measures		
	Test statistic	**Degrees of freedom**	**Post-hoc r score**
Degree	32.64**	2	0.178 (DL/GX>DR)
Density	8.64*	2	0.076 (DL>GX)
Betweenness	0.241	2	- Ω
Effective size	31.08**	2	0.172 (DL>DR)
Efficiency	9.45**	2	0.081 (GX>DL)
Constraint	15.15**	2	0 (DR>GX)

*****Kruskal-Wallis test score p = 0.026, ** p = 0.05

Ω = no significant relationship observed, therefore no score provided

5.4.2.1 Comparing degree centrality across communities

Dong Rui (5.85/98) is associated with significantly smaller networks than Giao Xuan (6.91/125) and Da Loc (9.39/162). This reflects the close-knit community networks in this community that are based on kinship and strong bonding social capital ties which do not extend beyond the local community. These networks are important for accessing the necessary information on mangrove system status and condition in order to respond to day-to-day changes in the availability of MSPG that support local livelihoods. Da Loc and Giao Xuan, with medium and high aquaculture activity respectively, are associated with

larger networks. Following from the results observed in the previous chapter, this is likely to be due to networks of these communities reaching beyond the local community in order to access the necessary skills, capital and domestic and international markets required to establish successful aquaculture ventures. These market based networks are typically comprised of weak bridging social capital.

5.4.2.2 Comparing network density across communities

Giao Xuan (0.09/106) is associated with significantly less dense networks than Da Loc (0.09/140), and notable but not statistically significant less density than Dong Rui (0.12/129). This indicates that the networks of Da Loc and Dong Rui have greater connectedness. Following from results from the previous chapter, networks are also typically local, being based on stronger bonding social capital. Higher density values indicate that more connectedness and redundancy is embedded within these networks. This suggests that such networks are more adaptive as information on mangrove system condition is shared and flows around the densely connected community network, with greater redundancy ensuring that the loss of any single connection is buffered by other similar ties. That Giao Xuan is associated with less dense networks reflects the market based nature of such networks, which typically exhibit weaker ties of bridging social capital that reach beyond the community itself and therefore have less 'connectedness'. In addition, the creation of aquaculture farmers, employees and marginalised households associated with communities with high aquaculture activity leads to reduced density among community networks as interaction among households from these different groups decreases. Such networks have greater emphasis on productivity as households engaged in aquaculture focus network efforts on gaining access to the resources necessary for its establishment and maintenance, rather than the sharing of information regarding mangrove system status and condition.

5.4.2.3 Comparing betweenness centrality across communities

Dong Rui (9.3/122) is associated with notably lower betweenness values than Giao Xuan (10.09/127) and Da Loc (8.12/158), although this is not statistically significant. The lower betweenness value reflects two characteristics of social networks in Dong Rui. First, aquaculture has not fragmented the community into aquaculture farm owners, employees

and marginalised households, and there are therefore fewer groups within the community to bridge. Second, Dong Rui's networks are small, dense, and do not typically extend beyond the immediate community, and hence there are less groups external to the community to bridge. In Giao Xuan, more groups are available for bridging to occur, both within the community between aquaculture farmers, employees and marginalised householdss, and beyond the community in terms of networks for accessing the resources necessary to develop and maintain aquaculture, and the domestic and international market networks for aquaculture goods.

5.4.2.4 Comparing network effectiveness across communities

Da Loc (8.12/158) is associated with significantly higher levels of network effectiveness than Giao Xuan (6.29/130) and Dong Rui (5.06/96). This reflects a greater number of clusters of resources available to the community for households to access. In addition, there are limited resource clusters external to the community, as networks from this community are typically local, small and dense and based on kinship ties. This suggests that networks are creating and diffusing information regarding mangrove system status and condition from a low number of resource clusters with high dependency on MSPG. Conversely, Da Loc and Giao Xuan are associated with higher network effectiveness. This reflects market networks that extend beyond the community to access resources such as finance, skill, labour, capital and markets necessary for the development and maintenance of aquaculture.

5.4.2.5 Comparing network efficiency across communities

Giao Xuan (0.9/141) is associated with greater network efficiency than Da Loc (0.87/106), and notably but not statistically significant than Dong Rui (0.87/124). Following from the findings from the previous chapter, this indicates that in order to increase aquaculture productivity, owners use large and diluted networks that extend beyond the local community to access the greatest number of resource clusters. Efficiency is increased by using the fewest number of network ties possible, which are comprised of weak bridging capital ties. However, the greater level of network efficiency can be detrimental to adaptive capacity. This is due to low levels of network redundancy as there is little tie duplication within these productive networks, and hence the network becomes vulnerable through

reduced ability to buffer the network from the loss of any single tie. In contrast, the small, dense networks associated with Da Loc and Dong Rui are more congruent with adaptability, with strong bonding social capital, connectedness and redundancy increasing resilience through buffing in the case that any single tie is lost. This ensures that the day-to-day flow of information regarding the condition of mangrove systems is maintained for those whom depend on MSPG for their livelihoods.

5.4.2.6 Comparing network constraint across communities

Dong Rui (0.38/143) is associated with statistically significant higher network constraint than Giao Xuan (0.31/101), and notable but not statistically significant constraint than Da Loc (0.33/125). Network constraint also indicates network redundancy. This reflects the small, dense local networks of Dong Rui, meaning that a household's contacts are typically connected to each other. In terms of productivity, the strong bonding social capital ties in Dong Rui indicated by small and dense networks are deemed ineffective, inefficient and constrained. However, this is advantageous in terms of adaptive capacity as the duplication of ties among a household's contacts increases network redundancy, and hence buffering capacity to cope with the loss of any individual tie within the information network. Conversely, Giao Xuan is associated with low network constraint. This reflects the productive, effective and efficient nature of networks in this community. Such networks extend beyond the community in order to access the greatest number of resources using the least amount of contacts, and therefore a household's contacts are less likely to be connected to each other. Low network constraint also provides the opportunity for households to control the flow of resources and information within the network to their advantage.

5.4.3 Comparing livelihood diversity and social network characteristics within communities

Having established a set of livelihood and social network characteristics and values, it is possible to determine whether there is a relationship between livelihood characteristics within communities and their social connectivity (research question 3) (Table 5.6).

Table 5-6: Results of Kruskal-Wallis tests for significant differences in social network scores according to livelihood measures in the three study communities

Dong Rui						
	Density	**Degree**	**Betweenness**	**Effective size**	**Efficiency**	**Constraint**
Income	9.15***	3.26	0.91	1.11	10.78*	0.66
MSPG dependency	1.88	1.82	4.66*	2.46	1.85	4.55
Livelihood diversity	0.7	0.49	1.48	0.71	0.35	1.1
Da Loc						
	Density	**Degree**	**Betweenness**	**Effective size**	**Efficiency**	**Constraint**
Income	0.51	0.54	1.67	0.21	0.431	0.59
MSPG dependency	2.92	3.71	5.92*	4.54	3.13	3.04
Livelihood diversity	4.45	2.33	0.02	1.69	0.94	1.68
Giao Xuan						
	Density	**Degree**	**Betweenness**	**Effective size**	**Efficiency**	**Constraint**
Income	1.63	0.31	0.96	0.46	1.22	2.24
MSPG dependency	4.66*	0.85	0.28	0.26	3.88	0.19
Livelihood diversity	4.49	0.75	3.01	0.54	4.36	5.93*

***p = 0.025, ** = 0.05, *= 0.1 (*nb: *** and ** are statistically significant, while * is evident but not statistically significant*)

In Dong Rui there was a significant difference in density scores according to income, with higher income households having greater density than lower income households. Dense networks reflect strong bonding ties within Dong Rui, which can enable the quick dissemination of information regarding the status and condition of mangrove systems necessary to support livelihoods and respond to change. High income households in Dong Rui also benefit from increased network resilience through higher levels of connectedness and redundancy, i.e. the flow of information is buffered from the loss of any single tie. Low income households in Dong Rui are at a disadvantage from having more diluted networks were information spreads less quickly and is more vulnerable to the loss of any single tie. Although not statistically significant, a difference was observed in efficiency values according to income, with lower income households having more efficient networks. As low income households tend to be marginalised households with greater MSPG dependency, this reflects that such households are using their networks to access the greatest amount of mangrove system information with the least amount of network ties possible. However, this indicates less network redundancy meaning less resilient networks that lack the ability to buffer against the loss of any single network tie. Although not statistically significant, a difference was also noted in betweenness scores according to MSPG dependency, with low dependency households having greater betweenness than high dependency households. This indicates that households with low MSPG dependency, which tend to be more advantaged households, bridge divergent households within Dong Rui. This means such households have the opportunity to access and control information

regarding mangrove systems from diverse households. Conversely, households with high MSPG dependency, which are typically less advantaged with low incomes, do not have access to diverse sets of groups and can only retrieve information from other similarly less advantaged households. This limits their livelihoods and ability to respond to MSES change.

In Da Loc, although not statistically significant, a difference was observed in betweenness according to mangrove dependency, with more MSPG dependent households scoring lower in betweenness values. This indicates that more MSPG dependent households in Da Loc play less intermediary roles between groups, resulting in low access to diverse information sources. Highly MSPG dependent households tend not to have connections to aquaculture farm owners and employees, and typically only communicate with other highly MSPG dependent households from which they access information regarding mangrove system status and condition. Less MSPG dependent households tend to be more advantaged households with higher incomes from aquaculture. These households use connections external to the local community in order to access the resources necessary to establish and maintain aquaculture. However, these are typically based on weaker market based bridging ties meaning that networks are vulnerable to the loss of any single tie.

In Giao Xuan, although not statistically significant, there was a notable difference in network density values according to mangrove dependency. Households with some level of MSPG dependency had greater density than those with no MSPG dependency. This is reflective of less advantaged households in Giao Xuan, which depend to some extent on MSPG for their livelihoods. Such households possess stronger bonding social capital based on kinship ties which they use to access information regarding the status and condition of mangrove systems, which is crucial to support their livelihoods and respond to MSES change. These networks are highly connected with high redundancy, increasing resilience through great ability to buffer the network against the loss of any one single tie. Conversely, households with no MSPG dependency, typically successful aquaculture farmers, tend to have diluted networks that extend beyond the local community in order to access the resources necessary to establish and maintain aquaculture. However, these networks have less connectedness and redundancy and are therefore vulnerable to the loss of single ties.

Also in Giao Xuan, although not statistically significant, a notable difference was observed in constraint according to livelihood diversity, with lower livelihood diversity households possessing less constrained networks. Households with lower livelihood diversity are typically engaged in aquaculture, either as farm owners or employees on farms. The networks of such households are more market focussed and tend to extend beyond the local community in order to access the resources necessary for aquaculture development and maintenance. Such networks are likely to be less constrained as connections are less likely to be connected to one another. However, such networks have less connectedness and redundancy and are therefore vulnerable to the loss of single ties. Conversely, households with greater livelihood diversity tend to be more disadvantaged and rely on numerous income streams to support their livelihoods. The networks of such households tend not to extend beyond the local community, relying on information about mangrove system status and condition internal to the community, and are therefore highly constrained as connections tend to be connected to one another. However, this can be advantageous to such households as constrained networks mean the flow of information has greater connectedness and redundancy, indicating greater resilience to the loss of any single tie.

5.5 Discussion

5.5.1 Implications of livelihood characteristics on resilience across communities

An understanding of the impact of aquaculture on adaptive capacity can be grasped by observing the aggregate values of livelihood diversity measures (i.e. income, MSPG dependency and livelihood activities) between communities with different levels of aquaculture activity. Findings suggest that higher levels of aquaculture activity are associated with a higher aggregate income of communities, with a large effect on income inequality, whilst MSPG dependency and livelihood diversity are both lower. Results from Orchard et al. (2014) indicate that political and economic reform in Vietnam, in the shape of devolved land rights and market liberalisation, has altered household livelihood activities, particularly in communities with higher levels of aquaculture activity. Although higher levels of aquaculture activity increase the number of livelihood activities available to households, the actual number of livelihood activities that households engage in was found to be less than in communities with lower aquaculture activity. This corresponds with

findings from Cinner and Bodin (2010) in their study of fishing communities in Kenya, who found that households in more developed communities were less likely to have supplementary livelihood activities than those with lower levels of development. Furthermore, although on average household income is higher and MSPG dependency is lower in communities with high levels of aquaculture activity, those households that lack the capacity to take advantage of the livelihood opportunities provided by aquaculture risk becoming increasingly marginalised and dependent on mangrove system commons that are decreasing in their extent (Orchard et al., 2014). The significant divergence in aggregate livelihood diversity measures between communities is important because livelihoods are the means by which households in mangrove system dependent communities interact with one another and the changing environment around them (cf. Frost et al., 2006) which greatly influences adaptive capacity (Vincent, 2007). Hence, livelihood changes subsequent to rapid aquaculture growth, with some households able to take advantage of new opportunities while others cannot, will alter the levels of recognition given to certain groups within MSES governance networks, with implications for environmental justice.

5.5.2 Implication of social network characteristics on resilience across communities

Examining the impact of different levels of aquaculture activity on social networks is important because changes in livelihoods subsequent to rapid aquaculture growth will alter social capital and levels of recognition within MRDC. This influences adaptive capacity by shaping resilience through the ability of MRDC to reorganise and agree on how mangrove system resources are used and/or misused (Baird and Gray, 2014). Households with greater recognition will be better positioned to influence reorganisation processes. In Vietnam, social networks have long been central to household coping strategies in times of stress (Luong, 2003). Results show that communities with low levels of aquaculture activity have smaller and denser networks than communities with high levels of aquaculture activity, suggesting a larger stock of bonding social capital and hence adaptive capacity in these communities. Previous research suggests that this can lead to lower levels of network fragmentation by facilitating trust and the creation of social norms and codes of behaviour favourable to natural resource management (Gutierrez Rodriguez et al., 2011; Barnes-Mauthe et al., 2013). Social networks of communities with low levels of aquaculture activity are smaller and denser than those with high levels of aquaculture activity suggesting that development may co-evolve with changes to network structures (cf: Maiolo

and Johnson, 1989). This corresponds with Baird and Gray's (2014) findings in their study of the influence of economic transition on Maasai communities in Tanzania, whereby: livelihood opportunities are low and social network interactions are high prior to transition; livelihood opportunities increase with development, which prompts changes in the traditional use of social networks; and households reduce their engagement with traditional social networks.

The observed differences in social networks in the present study indicate a move away from networks characterised by high levels of bonding in communities with low levels of aquaculture activity, to networks more characteristic of bridging capital in communities with high levels of aquaculture activity. Results show that households in communities with medium levels of aquaculture activity observe a greater number of contacts and effectiveness of their networks than communities with low aquaculture, although networks are less efficient. This implies that the greater redundancy in contacts is proportionate with the greater size of their networks, favourable for the maintenance of adaptive capacity (Beilin et al., 2013). This could be due to new contacts being made within the community but beyond immediate family and friends, indicated by the lower network constraint observed than in communities with low levels of aquaculture activity. The networks of households in communities with high levels of aquaculture activity are larger and more diluted as they expand out of the local area. In terms of productivity, networks are greater in effectiveness and efficiency as redundant ties are lower with networks extended beyond the community. Although network constraints are lower, this represents lower adaptive capacity through a lack of redundant contacts.

Regarding efficiency at the aggregate community level, households in Giao Xuan maintained significantly more efficient ties, and faced significantly fewer constraints to their networks. This may be due to the expansive nature of market networks, which span across different regions and groups, characteristic of communities with well-developed aquaculture. Previous research on organisational network dynamics advocates this type of network with regard to gaining competitive advantage in market settings (Burt, 2004). However, such structures may not be conducive to natural resource management which relies much more on cooperation, collective agreements and shared understandings in order to reorganise in response to MSES change (Adger, 2003). Communities with high aquaculture activity are characteristic of low constraint networks with many non-

redundant ties beyond their own group. These non-redundant ties connect households to contacts beyond their own group, enabling them to reach a diverse set of perspectives, skills and resources. However, the highly constrained networks observed in communities with low aquaculture development may be advantageous as greater network density can generate social capital through increased trust and shared understandings.

5.5.3 Implications of livelihood diversity and social network characteristics on resilience within communities

In communities with low aquaculture activity, such as Dong Rui, higher income groups have denser networks. This indicates that in these communities greater income levels are associated with having a greater stock of bonding capital (i.e. kinship and friendship), which provides greater adaptive capacity through network redundancy. Conversely, it appears challenging for those households with limited bonding capital to obtain higher levels of income and they risk becoming further marginalised (Orchard et al., 2014). In communities with high levels of aquaculture activity, such as Giao Xuan, networks are denser among groups with higher MSPG dependency. These tend to be more marginalised groups (Orchard et al., 2014), indicating that they rely on bonding capital to sustain their livelihoods. Differences in network density in groups within communities can have a number of implications for adaptive capacity. First, fewer links within a community can diminish collective memory to be used in times of change and uncertainty (Folke et al., 2003). Second, reduced density makes the loss of single actors more problematic as redundant ties characteristic of dense networks provide buffering capacity (Janssen et al., 2006). Third, reduced density may facilitate heterogeneity of experiences and attitudes as a diversity of actors can broaden collective knowledge (Folke et al., 2003). The final point may be less relevant in the studied communities as reductions in local network density are at the expense of market orientated networks to external actors, with short-term and large-scale economic goals in mind.

Although betweenness did not significantly differ between communities at the aggregate level, betweenness was greater in groups with medium levels of MSPG dependency within communities with low and medium aquaculture activity (Dong Rui and Da Loc respectively). With MSPG only moderately contributing to their income, households within these groups rely on other sources of income for their livelihoods (Orchard et al.,

2014). This suggests that by pursuing alternative income streams, these households act as a link between otherwise unconnected groups within communities (cf. Freeman, 1979). This can increase adaptive capacity as these households are able to access different groups and resources to respond to MSES change (Bodin et al., 2006).

Households with high levels of livelihood diversity were found to have the highest constraints in Giao Xuan. This could be due to the fact these households tend to be the poorest and most marginalised, with small and dense kinship networks. These households have smaller and denser networks than households with large and expansive networks linked to the aquaculture market, and tend to have less livelihood diversity and less network constraint. Increased development can result in imbalances in social capital within communities (Isaac et al., 2007), and King (2000) suggests that actors who are successful in furthering their goals will actively seek ties with others to continue the pursuit of their goals. The enhanced individual social capital gained from bridging ties to external connections from the aquaculture sector may contribute to inequity within communities, whereby certain households can maintain their structural position by controlling information from these external sources. Hence, it is possible that an individual's social capital may be reinforced over time as a function of his or her position in the network (Isaac et al., 2007). This is important because research suggests that as local resource extractors become increasingly integrated into global networks of trade (large scale), it is the local social networks (small scale) that largely determine who gets to participate and under what conditions (Frank et al., 2007).

5.5.4 Implications for adaptive capacity and recognition in environmental justice

The reduced network density observed in communities with high levels of aquaculture activity may have negative implications for adaptive capacity, as network density can foster the necessary trust between individuals and groups for reorganisation in response to MSES change to occur (Coleman, 1988; Pretty and Ward, 2001). Bodin et al. (2006) state that trust is important in two ways: firstly, it reduces the risk and cost of collaborating with others which is crucial for collective action to occur; secondly, it facilitates the creation and compliance with mutual norms with regards to acceptable behaviour in resource use. In communities with high levels of aquaculture activity, bonding capital has reduced while household network independence has increased. Baird and Gray (2014) suggest that this

can reduce capacity within communities to reorganise in response to MSES change, such as land conversion and degradation. In addition, reduced community cohesion, in this case through disengagement in community-level networks due to large and expansive aquaculture networks, can reduce the ability of communities to mobilise and act collectively in response to community-level shocks (cf. Adger, 2000). Hence, increased household development and resilience in the short-term may be being paid for through reductions in household and community resilience to MSES change in the long-term (Baird and Gray, 2014).

Effective reorganisation in response to MSES change can be difficult to achieve if few ties exist among actors. Sandstrom and Rova (2010) argue that less dense networks exhibit conflicting interests and perceptions. This, they argue, lowers adaptive capacity through a lack of common understanding and problem identification, such as resource condition, quantity of stocks and rules of use. Furthermore, the absence of a common understanding can obstruct effective rule-making and decrease legitimacy of formal management rules. However, there is a danger that too many ties can foster homogenisation and reduce the capacity for effective reorganisation (Bodin and Crona, 2009). For example, in communities with high levels of aquaculture activity, wealthy households with little MSPG dependency and large and expansive market oriented networks may be less aware of the degradation of the local mangrove systems. This could act as a barrier for community reorganisation as action would require the support of these influential households (cf. Bodin and Crona, 2009). Hence, homogeneity of households belonging to specific groups within communities is likely to hinder reorganisation efforts (Berkes et al., 2003). In light of this, Sandstrom and Rova (2010) argue that denser networks made up of heterogeneous actors can promote bridging of groups with conflicting perspectives. This could facilitate the development of common understandings of natural resource issues and dilemmas, and therefore the ability to reorganise in response to MSES change. Furthermore, linking mangrove system resource users to government representatives from higher institutional levels may help communities to deal with resource issues and dilemmas more effectively through access to additional support, as was found by King (2000) in a study with local fishermen in rural Kenya. Hence, in view of the observed growth and dilution of networks due to high levels of aquaculture activity, there is a need to balance the bonding and bridging elements of social networks in order to

foster effective and efficient natural resource governance (cf: Newman and Dale, 2005; Janssen et al., 2006).

The results presented here have several implications for the recognition component of environmental justice. As has been argued, households from marginalised groups may have potentially higher adaptive capacity due to greater redundancy in their social networks. However, these households face increasingly reduced access to mangrove goods and services necessary to respond to MSES change, and less recognition in MSES governance networks through the influence of market mechanisms and external actors. Conversely, households from higher socio-economic groups have potentially lower adaptive capacity as their networks are structured in such a way to increase productivity through reduced redundancy. However, these households are increasing their access to external resources (i.e. finance, technology, skills, markets and networks) in order to facilitate aquaculture productivity. The rising influence of aquaculture means that these households are gaining recognition in MSES governance networks, and able to influence processes of reorganisation in response to MSES change in their favour, to the detriment of households from marginalised groups. The antecedent vulnerability of these households means that they are disproportionately burdened with the negative impacts of aquaculture, whilst contributing least through their scarce involvement in aquaculture.

5.6 Contribution to knowledge

By analysing the impact of aquaculture on livelihoods and social networks, findings illustrate how these interacting elements have shaped resilience in three MSES in northern Vietnam. By employing an approach that provides insights into social capital in communities with differing levels of aquaculture activity, this study discussed how the livelihood context and the structure of social networks shape the potential for collective action in response to MSES change. Whilst efforts to increase social capital in natural resource dependent communities in order to build resilience are welcomed, the various ways in which aquaculture impacts the structure of social networks and the potential for collective action must be acknowledged. This research has identified changes in network redundancy and network connectedness due to increased market influence as important impacts to consider. Also highlighted as important are the conflicts occurring between (1)

productivity and adaptability, and (2) drivers from external markets versus local mangrove change.

Findings demonstrate how economic transition alters mangrove system governance through the increasing influence of market mechanisms on the structure of social networks. For example, small and dense social networks based on kinship have traditionally played a crucial role in rural Vietnam, representing a component of social capital used as an asset and coping strategy for households with few alternative assets. However, findings show that communities with a greater degree of aquaculture are associated with larger and less dense networks that are shaped by market relations for aquaculture goods that extend beyond the immediate community. This study has demonstrated how market relations have negatively impacted resilience by: (1) lowering the level of redundancy in social networks, reducing buffering capacity in the event that ties are lost; and (2) reducing the level of connectedness within communities as networks become less dense, compromising the ability of communities to self-organise.

Findings presented here highlight important features of communities that should be considered within environmental governance more widely. For example, the increasing influence of external market relations means that community networks risk becoming fractionalised among groups with differing needs regarding networks of (a) productivity or adaptability, and (b) priorities for responding to market changes or mangrove system changes. Households able to access the resources necessary to establish successful aquaculture have shaped efficient networks that focus on adapting to market forces external to the community in order to maintain productivity. Conversely, more marginalised households that have retained networks high in connectedness and redundancy in order to adapt to mangrove system change emanating from within the community. While networks that extend beyond the immediate community present an opportunity to access external resources for some households, they are extracting resources away from others. This has implications for the recognition component of environmental justice (see Figure 2.1, page 25) as affiliation to the governance networks of MSES become based on socio-economic status (Figure 5.2). How mangrove system change affects resilience depends on the impact of aquaculture on livelihood contexts and social network structures, and will manifest differently depending on the diversity and balance of recognition of different groups necessary for sustainable MSES governance.

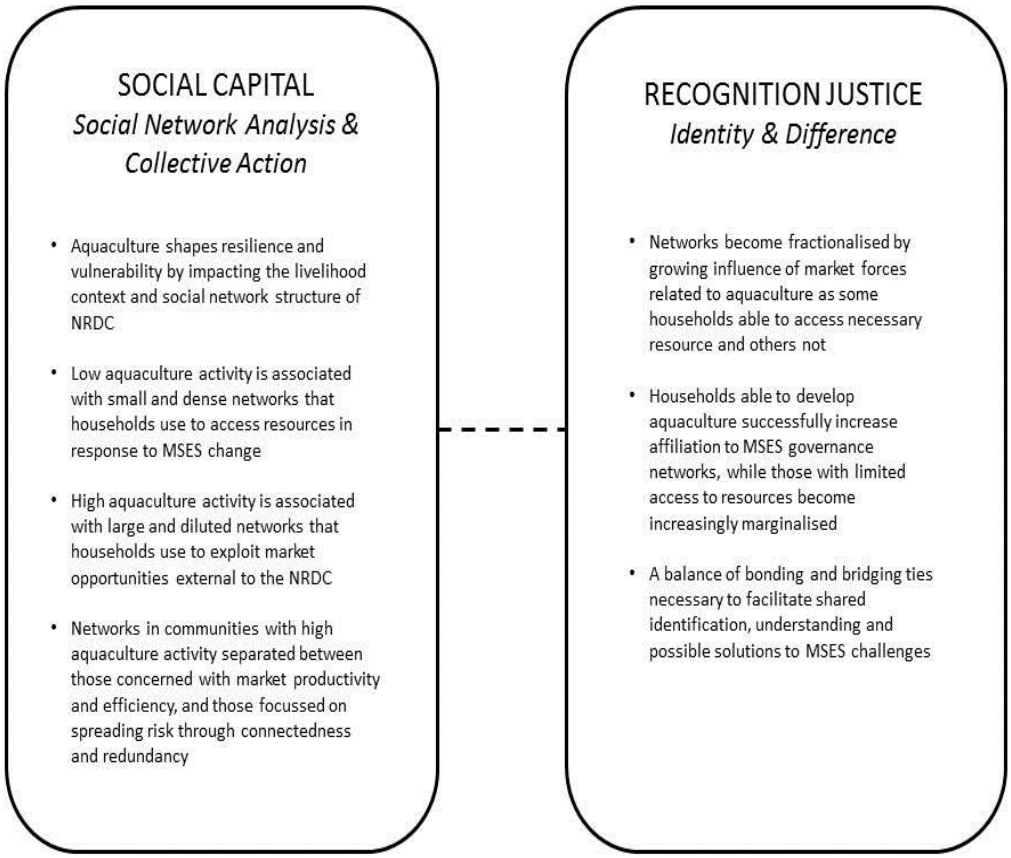

Figure 5.2: Results linking social capital and recognition justice in MSES

5.7 Conclusion

This chapter has examined the impacts on livelihoods and social networks of different levels of aquaculture activity. Using a quantitative approach and social network analysis, it studied three mangrove system dependent communities with differing levels of aquaculture activity. Results indicate that economic development, specifically through increases in aquaculture, does impact livelihood diversity and community network structures. Although average household incomes are higher and average MSPG dependency is lower at higher levels of aquaculture activity, income inequality is shown to be greater with increased marginalisation of some households that are unable to take advantage of the opportunities provided by aquaculture development. This has implications for environmental justice as these households are faced with increasingly less recognition within MSES governance networks, which shape MRDC reorganisation in

response to MESES change. Furthermore, although aquaculture increases the number of livelihood activities available for households to potentially engage in, the average number of livelihood activities households actually engage in is lower as household specialise in this industry. This reduction in livelihood diversity has negative consequences for household resilience as risk spreading is reduced as households become more dependent on the aquaculture industry. Higher levels of aquaculture activity were associated with larger and more dilute networks, with impacts on bonding capital within these communities. In addition, although observed higher network efficiencies are beneficial in terms of productivity, they are detrimental in terms of adaptive capacity due to loss of redundancy. There was a divergence in social network measures observed among certain livelihood diversity groups. This could lead to fractionalisation within communities due to conflicts in land use, with more marginalised groups unable to influence processes of reorganisation in response to such changes due to lower levels of recognition within MSES governance networks. A balancing of bonding and bridging capital may be required in order to foster collective action among communities to respond to shocks and natural resource dilemmas.

Social networks play a crucial role in responding to MSES change in rural Vietnam, which represent a key component of social capital and support for households with few alternative assets. Building and supporting social networks among MRDC can help foster effective reorganisation in response to MSES change through shared understanding, not only of the resource itself, but of the perspectives of divergent stakeholders. However, the lower level of recognition of marginalised groups in MSES governance networks means that they are unable to influence reorganisation processes, resulting in the uneven distribution of adaptive capacity within MRDC. This is crucial in transition economies as the state is rolled back and traditional community networks (i.e. bonding capital) are replaced by external networks (bridging capital) oriented towards markets and commerce. Regarding the implications for policy and development practice emanating from this study, mangrove system management should focus on increasing adaptive capacity rather than productive capacity. One way to move towards this could be to broaden the interpretation of diversity from livelihood activities to also include diversity of social networks ties. This calls for a balance between bonding and bridging capital, linking various stakeholder groups in order to foster collective action on mangrove system resource issues. These recommendations should be considered as supplementary to existing efforts and forms of support, not a substitute. Repeated interactions of the sort recommended here will help to foster the

necessary levels of trust required for effective reorganisation in response to MSES change to take place, as trust is an outcome of social capital and not a source of it. However, equal recognition must be given to marginalised groups within MSES governance networks if environmental injustice is to be avoided. In order to achieve this, it is crucial to understand the processes that create and maintain uneven distribution and recognition in adaptive capacity. Analysing the institutional processes occurring at multiple levels of MSES governance over time provides understanding into the procedural component of environmental justice, which is addressed in the following chapter.

Chapter 6 - Environmental entitlements: institutional influences on mangrove social-ecological systems

6.1 Introduction

Results from this study so far indicate that mangrove goods and services are unevenly distributed within MRDC, through differing levels of access to the resources necessary to sustain livelihoods and respond to MSES change. As livelihoods comprise a crucial component of adaptive capacity, this has implications for the environmental justice aspects of adaptive capacity within MRDC. Furthermore, results have shown how the rapid growth of aquaculture has altered MRDC livelihoods and levels of social capital within MRDC, through alterations in the social networks necessary to effectively reorganise in response to MSES change. As social capital is a crucial component of adaptive capacity, this has implications for the environmental justice aspects of adaptive capacity in MRDC, through differentiation in the recognition of households in MSES governance networks. In order to understand the processes that create and maintain current inequalities in distribution and recognition, it is necessary to analyse the institutional processes occurring at multiple levels of MSES governance, which addresses the procedural component of environmental justice.

The social aspects of MSES interactions involve the institutional processes and procedures of state, private sector, and civil society at multiple levels (Berkes, 2008; Blomquist, 2009). Such processes and procedures shape the distribution and recognition of adaptive capacity within MRDC (Schlosberg, 2004). Institutions also link levels of decision making both vertically and horizontally (Mwangi and Wardell, 2012). Governance institutions do not always reflect this complexity and typically focus on a single level (Ostrom and Nagendra, 2006). Using a multi-level governance approach to analyse SES provides scope to explore complex institutional processes occurring at multiple levels (Termeer et al., 2010). This will increase understanding of the procedural component of environmental justice through the exploration of the procedures within MSES governance that create and maintain unequal distribution and recognition in adaptive capacity within MRDC. In Vietnam, national level political and economic reforms have exposed MSES to pressures from various levels. Enduring, top-down national state planning structures may not provide effective solutions for the overarching challenge of MSES governance (Van Hue and Scott, 2008), while policy decisions at international and national levels could threaten

the ability of households to access and control the MSPG that they rely on for their survival (Luttrell, 2006).

Drawing on the environmental entitlements framework, this chapter examines how multi-level governance processes are influencing mangrove entitlements, and the procedural component of environmental justice, following devolution, decentralisation and market liberalisation reforms (1986-2012). The objective of this chapter is to explore how institutions and processes occurring at multiple levels of MSES governance are shaping local level entitlements to MSPG. The research questions are: (1) What are the current formal and informal institutions relating to MSES governance? (2) What is the role of state, private sector and NGO actors in shaping household entitlements to MSPG? And, (3) What institutional factors have influenced the capabilities of MSES dependent households. It will be argued that political and economic reform has reinforced pre-existing power structures and concentrated of wealth among local elites, negatively impacting the mangrove entitlements of marginalised households. The lack of formal recognition of civil society has further constrained the capability of marginalised households to participate in mangrove management decisions, with implications for procedural component of environmental justice.

6.2 Methods

A qualitative approach was taken to data collection and analysis through a series of semi-structured interviews (see section 3.5.3 for details). For details of the sampling process see section 3.5.3. The time span considered in the interviews was limited to the period 1975-2012. This covers the post-reunification period, encapsulating the collectivised farming era and subsequent market liberalisation, devolution of land management, and decentralisation of land allocation decisions: significant events in setting the boundaries of household access to mangrove systems. Throughout this chapter, the macro level refers to national and international level institutions, the meso level encompasses institutions operating above household and below national institutions, and the micro level refers to household institutions. For details regarding the identification of formal and informal institutions (research question 1) see section 3.9. To answer research question 2, semi-structured interviews with all respondents were used to identify how key state, private sector and NGO actors have influenced mangrove entitlements. Interviews with state,

private sector, NGO and university stakeholders (i.e. experts) sought to elucidate changing roles and influences in MSES governance since the implementation of devolution, decentralisation and market reforms. Household interviews then sought to reveal how the changes identified in the stakeholder interviews have impacted household mangrove entitlements. To answer research question 3, semi-structured interviews with households and stakeholders were used to ascertain how formal structures, informal arrangements, and key actors, had affected household capabilities to access MSPGs. Interviews with state, private, NGO and university respondents sought to ascertain how formal and informal structures had influenced the ability of actors external to the state to influence policy and regulation decisions relating to mangrove systems since economic reform. Interviews with households sought to understand changes in how state, private and NGO actors and informal structures had affected their ability to influence and/or participate in decisions relating to MSPGs. This is crucial for understanding the procedural component of environmental justice. For details on how the data for this chapter was analysed, see section 3.9.

6.3 Results

6.3.1 Formal and informal institutional arrangements

This section identifies the current formal and informal institutional mechanisms across and within levels that determine household endowments, entitlements and capabilities (research question 1 of objective 3).

6.3.1.1 Formal institutions

Differences in mangrove system endowments derive largely from variations in statutory rights (Agrawal and Ostrom, 2001) and land use regulations (Weyerhaeuser et al., 2006). The same laws and regulations that govern terrestrial forests apply to mangrove forests, with the primary statutory laws underpinning the rights and duties for mangrove forest stakeholders being: the Land Law 1993; the Forest Use and Development Law (FPDL) 2004; and the Civil Code 2005.

Forestry and Land policy

Until the mid-1980s, forestry policy was characterized by centralized State control and forests were deemed national assets owned by the State. State Forest Enterprises (SFE) and other State organizations were in control of 70% of forestland (Vien, 2008). However, corrupt staff in the forestry sector, a lack in effective monitoring and enforcement of legislation and policies, and a lack of incentives for local people to conserve and sustainably manage forest resources stemmed from the institutional problems associated with centralised state ownership (Ha et al., 2014; Wibowo and Byron, 1999). Thus, state ownership of forest resources led to de jure state property but de facto open-access (Bien, 2001), and poor management of forests by SFE resulted in severe forest degradation and loss (Sikor, 2001; Vien, 2008). This was disastrous for the millions of people dependent on forest products for their livelihoods (Thanh et al., 2010). Local people's interest and insights were not taken into account in forest management and the policy framework led to conflicts between local resource users and state forest organizations such as state-owned forestry companies and forest rangers (Thanh et al., 2010; Ha et al., 2014). The unequal distribution of land emanated from the appropriation of land by farmers, causing intense conflict over forest rights and boundaries among actors (Ha et al., 2014).

The 1986 'Doi Moi' economic reforms led to the development of the 'Socialist-oriented market economy', bringing to an end the push for collectivisation and the exclusive commune cooperatives on agriculture and forestry (Van Hue, 2008). After the initial success of 'Doi Moi', the legal framework of land tenure changed further, devolving from State-based to society based management. Devolution aimed to address institutional problems, which were identified as the major reason behind deforestation and forest degradation (Ligon and Narain, 1999), by increasing the power of local people and their ability to benefit from forests by way of legal acts (Edmunds et al., 2003) and institutional changes (Thanh and Sikor, 2006). In 1991, supported by the International Union for Conservation of Nature (IUCN) and the United Nations Development Program (UNDP), the government released an important report highlighting forest loss. The report argued that '*the most important issue in Vietnam is protection*' (Ministry of Forestry, 1991: 91), and that '*without effective support from external sources Vietnam will not be able to maintain a sufficient base for the threatened species or its natural habitat*'. In light of these challenges, the government passed the Law on Forest Development and Protection in 1991 and the Land Law in 1993 under which it shifted focus from forest production to nature

conservation. The Land Law states that land is the property of the Vietnamese people, with the State as representative owner (Land Law, 2003: Article 5, Clause 1). The Land Law clearly states that the land is planned and generally managed by the state but can be allocated to individuals, households, social organizations and communities for long-term use in compliance with agreed purposes. Lease holders can exchange, transfer or inherit land use rights, or use the land as collateral for bank loans (de Jong et al., 2006).

The 1991 Forest Protection and Development Law defines the legal opportunities for forest land allocation and the leasing of forests to individuals, households, management boards, economic organizations and communities. The Law indicates the state policy of investing in, encouraging and supporting forest protection and development; expanding the market for forestry products and insuring increased forest plantation (de Jong et al, 2006). Under the Forest Protection and Development law, forests are classified into three categories: special-use; protection; and production. Special Use Forest is primarily used for preserving the natural form of national forest ecosystems, protecting ecosystems, plant and animal diversity, preserving historic, cultural and scenic sites. Protection forest is primarily used for watershed protection, wave protection, environmental protection, and protection against high winds. These two categories are under control of State Management Boards. The third category of forest, production forests, are mainly used as a source of wood and other forest products, which are under the management of the SFE. This forest category can be exploited for commercial purposes and to contribute to socioeconomic development (Ha et al., 2012).

Production forests are managed by SFEs (now called forestry companies) who exploit them on a commercial basis, and are legislatively responsible for the socio-economic development activities in and around the forests. These state organizations are actually allocated the forests from the government. Production and less-restricted protection forests can also be allocated to households and individuals for long-term use. When a forest is allocated to households, they receive a 'red book' forestland use title for up to 50 years, with a bundle of rights consisting of rights of use, transfer, lease, inheritance and mortgage (Ha et al., 2014). Since 1993, the Vietnamese government has strengthened the special-use forest system to meet their obligations to the Convention on Biodiversity (CBD) and the Ramsar Convention by increasing the total surface area of protected areas to two million hectares (Dung et al., 2013). The government then signed

the Convention on Biological Conservation in 1995 and implemented the National Biodiversity Conservation Strategies in 1999. To protect biodiversity resources, the government often seek financial and technical support from donor agencies and Western conservation organisations (Phuc, 2009). However, in Vietnam, like many other developing countries (Hayes 2006), prohibiting natural resource use in protected areas provides no incentive for responsible and sustainable use; rather, local residents maximize resource exploitation as opportunities arise (Dung et al., 2013). In addition, the devolution of forest-use rights has not been comprehensive and far-reaching enough, resulting in the same institutional problems associated with centralised state ownership and additional misallocation of land to privileged actors (Ha et al., 2014).

By 1998 the government had allocated 7.2 million ha of forestland, of which 5.4 million was to SFE and newly developed Forest Management Boards (FMBs) (Ha et al., 2014). Therefore, the government was essentially decentralizing responsibility for forests, not from the State to households, but to various State entities (McElwee, 2004). SFE typically leased land to privileged people within communities who had better access to social networks, whom themselves often re-leased forestland rather than farming themselves, without any certainty of the leasing period or forest use-rights. In some places local conflicts occurred among coastal villagers over allocating land for aquaculture practices (Van Hue, 2008). During this period, coastal shrimp farmers tried to illegally extend their shrimp pond areas by encroaching on the open waterfronts or removing mangroves for land use rights to develop new shrimp ponds (Nguyen, 2014). This caused livelihood insecurity, destroyed farmers' motivation for forest management and blocked incentives to invest in both aquaculture and forestry (Ha et al., 2014). This has contributed to the inequity between rich and poor and enhanced the difficulty to achieve cooperation among communities (Ha et al., 2014).

The Vietnam Civil Code (2005) provides for common ownership of land rights by communities, but does not recognise communities as legal entities. As such, communities cannot enter into economic transactions such as leasing and transferring their rights. Although there is formal recognition of the right of communities to be granted land-use rights at the macro level, this is rarely the case in practice at the micro level. Nevertheless, subsequent to market liberalisation and in recognition of the limited capacity of the state to carry out all national duties, the Communist Party increasingly recognise the

opportunities that non-profit organisations and others outside the state administration provide.

Wetland policy

Although Vietnam signed the Ramsar Convention in 1989, international assistance on wetland resource conservation has only contributed to better understanding of the characteristics and consequences of environmental change in the five areas designated as Ramsar sites. A comprehensive and effective legal framework for wetland protection does not exist in Vietnam. Wetlands management is addressed indirectly through various laws and regulations relating to environmental protection, agriculture, forestry and aquaculture policies (Nang, 2003). The constitution of Vietnam establishes public ownership of lands, forests, rivers, lakes, waterheads and underground resources. The Land Law affirms the need for environmental protection and the need to implement measures for land protection, enhanced sedimentation, ecological protection. The Land Law uses the term 'lands with waterbodies' to describe wetlands. However, the Land Law does not establish a separate framework for wetlands management or specify the precise meaning of 'lands with waterbodies', but includes wetlands as part of other specified lands (agriculture, forest).

Wetlands management issues are also referred to in sections of the Land Law relating to the protection and exploitation of aquatic resources. Wetlands are defined as 'lands with waterbodies for aquaculture and aquatic resource exploitation'. Regulations encourage economic exploitation of wetland resources and do not include a clear policy to address their conservation. The National Aquaculture Development Programme (1999) greatly influenced the rapid spread of aquaculture. This was facilitated through two central policies that: granted households the right to convert low-productivity and uncultivated land to aquaculture use; and provided financial support to poor farmers without collateral. Hence, wetlands have been exploited to increase food production without adequate recognition of their crucially important ecological functions. However, wetland protection issues have been covered under legislation on the protection and exploitation of aquatic resources and the prevention of damage to aquatic resources and pollution of habitats (Nang, 2003). Nevertheless, government agencies are not fully aware of the special features of wetlands and instead, these agencies continue to apply a sectoral style of

management, focussing on land use to exploit wetland resources. A comprehensive framework for wetland management would provide a legal basis for specific regulations on wetland protection, management and use.

Mangrove system jurisdiction

Figure 6.1 illustrates the formal arrangements across levels in specific relation to mangrove system management. At the meso level, Province People's Committees (PPC) implement and enforce the Land Law and evaluate and approve plans of organisations to convert land to other uses (agriculture, aquaculture or other productive uses). District People's Committees (DPC) evaluate and approve household and individual plans. Plans for conversion to agriculture or aquaculture must comply with the applicable land use master plan and an environmental impact assessment must be completed. Commune People's Committees (CPC) (the lowest level of state administration) exercise state authority over land and are temporary custodians of unallocated land. Management of trees on special use and protection forestry land is the responsibility of the Ministry of Agriculture and Rural Development (MARD) (Table 6.1). Although there are MARD branch offices at provincial (PARD) and district (DARD) levels, there is no department with a particular focus on mangroves. District staff of MARD's Department of Forest Protection usually support CPCs to manage mangrove forests. The Ministry of Natural Resources and Environment (MoNRE) is responsible for special use and protection forestry land management (including wetlands), and they also have branch offices at the provincial (PoNRE) and district (DoNRE) level responsible for local land management and supporting CPCs at each level. Ministries are obliged to coordinate their activities as failure to do so can lead to misallocation of land use certificates.

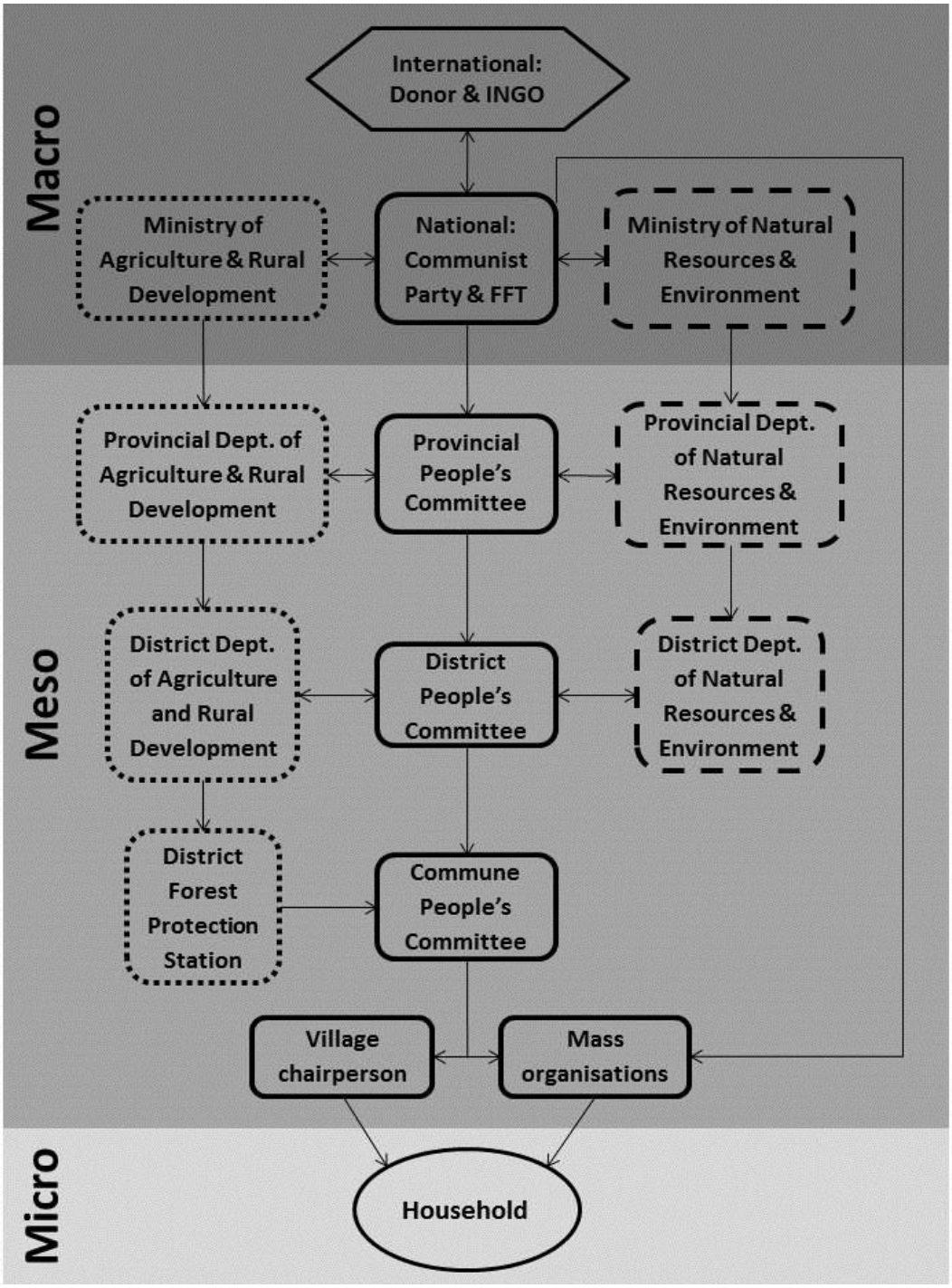

Figure 6.1: Formal structures for forest management in Vietnam. Adapted: Hawkins et al. (2010)

Table 6-1: Responsibilities of key ministries in mangrove governance

MARD (forest/fisheries)	MoNRE (land/water)
Forest use planning	Land use planning
Forest protection and development	Surveys and mapping
Forest boundary demarcation	Land allocation
Forest allocation and leasing	Land registration
Forest conversion	Issuance of land use certificates
Aquaculture and fisheries management	Geology and mining
	Water management

The Land Law and Forest Protection and Development Law each state that MARD and MONRE must coordinate their activities with one another in managing lands and forests (Hawkins et al., 2010). Coordination is important, for example, for MONRE to issue appropriate and accurate land use certificates. The certificate should reflect the quality, type, and extent of any forest on the land, information that can only be obtained from MARD. If the ministries fail to coordinate, land use certificates for forest land will be incomplete and inaccurate. Yet, in practice, coordination between MARD and MONRE at all levels is often very weak. Weak management capacity, oversight and poor coordination among relevant sectors, insufficient funding, and deficient institutional and legal frameworks have resulted in ineffective mangrove system management. The unclear and confused division of jurisdiction and weak collaboration between these two ministries creates confusion for stakeholders and uncertainty in mangrove management (Nguyen, 2014). While People's Committees have clear jurisdiction, they may lack the resources of specialized expertise to exercise effective mangrove management (Hawkins et al., 2010).

The Grassroots Democracy Decree

During the 1990s, socio-political disorder exacerbated by the shortcomings at the level of the local authorities increased the awareness of the government of concerns about people's political rights, especially in rural areas, and of the risks of spontaneous resistance by those not in favour of the socio-political stabilization of the country (Ca, 2011). An important development in civil cooperation, which affected household capabilities to access MSPGs, was the Grassroots Democracy Decree (1998), which gives the right to the population to be informed about and carry out, discuss and monitor decisions relevant to them. The aim of the decree was to increase the participation of people in decisions about important socio-economic activities in their localities, according to the principle of "*people know, people discuss, people do and people check*" (ibid, 29), in addition to the indirect democratic system through the National Assembly and People's Councils at all levels. The Ministry of Agriculture and Rural Development (MARD) advised local authorities to develop village conventions for forest protection together with local residents, and provide timely information to the people on important plans and activities that will be carried out in their localities, such as state policies, new laws, the long-term and annual development plans of local authorities, budget predictions and actual expenditure by communes, as well as

resolutions and plans relating to loans for the development of production, the results of inspections and checks on negative actions by state cadres, and so on (Ca, 2011).

In addition to certain management institutions such as the state and the Communist Party, a special character of the political structure in Vietnam is the legal acceptance of participation in management activities by certain socio-political organizations. Many localities set up steering committees to exercise democratic rights with the participation of Communist Party members, state officials and inspection committees, as well as social organizations such as the Fatherland Front, the Veterans' Association and the Women's Association (Ca, 2011). These efforts have seen varying degrees of success. At the micro level, Mass Organisations are government sponsored bodies, such as worker and youth unions and associations, which fall under the umbrella of the Fatherland Front: described in Vietnam's constitution as "the political base of people's power" mandated with promoting "national solidarity" and "unity of mind in political and spiritual matters". Hence, Mass Organisations are linked to the Communist Party at the macro level while also playing a semi-independent role at the micro level. Regarding forest governance, their key role is raising awareness of national policy and state intentions, and also mobilising local villagers and communities for protection and management of forests at the meso level. Membership of Mass Organisations is the largest of any organisation in Vietnam (membership is often mandatory with public sector employment), and State and NGO mangrove projects are largely implemented through them. Mass Organisations are largely government funded, and are accountable primarily to the state, not their members or other citizens. Mass Organisations hold democratic elections, but elected leaders must be approved (or even pre-approved) by higher levels of government.

6.3.1.2 Informal institutions

Analysis of informal institutions provides the implementation context for formal institutions, providing crucial insights into the implications for implementation. Two logically opposed but functionally complementary principles and values are identified in Vietnamese society (Jamieson, 1993). The first, yang, is influenced by Confucianism and comprises strict rules of behaviour based on social roles, participation in public life within a rigid hierarchy, and (male) dominance. This sees the world/universe as hierarchical, which should be reflected in society and people's relationships with one another. People should

conform to the rules regardless of circumstance, individual preference, and consequence, or face inevitable misfortune. This principle clearly resonates with the legacy of centralised state structures and processes that formal institutions are implemented within in Vietnam, and typically occur at the macro and meso levels of mangrove system governance. Subsequently, mangrove system governance is characterised by hierarchical structures with an aversion to public participation. Such a context has implications for the implementation of devolution, decentralisation and market reforms. Although reforms appear far reaching on paper, they are often only partially implemented, failing to include or benefit those at the micro level that have no affiliation to the state apparatus and no avenue to participate or influence governance processes. In addition, the Mass Organisations that implement aspects of the 'Grassroots Democracy Decree' are very much part of the state apparatus, meaning that 'grassroots democracy' is essentially shaped by the state with little organic bottom-up participation. As such, mangrove system governance fails to capture the knowledge and challenges of those whom depend greatly on MSPG, and are more sensitive to changes in mangrove system functions and processes through their livelihoods. In the three study communities the rules for mangrove system use were formulated and enforced through formal governance structures, and open criticism and challenging by individuals of formal management structures was not common.

The second principle, yin, is influenced by Buddhism and promotes notions of egalitarianism, flexibility, female participation, empathy and spontaneity. Mediation and passivity are favoured when it comes to public affairs, with participation often denigrated as a "…*futile struggle to impose one's will upon a reality that is indifferent to it*" (Jamieson, 1993: p21). This principle is observed to a greater extent in at the micro level of mangrove system governance. There is a lack of meaningful engagement in public affairs, unless Mass Organisation instructions instil a feeling of obligation and duty among members, as this is deemed as a waste of time within existing hierarchical power structures. A rich informal sector has developed at the micro level which is more in line with the principle of yin, developed to circumnavigate unsuitable top-down structures through customary codes that are more flexible, dynamic and sensitive to change. Although there was little evidence of public participation and outspokenness in the formal structures of mangrove system governance, communities were found to challenge and circumvent formal structures through their day-to-day activities related to the yin principle. In all three communities many marginalised households which are heavily dependent on MSPG were observed

engaging in informal institutional arrangements, including: pooling of resources such as finance, food and information on mangrove system condition and status, labour sharing, and exchanges and other forms of non-financial support. Such informal arrangements featuring characteristics of the yin principle are crucial in order for marginalised households, whom lack access to the opportunities and benefits presented by aquaculture and also government safety nets, structures and processes, to spread risk and respond to MSES change.

In the three study communities informal rules were principally influenced by the family unit, which largely determines sanctions, taboos, traditions, and codes of conduct in Vietnam (Jamieson, 1993). Family is the fundamental unit of social organisation. Membership and position in the family is the primary element in personal and social identity (Nguyen, 1985). Respect for elders, obligation to parents, and benevolence, obedience, and loyalty strongly guided the behaviours and attitudes of individuals within families. Nguyen (2005) notes that individual interests are typically surrendered for the interest of the family, and relationships of mutual dependence and obligation within the collective are prized. This often conflicts with a public servant's obligation to wider society, with family obligations often deemed greater than those to the public, and shame may even be directed to those that favour the latter (Jameison, 1993). The Vietnamese proverb "If a man becomes a mandarin, his whole lineage can ask favours of him" reflects the notion that those serving in the public realm will breach legalities in order to advance family interests. This has implications for the implementation of formal institutions as the benefits of political and economic reforms can become captured by the families of elites and their friends. This was observed in all three communities, with many households stating that mangrove system land was appropriated by government representatives and allocated to their family, friends and associates following devolution and changes in the Land Law. In some cases, mangrove system land was allocated to family and associates external to the community in order to establish aquaculture farming. The weak formal institutional frameworks that policies were implemented within provide the opportunity for reinterpretation of the meaning and misappropriation of the benefits by local authorities. In addition, money from state and NGO donors for mangrove restoration projects was also felt to be appropriated by elites working for the government and their associates, and many marginalised households being denied the benefits of such projects. Many households, even some of the most marginalised, accepted that the families of

government representatives would benefit from their influential position, and admitted that they would do the same in their position. However, there was a threshold that this became unacceptable, when greed had a negative impact on the lives of others then communities may come together in order to challenge local authorities (see section 6.3.3 below).

Vietnamese families are patriarchal (Nguyen, 1985). As well as performing most of the domestic duties, women also worked long hours on aquaculture farms as waged labourers, collecting MSPG, tending to the household farm or working as labourers on construction sites. Although the crucial role of women within the household was recognised and highly regarded among most households in the study communities, they were often observed and described to be subordinate to men. Observations were in line with Jamieson (1993) who suggests that women are frequently expected to be submissive, supportive and compliant towards their fathers when young; their husbands when married; and their sons when old. Despite formal recognition of the rights of women to acquire land-use rights at the macro level through the Land Law, informal patriarchal customary norms mean that it is rarely the case in practice at the micro level, and entrenched customary norms ultimately constrain women's access to land (Van Hue, 2006). Although Vietnam's Land Law states gender equality regarding access to property and land rights, in practice, women are allocated less land and often not included in the issue of land-use right certificates. These certificates are required for formal state recognition of use rights, secure tenure, formal land transactions, access to formal credit and for the legal protection of land-use rights (Gammeltoft, 1999).

The nuclear family is embedded within the extended family, which includes the deceased and not yet born. Rambo (2005) states that there are strong obligations to repay ancestors for the gift of life which is deemed a determining component of virtue and achievement, as ancestors accumulate (spiritual) merit through the efforts and sacrifices they have made in the past in order to ensure family heritage. Most households engaged in veneration and offerings to deceased family members. Jamieson (1993) writes that any success experienced by individuals increases their obligation to give thanks, and in all households small shrines were apparent, with photos, incense and food offerings to ancestors. In all three communities, temples were present in the grounds of many wealthy households, which were often larger and more elaborate than living quarters, to signify

success, wealth, and virtue in veneration to their ancestors. In many cases, such beliefs in ancestry can create a level of fatalism. Many advantaged households believed that they had been able to achieve their success in aquaculture as a result of the good fortune bestowed upon them by their ancestors. Although these households expressed regret at the predicament of marginalised households, it was perceived that this must be the result of negative actions of their ancestors which they must pay for. Further, this perception that your fortune is determined by the actions of your ancestors was held by some marginalised households themselves. This often results in an attitude of resignation to the inevitable, and that acceptance rather than resistance against inevitability is a more appropriate course of action.

Much of Vietnam's economic growth since transition has been driven by intense exploitation of natural resources. Land-use has intensified, demand for water resources is rapidly rising, and mangrove systems are being degraded and lost. The literature suggests three overarching worldviews of nature in Vietnam (Vi and Rambo, 2003), which were confirmed during dialogue with interviewees. The first sees nature as a resource to be exploited for the benefit of society (Jamieson, 1991). Interviews with government officials suggested that they regard the environment as a resource to foster the economic growth of Vietnam, and that the environment will heal itself once a satisfactory standard of living has been achieved. The second implies that people should maintain balance and live in harmony with nature (Le, 1999). Interviews with households indicated that the spirits of ancestors are often believed to reside in nature, and should be honoured in rituals and offerings in order to maintain harmony between the elements, ancestors and people. Beliefs are highly superstitious and failure to comply is believed to invoke bad luck. Finally, nature is viewed as a threat to human survival, in the form of floods, typhoons, droughts and other natural hazards (Rambo, 1982). Interviews in all three communities indicated that deep sea fishing was not practiced as it was perceived as "…dangerous…" and "…people have died…" (Male interviewee, Giao Xuan, June 2012). This places greater pressure on intertidal areas to provide food for subsistence and income. Sustainable development of mangrove systems requires that natural resources be exploited within thresholds that allow renewal to take place, which will require a balance of the above stated worldviews.

6.3.2 State, private sector and NGO actors at the macro and meso level

State, private sector and NGO actors are central to management of both mangrove SES and the links between institutional levels. This section focusses on research question 2, using the environmental entitlements framework to identify how these actors have modified and shaped mangrove system governance structures at macro and meso levels.

6.3.2.1 Macro level actors

Since economic reform (in 1986), the central State's main concern is achieving economic growth. In line with the worldview that depicts the environment as a resource, economic growth is fuelled by extraction-based export industries, with (often illegal) river and ocean bed sand mining posing particular a threat to mangrove systems. Vietnam's MSPG were opened to domestic and international markets, most notably to China. This rapidly increased the price of MSPG, and combined with the devolution of land management, resulted in rapid growth of the aquaculture industry.

In light of the 2004 tsunami and increasing intensity of typhoons in the region, and worldviews that consider the environment as a threat to human survival, there has been growing recognition of the benefits mangrove forests provide:

> *"More mangroves mean that provincial governments need less money from us for storm damage and dike maintenance."* (Male interviewee, National government, August 2012)

Recognising their lack of capacity to undertake large scale mangrove rehabilitation, the government has increasingly accepted external support, acknowledging the benefit international NGOs offer through their international experience working in coastal areas. Vietnam has recently been the target of numerous mangrove afforestation projects. This has been facilitated by increasingly open international relations following economic reforms at the macro level, allowing international development agencies, both governmental and non-governmental, to provide the necessary finance and capacity to Vietnam's government to undertake substantial replanting initiatives. International NGOs must clearly demonstrate how their work will align with government policies in order to be

granted permission to work in Vietnam. Although this has created opportunities for new relationships to be forged between various stakeholders, relationships are still in line with the informal institution of not speaking out in public on formal issues. However, these novel arrangements present some complications:

> *"Ministries work under the state so they are not often critical. INGOs can be more outspoken than Vietnamese, it's the culture. But Vietnamese NGOs have the cultural understanding to be able to challenge the state without them being too offended because they are not outsiders pointing the finger, it can be received more favourably. It's complicated…you need to find a balance."* (Female interviewee, international donor, September 2012)

The signing of numerous international economic and environmental agreements in order to foster financial support from international donors has also led to a plethora of conflicting rules and regulations, and national policy and regulations have failed to keep pace with the rapidly growing aquaculture industry. Insufficient coordination and increased competition for limited funds between and within administrative levels of MARD and MoNRE have compounded an already weak regulatory framework, with concern that mangrove areas are subject to the same regulatory framework and categorisation as terrestrial forests:

> *"Mangroves are highly sensitive and need unique conditions in order to grow. They have different uses for different groups and face different challenges than terrestrial forests."* (Male interviewee, international donor, August 2012)

Despite the significant rise of mangrove conservation in terms of policy attention, substantive change has been negligible. This is reflective of the yang principle of Vietnamese society:

> *"There is still too much emphasis on top-down management in Vietnam. Although there is lots of talk of bottom-up management, most officials are unfamiliar with these concepts so there is little change on the ground."* (Male interviewee, University institute, August 2012)

6.3.2.2 Meso level actors

Achieving short-term national economic targets remains the priority of local authorities. Devolution of land use and decentralisation of land allocation within weak policy and regulatory frameworks, combined with market liberalisation, has meant that many provinces are able to generate income surpluses, largely through MSPG exploitation, in line with the 'natural environment as resource' world view. Consequently, some local authorities may contribute significantly to the national budget and no longer require provincial or central State support. This is particularly so in areas with successful aquaculture farming sectors and can reinforce the local authority's ability to overrule decisions made at higher levels.

In the early 1990s aquaculture was established on the intertidal mudflat areas in Giao Xuan. This was largely due to strong trade links with China that facilitated access to the necessary networks and skills to exploit the lucrative clam market. In Da Loc the clam aquaculture industry took longer to establish, developing during the late 2000s as locals observed the financial benefits gained by neighbouring provinces. Local households in both Giao Xuan and Da Loc were encouraged to take loans to develop aquaculture farms. In Dong Rui, the Sino-Vietnamese War (1979) saw the extensive mangrove area previously settled by ethnic Chinese groups resettled by ethic 'kinh' Vietnamese from nearby Hai Phong city. Huge swathes of mangrove land were allocated to shrimp aquaculture investors from Hai Phong city and surrounding coastal provinces, who had connections to the newly appointed local authorities.

When local authorities observed the financial potential of aquaculture, large areas were allocated for aquaculture development:

> *"The district came when they saw they could make money from auctioning land and imposing taxes. You can have as much land as you want, as long as you have the money or you are well connected"* (Male interviewee, Giao Xuan, June 2012)

Restrictions on the amount of land any individual could acquire led local officials to use the names of family and friends or pseudonyms to sign contracts for large scale investors.

At the same time local authorities recognised the benefits that mangroves provide, and encouraged mangrove projects in their jurisdiction. However, with land scarce for mangrove projects, households complained that land would often be annexed for projects with little compensation given:

> *"The government took my land and sold it to the foreigners to plant trees. They don't care about the trees as long as they get the money for the projects."* (Male interviewee, Giao Xuan, June 2012)

Concerns were also expressed that when projects finish the land will be reallocated and converted back to aquaculture.

Interviews with national university representatives suggested that in many cases local authorities lack understanding of new concepts introduced by international NGOs relating to mangrove management, such as co-management or community-based management. As such, local authorities often only agree to short-term commitments, needing to see the benefits (usually economic) of projects before longer-term commitment is considered. Interviews with international donors suggest that this has led to a multitude of pilot projects:

> *"…the government have piloted numerous community-based projects, which keeps the international donors happy, while nothing substantive actually happens on the ground, keeping local authorities happy. We need to see real change and long-term commitments that recognise the rights of communities to manage forests."* (Male interviewee, international donor, September 2012)

Interviews with Vietnamese NGOs and International NGOs revealed that their definition of 'community-based projects' entails working with the local authorities, Unions and village heads through formal institutional structures. However, households frequently perceived these institutions as illegitimate, suggesting that they are formed through cliques of family and friends of local elites, with negative implications for the procedural component of environmental justice. Nevertheless, it was recognised that NGOs must manage their relationships with local authorities carefully, otherwise they risk compromising their ability to work in the locality.

6.3.3 Micro level MSPG entitlements

This section addresses research question 3 and situates household MSPG entitlements within the prevailing governance structures and processes occurring at the macro and meso levels.

In Giao Xuan and Da Loc, land reform permitted some households to acquire mangrove system land, while economic reform facilitated some households' access to domestic and international markets, networks, and knowledge. Many exploited these opportunities, combining endowments to develop successful aquaculture farms and increase their entitlements to MSPG. Although most ventures were highly productive in the initial 2-3 years, productivity fell significantly due to lack of environmental planning. While some aquaculture farmers were able to draw on financial and human capital to sustain their aquaculture farms, many struggled and often resorted to selling farm assets causing endowment loss:

> *"I got a bank loan to set up an aquaculture farm, but I didn't know anything about aquaculture. When all the animals died I couldn't make money. I got more bank loans to pay my debts hoping that the animals would return…but they never did. I had to sell everything at a cheap price and now life is a struggle."* (Male interviewee, Da Loc, August 2012)

In Dong Rui, only a very small number of households closely connected to the local authorities benefitted from political or economic reform as the majority of mangrove system land was allocated to external aquaculture investors. Most households expressed the negative impacts of a rapidly growing aquaculture industry:

> *"They came and used big machinery and strong chemicals to prepare the land for aquaculture…the water turned dirty and polluted."* (Male interviewee, Dong Rui, July 2012)

In all three communities, mangrove commons drastically reduced compared to the pre-reform era due to the growing aquaculture industry, with more MSPG dependent households facing increased dangers through this endowment loss:

> *"Now we have to go by boat to find the animals and it is very dangerous. Two years ago four women were on a boat and a strong wind sank the boat and they all died. One man will always go to steer the boat now, meaning we spend less time doing work at home."* (Male interviewee, Dong Rui, July 2012)

Increased prices for intertidal seafood have also incentivised MSPG collection for sale, increasing pressure on the reduced common areas, with MSPG often being harvested before they are old enough to reproduce. The combined effect of environmental impacts caused by aquaculture, and increased pressure on greatly reduced common areas for MSPG, has contributed to the reduced quantity and quality of MSPGs. This is having a negative impact on those households most dependent on MSPG for their livelihoods, reducing their MSPG entitlements through the reduced productivity of mangrove systems.

Household interviews revealed that land given by local authorities for mangrove planting projects had also reduced the amount of common land for MSPG, causing endowment loss. Local residents are usually prohibited from entering newly planted areas during the initial sensitive years of tree development and then find it difficult to collect MSPG in more densely forested mature mangroves. Households stated that projects were typically imposed in a top-down manner with little community input, with implications for the procedural component of environmental justice. Concerns were expressed that the finance from large international NGO projects was captured at various levels of state administration. When funds have filtered down through all the levels of government, there is little money left to pay households participating in mangrove projects at the micro level, resulting in negative entitlement changes through transfer failures:

> *"We know that the foreigners give the government lots of money to plant trees, but the Commune, village and Union leaders take most of the money themselves and don't leave much for us. We get some money, but not as much as I could make collecting crabs."* (Female interviewee, Dong Rui, July 2012)

In addition, projects relating to coastal livelihoods in Giao Xuan, which aim to reduce pressure on mangrove systems through alternative livelihoods (e.g. bee-keeping, mushroom growing, eco-tourism), are little known among households. Those households with awareness stated that these projects fail to target the poorest or most dependent on MSPG, and are often appropriated by family and friends of local authorities. This results in negative MSPG entitlement changes for the most mangrove dependent households, and implications for the recognition and procedural components of environmental justice.

Households frequently attributed wetland degradation to the conduct of local authorities, making them reluctant to be involved in mangrove projects:

> *"…I have never been asked for my opinion; we just get told to plant…we are given small money to plant trees that the government cut down and destroyed in the first place!"* (Female interviewee, Dong Rui, July 2012)

This has implications for procedural environmental justice, as households suggested that opinions and concerns expressed through formal channels are largely ignored, and those speaking out could even face retribution from local authorities for doing so:

> *"There is nobody we can turn to in order to raise concerns. Nothing ever changes and your life will be made much more difficult for speaking out. The Unions, the village committee, and the commune are all family or friends with each other"* (Female interviewee, Da Loc, August 2012)

A project from the international NGO Cooperative for Assistance and Relief Everywhere (CARE) did request feedback from residents, and the information gained was crucial to the success of the project:

> *"…we told CARE about the barnacles on the young trees. They take nutrients from the trees and are too heavy for the branches and make them snap, so CARE pays us to scrape the barnacles off the young trees now."* (Male interviewee, Da Loc, August 2012)

Nevertheless,

"CARE does try to understand the local people, but it is difficult for them because people are afraid to speak out…Any problems with the mangroves are due to the local government, not CARE. I am worried that when CARE leave the mangroves will disappear again." (Male interviewee, Da Loc, August 2012)

The lack of procedural environmental justice has prompted instances of collective action to challenge local authorities on matters related to mangrove land allocation and financial matters in all three communities. These actions and decisions were made between households based on the yin principle. These were met with varying degrees of success, with one outcome being that the community in Dong Rui forced the local chairman to resign. As local officials were unresponsive to residents' demands, the community circumvented the formal meso level of state authority, taking their concerns, at great expense and jeopardy, straight to the national government in Hanoi. However, households stated that the chairman was replaced with a representative who exhibited similar behaviour to his predecessor, by which time the community were too tired to protest again. With few avenues for recourse, such as alternative political parties, an open media, or thriving civil society, many households expressed how they have become disillusioned and detached from political issues. Constraints to procedural environmental justice, resulting from a lack of public participation in MSES management, have been exacerbated by top-down governance structures. This has reduced household capabilities to influence decision making processes and procedures, and thereby modify or improve their entitlements in the light of challenges emanating from political and economic reform.

6.4 Discussion

This section considers the implications of actions taken at macro and meso levels of governance (research questions 1 and 2) for household (micro level) entitlements to MSPG (research question 3). The institutional challenges are discussed in relation to: the effects of land reforms on household MSPG endowment sets; the effects of economic reforms on household MSPG entitlement sets; and the subsequent impacts on the procedural component of environmental justice through the capabilities of households to participate in decisions that affect their entitlements.

6.4.1 Endowments

Political factors relating to land use allocation strongly influenced household mangrove endowments. Devolution and decentralisation occurred within weak, contradictory and often non-existent policy and regulatory frameworks. This resulted in the privatisation of tenure rights, creating the opportunity for local authorities to interpret and redefine land reforms, with implications for the procedural component of environmental justice. The subsequent elite capture and misallocation of mangrove system land caused mangrove endowment loss for the most marginalised groups.

Governance processes were found to be unaccountable, opaque and inequitable, particularly at the meso level, with ineffective cross-level support and cross-scale links between the state and resource users, constraining the effective devolution of land management to the micro level (cf. Child and Barnes, 2010). Findings corresponded strongly with those of Sikor and Nguyen (2007) from Vietnam's central highlands, who found that broader political and economic processes, when combined with local power relations and institutions, limit the access of marginalised groups to the resources and benefits emanating from devolution.

The formalisation of private tenure rights has reduced endowments for communities, particularly women. This finding is not specific to the Vietnam context (cf. Mwangi and Dohrn, 2008). Although there is formal recognition for women and communities to acquire land-use rights at the macro level, informal patriarchal customary norms and lack of formal recognition of civil society means this is rarely the case in practice. Subsequent to the formalisation of private tenure rights, the remaining mangrove commons has become de facto open access and it is almost impossible for women and communities to defend their endowments against outsiders and local governments, who often appropriate land in the name of national interest and development.

6.4.2 Entitlements

The impact of market reform on natural resources can both influence and be altered by the institutions that determine environmental entitlements at the local level, often to the detriment of the most marginalised groups. As suggested by Fischer (2010), when

economic growth is given priority over social and environmental goals, market forces can place natural resources under increased pressure, as was observed with the rapid development of the aquaculture industry in each community. Rapid economic growth and demand for natural resources, when combined with weak national-level institutions for natural resources, means that Southeast Asian economies can benefit from short-run economic gains (Coxhead, 2007). However, this comes at the expense of rapid resource degradation and substantial negative effects on household MSPG entitlements as mangrove system commons become rapidly degraded.

Inequality, vulnerability, and mangrove system use are closely intertwined through market dynamics, negatively altering household vulnerability and the environmental entitlements of the most marginalised. Although increased market integration granted some households access to wider markets and social networks to exploit market opportunities, in line with findings from the tea agro-forest plantations of southwest China (Ahmed et al., 2010), these opportunities were not available to all households. Furthermore, despite a rapidly growing aquaculture sector income inequality has increased with some households becoming more dependent on natural resources and so vulnerable to rapid environmental change (cf. Adger, 1999). Even with increased wealth from a rapidly growing aquaculture sector, foraging activities still persist among poor households, and market incentives encourage households to employ unsustainable techniques to harvest MSPG. This further degrades the significantly reduced mangrove system commons, forcing more marginalised groups further into poverty (Orchard et al., 2014). Wealthier households, however, can utilise market forces to consolidate their position through the acquisition of cheap assets from households struggling to develop aquaculture farms with mounting debts (cf. Eriksen and Silva, 2009).

Market liberalisation alongside contradictory and weak policy and regulatory frameworks has resulted in divergent interpretations by local authorities on the conversion and use of mangroves, resulting in unsustainable ecological outcomes and MSPG entitlement loss for households. Rapid and haphazard conversion of land to intensive aquaculture activities has degraded the mangrove system upon which the sector relies (cf. Paul and Vogal, 2011; Qasim et al., 2013). Externalities caused by market reforms, without institutional arrangements that clarify rights and responsibilities, can negatively affect social and environmental functions that are intimately linked to household MSPG

entitlements (Meinzen-Dick, 2007). It is vital to recognise the full economic, ecological and institutional context of natural resources, and underlying issues such as insecure tenure rights, otherwise environmental policies will fail and markets will obstruct sustainable the use of natural resources and MSPG entitlements for households.

6.4.3 Capabilities

The lack of meaningful participation of MSPG users in local formal institutions reduces their capability to negotiate and influence resource management decisions, negatively impacting mangrove entitlements and the procedural component of environmental justice. Regarding land reforms, the literature suggests that for decentralisation to work, democratically operational local governments and institutional constraints are necessary in order for authority figures to be accountable for their decisions (Agrawal and Ribot, 1999; Ostrom, 2000). Without this, communities are unable to exert pressure on local authorities deemed to be violating management rules or misappropriating resources (Kauneckis and Andersson, 2009). Subsequently, decentralisation has created new challenges including the need for norms for local participation in management decisions, prevention of elite capture, and to foster accountability between resource users. Market reforms have consolidated power at the meso level through increased income and ability to disregard national policy and regulation. Hence, as well as overruling national policies and regulations, local authorities remain unaccountable to the populations that they supposedly represent. This constrains the most MSPG dependent households' ability to challenge or influence local authority decisions to increase their MSPG entitlements.

In addition to the concentration of power at the meso level, the legacy from the previous command economy and enduring informal institutions means authority figures are rarely challenged. Public involvement in environmental issues tends to be technocratic, expert-driven and non-transparent, and is usually conducted through authorised state channels such as commune leaders, Mass Organisations and professional organisations (Hostovsky et al., 2010). Consequently, communities of mangrove users have become disillusioned and detached from the political processes that determine endowments and entitlements to MSPGs. Only in limited cases, when authorities at the meso level were perceived to be having substantial negative effects on micro level livelihoods through

mangrove system mismanagement, as was observed in Dong Rui, are communities likely to act collectively to express their concerns.

In transition countries with low levels of citizen participation, civil society plays a potentially crucial role in facilitating and institutionalising procedural environmental justice through participation in environmental governance (Stringer and Paavola, 2013). Due to the one-party political context operating in Vietnam, along with scant recognition of civil society and negligible levels of press freedom, concerned citizens have limited alternative avenues to appeal the decisions of the state, restricting the procedural component of environmental justice. Nevertheless, the emergence of international and Vietnamese NGOs, and growing attention on mangrove conservation and rehabilitation, have created an opportunity for civil society to develop. NGOs have been able to gain influence in environment and development issues, albeit modest, by maintaining a largely non-oppositional stance towards government. However, research from China by Trang and Man (2008) illustrates that without the opportunity to exploit a moderately free and sympathetic media, gains will be limited. With scant formal or informal recognition of communities in natural resource management and the limited advocacy role of NGOs, conservation and rehabilitation initiatives risk reinforcing existing power structures and the enduring legacy of top-down planning, as has been found elsewhere (Stringer et al., 2007). Recognising the constraints posed by local power structures that make participation challenging for mangrove users, it is crucial that emerging civil society institutions are inclusive and responsive to micro level actors, while linking the interests of these actors to higher levels of decision-making (cf. Berkes, 2008).

6.5 Contribution to knowledge

Although changes to formal institutional structures appear positive on paper, it is the informal institutional setting that provides the context that shapes how such changes play out. Formal devolution of land use rights, decentralisation of land allocation authority, and market liberalisation are implemented within an informal institutional context of hierarchy and discouragement of public participation. Incoherent and conflicting formal institutions relating to mangrove governance, which are characterised by priority of exploitation over conservation of natural resources, result in reforms that can be reinterpreted and renegotiated by authority figures. The imposition of policies developed to encourage

democracy in decision making by state sponsored organisations, combined with informal institutions that discourage public participation, further reduce accountability and legitimacy of formal structures. The informal institution whereby family is considered the most important social unit also contributes to the benefits of reforms being captured among the families of authority figures. Furthermore, although women's rights to land use rights are acknowledged formally, informal patriarchal customary norms prevent this actually being realised. Despite informal institutional settings that have reinforced pre-existing power structures at the local level, many informal institutions have developed which are crucial in order for marginalised households, whom lack access to the opportunities and benefits presented by formal reforms, to spread risk and respond to MSES change.

By analysing multiple levels of MSES governance and household mangrove system entitlements, findings demonstrate the importance of considering how these interacting elements have shaped the distribution of the benefits and burdens of MSES change, and recognition in the processes of MSES governance. By using a framework that provides insights into the ability of households to gain legitimate access to mangrove system goods, this study shows how institutional structures and processes at and among the macro and meso levels have shaped mangrove system entitlements at the micro level (i.e., households). Devolution of land management, decentralisation of land allocation authority, and market liberalisation implemented within the Vietnamese context has concentrated power and wealth at the meso level. This has resulted in differentiation in mangrove system entitlements among households, with those most able to access and bundle endowments effectively, usually through power, wealth and influence, gaining greater entitlements. Whilst calls for multi-level governance of SES are welcomed, it must be acknowledged that such an approach is not conducive to the Vietnamese situation. This is due to the challenges posed by a strong legacy of top-down centralised State control, and powerful and wealthy actors at the meso level that frustrate efforts to foster interaction between macro and micro levels of governance.

Findings illustrate how transition processes have altered MSES governance through increasing influence of market mechanisms. Transition reforms at the macro level in the form of devolution of land management from central government to households, decentralisation in land allocation authority from central to local government, and market

liberalisation, have been implemented within a weak formal institutional framework, creating the opportunity for local authorities at the meso level to re-interpret reforms and regulations. Furthermore, the lack of clear regulation on mangrove system land results in a bias towards the informal institutional context that favours patriarchy, hierarchy and detachment relating to public affairs, resulting in concentration of power and wealth at the meso level. Subsequently, at the micro level mangrove system land has been appropriated by households with access to finance, labour, skills, networks and markets in order to develop successful aquaculture farms. Findings demonstrate how the entitlements of marginalised households have been negatively impacted through: (1) reduced mangrove system endowments due to the reduction and degradation of mangrove system commons; (2) entitlement failure through social, political and economic processes that have institutionalised limitations on the opportunities and rights of marginalised households to access mangrove systems.

Findings presented here highlight important aspects of institutional structures and processes that should be considered within environmental governance more widely. First, devolution, decentralisation and market liberalisation have been implemented within a weak formal institutional framework resulting in partial implementation. Second, partial implementation of formal institutions is shaped by informal principles that concentrate power and wealth at the meso level and reinforcing pre-existing power structures. Finally, marginalised households face endowment loss through degradation and loss of mangrove systems and entitlement failure through processes that limit opportunities and rights. This has implications for the procedural component of environmental justice (see figure 2.1, page 25), which is concerned with participation in the institutional processes that allocate natural resources in order to achieve equitable distribution and recognition (Figure 6.2). First, the lack of civil society results in absence of participation in mangrove system governance, with Mass Organisation deemed illegitimate. Second, one-party politics and restricted press freedom result in unaccountable governance processes and little avenue to challenge decisions. Finally, a lack of ability of households to control their political environment and participate effectively in mangrove system governance reduces households capabilities. How MSES change affects household entitlements to mangrove system goods depends on institutional structures and process that occur between and among multiple levels of MSES governance, and will manifest differently depending on the level of accountability, transparency and participation in decision making processes.

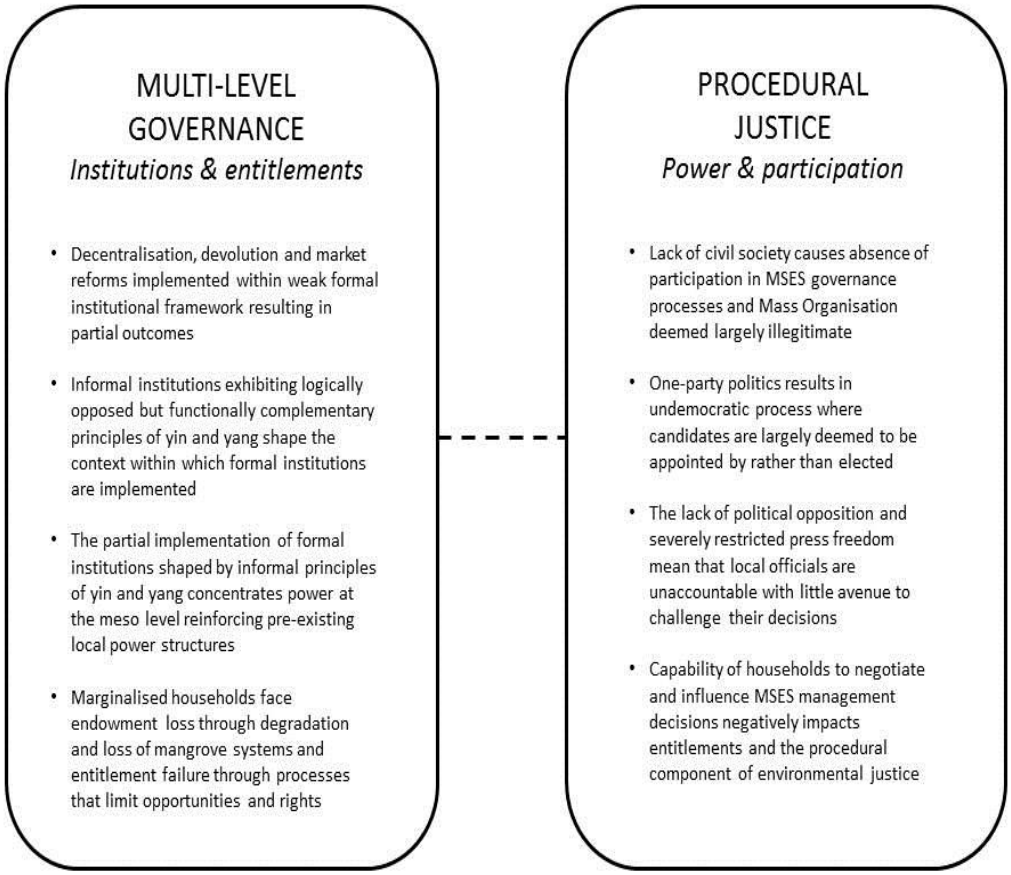

Figure 6.2: Results linking multi-level governance and procedural justice in MSES

6.6 Conclusion

In the context of SES characterised by complexity and interdependence between and within institutional levels, the impact of actions taken at multiple levels on household MSPG entitlements must be considered. It is imperative that consideration of MSPG entitlements of the most marginalised households and local people are involved and integrated into mangrove management. Current conventional regimes exclude the most marginalised households, constraining the procedural component of environmental justice, with negative impacts on local livelihoods and mangrove system integrity.

All formal institutional levels must acknowledge the distinction between mangrove and terrestrial forests, their multiple claims and uses, and the formal rights of communities, not just individuals, to acquire land use rights and secure MSPG endowments. Longer-term

land use rights must be provided to create incentives for sustainable use of resources, and thereby support household MSPG entitlements. Considering state actors at the macro and meso levels, land and economic reform within a weak policy and regulatory framework have concentrated power at the meso level, with local authorities able to redefine national policy and capture the benefits of reforms. Market reform has facilitated the rapid development of aquaculture, with some households able to benefit from short-term economic gains, while others have had their MSPG entitlements reduced through mangrove system degradation. With regard to micro level capabilities, the concentration of power at the meso level has constrained the ability of households to challenge or influence the decisions of local authorities and allowed the elite to capture the benefits from reforms. NGOs' definition and use of 'community' threatens to reinforce formal institutions which are perceived as illegitimate by the people constituting the communities. To ensure household MSPG entitlements are sustained, policies and projects should recognise the procedural component of environmental justice by acknowledging the full economic, ecological and institutional context of communities, and recognition of the diverse networks of interests interacting across and within levels. This would enable households to influence processes that could increase MSPG entitlements and the recognition and procedural components of environmental justice. It is crucial that emerging civil society institutions are inclusive and responsive to the needs of micro level actors, while linking their concerns to higher institutional levels, if more just and equitable governance is to occur.

Chapter 7 - Discussion

7.1 Introduction

The findings in this thesis support the assertion that human activity has contributed greatly to mangrove degradation and losses occurring in recent decades, largely due to conversion of mangrove areas to aquaculture (Spalding et al., 2010). It is unlikely that changes in habitat and species loss will be reversed under current governance regimes (MEA, 2005). Without sufficient and more equitable distribution of adaptive capacity within SES, the ability of those households most dependent on MSPG to sustain their livelihoods will be threatened through negative impacts on their ability to manage disturbance and change. Chapters 1 and 2 outlined the benefits of applying livelihood, social capital and institutions approaches to understand the environmental justice aspects of adaptive capacity within SES, and the research gaps and contribution to knowledge such analysis makes. Chapter 3 then set out the research design and methodology. This chapter brings together the findings from the results chapters (chapters 4-6) to examine the environmental justice aspects of adaptive capacity in Vietnam's MSES, offering insight into SES management more broadly. The key research findings emanating from this research which guide this discussion are:

1. The unequal distribution of adaptive capacity is linked to the unequal burden on livelihoods from MSES change, particularly the negative environmental impacts of aquaculture and subsequent unequal access to the mangrove resources necessary for households to respond to change. Households with greater dependence on MSPG find themselves locked into livelihood trajectories that can leave them more vulnerable due to constraints on past livelihood decision in response to MSES change. These same households have contributed least to MSES change through limited engagement in aquaculture.

2. Differing levels of aquaculture activity are associated with distinct livelihood contexts which influence the structure of household social networks, and hence adaptive capacity. Higher levels of aquaculture activity are associated with larger and less dense social networks, with negative impacts on adaptive capacity due to less redundant ties. The social capital of marginalised households is lower as social

networks are more influenced by private sector actors and external markets. Subsequently, marginalised households that are not involved in aquaculture have less recognition in the governance of MSES.

3. Institutional processes occurring at multiple levels of governance subsequent to political and economic reform have reinforced the concentration of power and wealth at the local (meso) level. Subsequently, elite capture of the benefits from reforms has reduced the MSPG entitlements of marginalised households. The lack of participation in the governance processes of MSES has implications for the procedural component of environmental justice, as governance procedures are dominated by the wealthy and powerful while overlooking the marginalised. This reinforces the power structures that create and maintain the inequitable distribution of adaptive capacity.

This chapter will discuss how analysing SES through approaches relating to livelihoods (i.e. ecosystem services and livelihood trajectories, chapter 4), social capital (i.e. social networks, chapter 5), and institutions (i.e. environmental entitlements and multilevel governance, chapter 6) can contribute to assessments of the environmental justice aspects of adaptive capacity. In what follows, section 7.2 revisits the findings from research objective 1 and discusses these in terms of the adaptive capacity of household livelihoods, and how adaptive capacity in SES is shaped by changes in the distribution of ecosystem services. Section 7.3 revisits the findings from objective 2 and discusses these in terms of the social capital component of adaptive capacity, and how adaptive capacity in SES is shaped by disparities of recognition in SES governance. Section 7.4 revisits the findings from research objective 3 and discusses these in terms of the institutional aspects of adaptive capacity, and how adaptive capacity in SES is shaped by participation in SES governance procedures. Section 7.5 synthesizes the findings across the empirical chapters, highlighting the opportunities and challenges for fostering environmental justice in adaptive capacity of MSES, and the associated contributions of the research to current knowledge.

7.2 Objective 1: Analyse local livelihoods to assess changes in the distribution of MSPG within MSES

7.2.1 The current distribution of adaptive capacity in local livelihoods

In the context of rural communities in developing countries, livelihoods are a key component of adaptive capacity used by households to respond to SES change (Nyamwanza, 2012). In Vietnam, in particular in the study areas in this research, livelihoods have been altered by significant MSES change experienced since political and economic reforms, largely via the rapid growth of the aquaculture industry. Aquaculture is a key aspect of change that encapsulates wider issues relating to MSES change, such as: devolution of land use; decentralisation of land allocation authority; privatisation of tenure rights; market liberalisation; participation in MSES governance; growing pollution levels and environmental change (e.g. alterations in hydrological flow, land use change, invasive species, and disease outbreaks). Although higher levels of aquaculture activity were found to be associated with greater aggregate community income and lower dependency on MSPG for some, higher levels of aquaculture activity were also found to be associated with significant income inequality and lower livelihood diversity among households, with off-farm livelihood activities found to be significantly lower. Aquaculture has also significantly influenced the distribution of MSPG dependency between households that are less dependent and have been able take advantage of the benefits emanating from aquaculture (i.e. farming and employment). Female-headed households with less secure tenure rights, are more dependent on MSPG for their livelihoods, and were found to be more vulnerable to MSES change.

Using an environmental justice lens to analyse the use of MSPG in livelihoods within and among communities provided a way to assess current variations in the distribution of adaptive capacity in the MSES. Aquaculture was found to be the primary driver of MSES change, consistent with findings from the wider Southeast Asia region (Kirui et al., 2012). Deforestation and degradation from mangrove conversion to aquaculture has reduced the adaptive capacity of MSES in two ways: first, by reducing resilience through vegetation and biodiversity loss and lowering the ability of the SES to mitigate and buffer the impacts of disturbance (cf. Sonwa et al., 2012); second, mangrove degradation and loss has increased the vulnerability of those households who rely on MSPG for their livelihoods (cf. Walker et al., 2006). This is in line with findings from Sonwa et al. (2012), in their study of the impacts of climate-induced changes on forest provisioning services, and its effect on the economic and social well-being of rural households in Cameroon. Mangrove

deforestation and degradation has diminished the resilience of those households with greater dependence on MSPG for their livelihoods, especially their ability to buffer MSES change through increased MSPG use. This corresponds with findings from Kalaba et al (2013) in their study of the contribution of forest provisioning ecosystem services to rural livelihoods in Zambia's Miombo woodlands.

Demographic and socio-economic variables are related to adaptive capacity (Cutter et al., 2003), and findings from this research shows that female headed households with less secure tenure rights and low education levels are most dependent on MSPG for their livelihoods. Hence, analysing the dependency of households on MSPG provided valuable insights into the distribution of adaptive capacity within the MSES, highlighting those groups that lose out and better defining the losers from change processes. Greater mangrove dependency affects a household's adaptive capacity due to alterations in livelihood vulnerability and resilience to SES change through: (1) a significantly reduced mangrove commons for MSPG collection; and (2) the negative environmental impacts from rapidly developing aquaculture which reduces the quantity and quality of MSPG. Drawing on work on fairness in adaptation to climate change by Adger et al. (2006), this looks likely to have two important implications. First, those with currently high levels of MSPG dependence will be unfairly burdened with the negative impacts of MSES change (driven by aquaculture) due to greater dependence on MSPG and lower levels of adaptive capacity. Second, as these households are marginalised and lack the resources to establish aquaculture, they have contributed least to MSES change.

In addition to being a crucial livelihood response to SES change, ecosystem services provide an important mechanism for reducing income inequality (cf. Kamanga et al., 2009) and increasing livelihood diversification (cf. Shackleton et al., 2000), as their collection is free in monetary terms and requires little capital outlay (Heubach et al. 2011). Results indicate that communities with higher levels of aquaculture activity are characterised by significant income inequalities and reduced household livelihood diversity. Income inequality creates vulnerable groups through the concentration of resources among a small number of individuals. This reduces the livelihood options of marginalised households (Adger et al., 2006). Results indicate that the distribution of ecosystem services is becoming increasingly unequal and determined by market forces that serve the interests of elites. At the same time, the marginalised lose access to significant livelihood resources and

opportunities. McDermott et al. (2013) state that environmental justice becomes increasingly undermined and worsened due to growing inequality resulting from rapid development (in this case aquaculture). Diverse livelihood portfolios are considered a source of adaptive capacity, as engagement in a greater number of livelihood activities reduces household dependency on any single income source, and provides resilience through flexibility in livelihood options for households to buffer and respond to SES change (Pomeroy et al., 2006). A diverse livelihood portfolio therefore allows risk spreading. The observed reductions in aggregate household livelihood activities in communities characterised by high levels of aquaculture activity may be eroding adaptive capacity. However, results show that even though marginalised households face livelihood constraints due to the negative environmental impacts emanating from aquaculture, livelihood diversification was a strategy employed by low income households to increase their ability to buffer and respond to change. This concurs with findings from Kamanga et al. (2009) in their study of forest incomes and rural livelihoods in Malawi. The findings in this thesis have important implications because income inequality is concentrating ecosystem service benefits into the hands of elites, which creates vulnerable groups through the reduced effectiveness of a crucial livelihood option for marginalised households.

7.2.2 Livelihood trajectories and the shaping of current distributions in adaptive capacity

A household's current adaptive capacity is largely shaped by past livelihood actions, and access to the necessary natural resources and ecosystem services required to respond to SES change (Nyamwanza, 2012). Exploring the livelihood trajectories of households provided a way of assessing adaptive capacity through identification of the factors that have contributed to the current distribution of mangrove ecosystem services over time. Aquaculture was identified as a key aspect of mangrove change that significantly shaped three distinct livelihood trajectories (i.e. consolidator; accumulator; marginalised trajectories). Briefly revisiting the findings from chapter 4, we can identify the factors that have shaped the resilience and vulnerability of household livelihoods. First, the factors found to increase resilience of consolidator and accumulator livelihood trajectories were: access to aquaculture market opportunities (e.g. employment, knowledge, networks, finance); access to more secure tenure rights; high levels of labour and human capital;

access to support networks to buffer disturbance; and access to MSPG to buffer disturbance. Second, the factors found to increase vulnerability within the marginalised livelihood trajectory were: loss of access to MSPG reducing buffer to disturbance; low incomes and susceptibility to poverty (e.g. sickness, debt, asset selling); negative environmental impacts from aquaculture (e.g. alteration in ecological processes, exposure to climatic shocks and stress); discrimination; and elite capture reducing options to respond to disturbance.

Using a livelihood trajectory approach provided the opportunity to explore environmental justice through the dynamics of mangrove ecosystem service access and use in livelihoods, while increasing our understanding of current variations in the distribution of adaptive capacity in the MSES. Although Vietnam has experienced rapid economic growth at the national level, results indicate that local level livelihood trajectories differ significantly from one another. Observations from the three study sites suggest that livelihood trajectories are diverse and follow various paths. Sikor (2001) states that changes in national level structures combine with local level responses to shape multiple livelihood trajectories, and that development gains at the national level ignore crucial environmental justice issues at the local level. The conversion of mangroves to aquaculture has resulted in mutually reinforcing feedbacks involving increased aquaculture intensity, over exploitation of mangrove system commons, vegetation and biodiversity loss, and subsequent loss of ecosystem services. Past livelihood responses to these SES changes were shaped by interconnected social, political, economic and environmental factors that influenced household access to resources (e.g. finance, knowledge, social networks, physical capital, natural resources). These prior conditions shaped the current distribution of adaptive capacity through access to the resources (i.e. finance, secure tenure rights, skills, technology, networks, markets).

McDermott et al. (2013) use the term context equity to expand upon the notion of 'access' and take into account "…*the uneven playing field created by the pre-existing political, economic and social conditions under which people engage in and benefit from resource distributions – and which limit or enable their capacity to do both"* (p420). Differentiation in adaptive capacity was observed between households, with those households having greater resource access depriving marginalised households from the same access. This concurs with Pellow (2000), who argues that environmental injustice

divides communities, and exploring issues of power helps us to understand how and why people suffer from this injustice. Wealthy households were able to take advantage of their powerful and influential position and had access to resources (i.e. finance, secure tenure rights, skills, networks, markets) to appropriate mangrove ecosystem services, establish aquaculture farms and attain resilient livelihood trajectories through consolidation of their advantageous position. Conversely, marginalised households faced growing livelihood constraints due to lack of resource access and increased privatisation of tenure rights, reducing the mangrove commons they rely on for their livelihoods and consigning them to trajectories characterised by vulnerability. This corresponds with findings from Gunawardena and Rowan (2005) in their study of the Rekawa Lagoon system of Sri Lanka, where aquaculture developments was found to have disproportionately large impacts on traditional livelihoods and social welfare.

These results have implications for environmental justice due to the inequitable distribution of adaptive capacity, with wealthy households securing most of the benefits of SES change whilst marginalised households are disproportionately burdened with the negative environmental impacts (mostly from aquaculture). Walker (2009) suggests that when negative environmental impacts emanating from the actions of more advantaged households are disproportionately experienced by the already vulnerable, then claims of injustice become particularly powerful as they impinge on livelihood security. This is because the pre-existing conditions (e.g. political power and resource access) that shape environmental justice are essential for livelihood security in communities that are directly dependent on natural resources. Issues of distribution may also be intensified by the potential irreversibility of observed biodiversity loss, raising intergenerational concerns between present demands and future needs (Martin et al., 2013). Findings suggest that the lack of equality in prior social, political, economic and environmental conditions that enable environmental justice in the distribution of adaptive capacity exacerbates inequality and social differentiation by locking marginalised households into vulnerable trajectories. Although the livelihood trajectories of various groups differ significantly, they are interconnected, and thus, in order to assess the environmental justice aspects of adaptive capacity in SES, the livelihood trajectories of all groups must be acknowledged (Murray, 2002). Nevertheless, it must be acknowledged that livelihood trajectories are context specific, and the factors that constrain livelihood options and decisions in one situation will not necessarily be the same in a different context (Murray, 2002).

Integrating ecosystem service and livelihood trajectory approaches has provided the opportunity to explore the distribution component of environmental justice in adaptive capacity of MSES, and how resource access shaped past livelihood decisions to result in current distributions. In doing so attention has been drawn to those groups that have lost out from SES change, better defining who loses out from change processes, and providing explanation as to why. Focusing on winners and losers is an aspect of adaptive capacity in SES that is often missing from academic analyses. However, environmental injustice is not simply an issue of distribution. It also involves a lack of recognition of group identity and difference, which shall be discussed next.

7.3 Objective 2: Assess the impacts of key aspects of MSES change (i.e. aquaculture) on social capital

Cinner and Bodin (2010) argue that changes in livelihoods are associated with increased development which influences social networks and socio-economic development. Differing levels of aquaculture activity were associated with divergent livelihood contexts across communities. At the aggregate community level, higher levels of aquaculture activity are associated with: greater incomes; greater income inequality; lower levels of aggregate community MSPG dependency; and, lower household livelihood diversity. The impact of aquaculture on livelihood characteristics is important because livelihoods are the means by which households in mangrove dependent communities interact with one another and the changing environment around them. Differing levels of aquaculture activity were associated with different livelihood characteristics, which have also led to alterations in social network structures within MRDC. High levels of aquaculture activity were associated with: larger network sizes (i.e. degree centrality); lower connectivity (i.e. density); low redundancy (i.e. effective size); higher marginal productivity (i.e. efficiency); less restriction (i.e. constraint). Within mangrove dependent communities, household livelihoods can differ depending on the level of aquaculture activity, which can alter the social networks of mangrove dependent communities. In communities with low levels of aquaculture activity higher income households have significantly greater network density than lower income households. Lower income groups have greater marginal productivity, indicating less redundancy. In communities with medium levels of aquaculture activity, more MSPG dependent groups had less network betweenness suggesting these groups networks are

closer knit. In communities characterised by high levels of aquaculture activity, groups with no dependency on MSPG were more likely to have less dense social networks. Also within these communities, groups with lower livelihood diversity are characterised by less restriction or constraint, indicating reduced levels of redundancy.

7.3.1 Bonding social capital

Aquaculture has a negative effect on community bonding social capital, and is associated with lower adaptive capacity for marginalised groups with less recognition in MSES governance networks. In Vietnam, social networks have long been central to household responses to SES change, being used to pool risk and promote security and stability (Luong, 2003). Results indicate that different levels of aquaculture activity are associated with distinct livelihood contexts, and subsequent variation in bonding social capital with regard to the size and density of social networks. Communities with low levels of aquaculture activity are associated with smaller and denser networks than communities with high levels of aquaculture activity. This suggests that such communities are characterised by a larger stock of bonding social capital and higher levels of adaptive capacity due to greater redundancy of network ties. Adaptive capacity is also higher in these communities through: greater levels of bonding social capital fostered by lower levels of network fragmentation (Coleman, 1998); increased interaction and trust (Gutierrez et al., 2011); shared identification and understanding of environmental issues necessary for collective action (Petty and Ward, 2001); and the creation of social norms and codes of behaviour favourable to natural resource management that fosters adaptive capacity (Barnes-Mauthe et al., 2013).

Communities with high levels of aquaculture activity were found to be associated with larger and less dense networks, with a greater number of non-redundant ties suggesting lower levels of bonding capital and adaptive capacity. Sandstrom and Rova (2010) argue that less dense networks can exhibit conflicting interests and perceptions, lowering adaptive capacity through a lack of common understanding and problem identification, such as resource condition, quantity/quality of stocks and rules of use. These results are in line with findings from Maiolo and Johnson (1989) who suggest that development may co-evolve with changes to network structures. Results also concur with that of Baird and Gray (2014) in their study of the influence of economic transition on

Maasai communities in Tanzania, which indicate that: livelihood opportunities are low and social network interactions are high prior to transition; livelihood opportunities increase with development, which prompts changes in the traditional use of social networks; subsequently, households reduce their engagement with traditional social networks. Strong bonding ties within communities are lost in the process, leading to reduced levels of trust, norms and reciprocity and increasing vulnerability to MSES change.

As discussed in the previous section (7.2), high aquaculture activity was associated with distinct livelihood groups within communities (i.e. aquaculture owners and employees) which contributed to ecosystem services being unequally distributed. With regards to environmental justice, the weakening of community bonds due to socio-economic differentiation could increase the susceptibility of marginalised groups to the negative environmental impacts of rapid development in two ways: through fragmentation weakening political power, and through problems in initiating collective action (Pastor, 2002). Increased levels of aquaculture activity were associated with social differentiation and weakened bonding capital within communities (cf. Isaac et al., 2007), as those socio-economic groups with command over resources were in a position to increase their recognition in MSES governance networks, while marginalised households increasingly became the victims of misrecognition. Research suggests that where bonding capital is strong, the environment is in better shape (Bang, 2009; Mix, 2011). However, bonding social capital can be fostered when communities are brought together by a sense of environmental injustice. Although building such bonding capital within communities is often complicated by the need for equal recognition between and among different socio-economic groups, it is critical for protecting natural resources and environmental justice (Pastor, 2002).

7.3.2 Bridging social capital

The large and expansive social networks associated with high levels of aquaculture can reduce adaptive capacity at the community level. Communities with higher levels of aquaculture activity are associated with larger and diluted social networks, along with greater access to external sources of capital, skills and knowledge, market opportunities and social networks. Although these communities are associated with lower levels of bonding capital, the larger and more expansive networks of these communities facilitate

access to external resources by fostering bridging capital through connections to external communities. The social networks of these communities were found to exhibit greater effectiveness and efficiency and less constraint, indicating that the number of non-redundant ties that connect households to external networks and resources are in proportion to the larger and more diluted network. Previous research on organisational networks advocates this type of network with regard to increasing productivity and gaining competitive advantage in market settings (Burt, 2004). However, such structures may not be conducive to adaptive capacity, which relies on redundancy, cooperation, collective agreements and shared understanding of environmental issues among actors (Adger, 2003). The increased reliance on a small number of weak market based bridging ties can lower adaptive capacity by reducing the number of redundant ties required to buffer networks against the loss of any particular tie (Prell et al., 2009). With regard to environmental justice, Martin et al. (2013) argue that the absence of recognition is rooted in the creation of divergent socio-economic groups and status hierarchies resulting from the domination of economic perspectives that commodify nature. The subsequent misrecognition of marginalised groups within MSES governance networks reflects dominant norms of economic productivity (Schlosberg, 2007).

High levels of aquaculture activity reduce the recognition of marginalised groups within MSES governance structures, with subsequent inequities in the distribution of adaptive capacity. Results show that only a handful of households in communities with high aquaculture activity have bridging social capital due to their engagement in aquaculture market networks. These households are able to maintain their advantageous network position through bridging ties that facilitate their access to and command over external resources (cf. Isaac et al., 2007). Research suggests that as local networks become increasingly integrated into market orientated networks, it is the local social networks that largely determine who gets recognised in MSES governance networks (Frank et al., 2007). King (2000) suggests that actors who are successful in furthering their goals will actively seek ties with others to continue the pursuit of their goals. Furthermore, results show that households with high dependence on MSPG that are unable to access new market opportunities maintain their traditional bonding networks as a resource to respond to MSES change (cf. Busby et al., 2010; Cassidy and Barnes, 2012; Baird and Gray, 2014). Hence, it is possible that bonding capital within successful socio-economic groups is reinforced over time, and the resources attained through bridging ties become captured

within these groups (cf. Isaac et al., 2007). This fractionalisation of communities results in biases in the levels of recognition given to different socio-economic groups within MSES governance networks. The social, economic, and political structures that perpetuate discriminatory practices (Bohman, 2007) have implications for environmental justice regarding the right to equal respect, opportunity to participate, and cost and benefit sharing regardless of race, gender, age, religion or wealth (Fraser 2001; Bohman 2007).

Whilst communities with high levels of aquaculture have built bridging ties to other communities to develop and maintain aquaculture, there is a lack of bridging among different socio-economic groups within communities. Although collective action is occurring within socio-economic groups, either among high income groups seeking to maximise their profits and influence or among marginalised groups pooling resources in order to respond to MSES change, the subsequent homogenisation has fractionalised communities with high levels of aquaculture activity. A lack of bridging among socio-economic groups obstructs the opportunity for collective action between groups and prevents the creation of shared understanding of environmental issues (cf. Crona and Bodin, 2006). This highlights the need to balance the bonding and bridging ties of communities to help build trust across diverse groups, encourage a diversity of ideas, increase network flexibility and achieve equity in the distribution of adaptive capacity (Baird and Gray, 2014). This should link marginalised groups who have rich knowledge of MSES due to their high dependence, with those from higher socio-economic groups that are integrated into external networks of diverse actors and resources other than those based solely on market relations (e.g. NGOs, governments) (Bodin and Crona, 2009). Building bonding capital to bring communities unduly burdened by MSES change together, and bridging capital to link communities to each other and sympathetic external actors, is a key element of achieving recognition of groups affected by environmental injustice (Pastor, 2001). However, this will be more effective if built upon the existing social networks of groups fighting the injustice of misrecognition in MSES governance networks (Ramirez-Sanchez and Pinkerton, 2009; Schlosberg, 2013). The development of social capital, although necessary for self-organization and building adaptive capacity, can have potentially negative consequences such as coercion, corruption, and capture by local elites (Pretty 2003). Heterogeneous social networks that recognise the disparate claims of various groups can prevent elite capture (cf. Brockhause et al., 2012).

Analysing community social networks has provided the opportunity to explore the recognition component of environmental justice in adaptive capacity of MSES. The network structures that shape the social capital of divergent socio-economic groups have been discussed, drawing attention to divergent levels of recognition within MSES governance structures (see chapter 5). In order to better understand the previously discussed distributive and recognition outcomes of MSES, the next section will develop the discussion to consider procedural justice, uncovering the institutional processes that shape distributive and recognition outcomes.

7.4 Objective 3: Explore how institutions and processes occurring at multiple levels of MSES governance are shaping local level entitlements to MSPG

Various formal and informal institutions operate between and among levels of MSES governance that shape household entitlements to MSPG. Formal institutional arrangements are underpinned by a one-party political system characterised by slow, conflicting and negotiable processes with no recognition of civil society. Informal institutions promote patriarchy and social structures characterised by two logically opposed but functionally complementary principles of Confucianism (i.e. rigid, hierarchical and conformist) and Buddhism (i.e. flexible, egalitarian and spontaneous). At the macro level (i.e. national level and above), the state's main priority is economic growth, typically via the exploitation of natural resources. Political and economic reform has opened the economy to markets and increased NGO activity. While INGOs have increased their presence in Vietnam, often by pledging support to government policy, this often increases competition with the work of VNGOs. Reforms have led to a concentration of power and wealth at the meso level (i.e. provincial to local level). The power of local government to allocate land has led to misallocation to friends, family, wealthy households and aquaculture investors external to the community. Local households have been encouraged to take out bank loans in order to establish aquaculture, with those having to access additional finance, knowledge, technology, markets and networks able to develop aquaculture successfully, whilst those who have not typically struggle. INGOs and VNGOs often implement 'community-based' projects to promote development or conservation of mangrove areas, but their definition of 'community' typically entails working with local authorities, unions, and associations that are largely deemed as illegitimate by local

residents. At the micro level (i.e. household level) whilst some households are able to successfully bundle their endowments in order to increase their MSES entitlements, others face declining entitlements due to mounting debts, reduced mangrove commons, market incentives that increase competition for MSPG, and lack of participation in largely unaccountable formal local organisations.

7.4.1 Multilevel governance and the environmental justice aspects of adaptive capacity

Structural and institutional constraints at the macro level, emanating from a legacy of 'command-and-control' management, pose a barrier to multi-level governance of MSES and the procedural justice aspects of adaptive capacity. In line with findings from Schonig (2014) studying the governance of MSES in Ecuador, institutional processes at the macro level were not amenable to the complex nature of MSES that comprise cross-scale dynamics and feedbacks, uncertainty and change. The central unitary government of Vietnam gives priority to raising standards of living through economic development, which Folke et al. (2002) argue separates society from nature and undermines adaptive capacity through lack of understanding of complex SES dynamics. Despite decentralisation reforms, the priority given to economic growth, the regional economic quotas that the government set, and the appointment of local government officials by higher members of the unitary government, means that local governments remain upwardly accountable. This process is referred to by Ribot (2002) as deconcentration, which can reduce adaptive capacity through the reinforcement of pre-existing powers structures. Therefore, the type of powers gained through decentralisation (land allocation) and the corresponding restraints imposed (economic targets), along with the type of actors that gain powers (local government) and their accountability (negligible), have been used by the unitary government to limit the scope of reforms and ensure that the authority of the state is not threatened. The result has been the decision by many local authorities to convert mangrove system land to aquaculture in order to boost economic growth. In addition, despite increased pressure from international donors to initiate decentralisation, scant attention has been given to implementation or monitoring. Hence, by granting increased powers to local governments to meet economic targets, and by pacifying international donors, decentralisation has enabled the central unitary government to maintain political control in Vietnam. These findings are in line with Ribot et al. (2002) and their findings from the examination of

decentralisation processes in Indonesia. Governance institutions at multiple levels shape the environmental justice aspects of adaptive capacity partly through the processes that distribute access to mangrove goods and services (Braun, 2011). Results show that the state has not created the conditions in which environmental justice can prevail, which requires an institutional context that: challenges top-down economic decision-making structures which produce inequities; has downwardly accountable local authorities; promotes the right of various stakeholders at multiple levels to participate effectively in decision-making processes (Adhikari, 2002).

The increased influence of market mechanisms in MSES governance following economic reforms has, in addition to attaining rapid economic growth, fuelled land use conflict, created social inequalities, and increased mangrove system loss and degradation. This has implications for the environmental justice aspects of adaptive capacity as these issues disproportionately affect households from marginalised groups that depend greatly on mangrove commons for their livelihoods. This concurs with arguments presented by O'Brien and Leichenko (2003) relating to the negative impacts on adaptive capacity due to the increasing influence of markets on common-pool resources. Findings are also in line with Berkes et al. (2006), in that the increased influence of market mechanisms in MSES governance has created new markets for ecosystem provisioning goods that have developed faster than the capacity of institutions to respond to emerging environmental issues. Problems of fit between administrative and biophysical boundaries, and issues of interplay between ministries (cf. Young, 2002), are a significant barrier to adaptive capacity, which requires effective vertical and horizontal communication, coordination and collaboration to help stakeholders and institutions respond to MSES change (Borowski et al., 2008). The observed deconcentration of political and economic authority, and the privatisation and commercialisation of mangrove commons within bureaucratic institutions displaying inertia, also constrains adaptive capacity. In order to foster adaptive capacity, processes of MSES governance at the macro level need to foster flexible policy conditions, collaborative decision making within a nested hierarchy that does not reside at one single level, and the ability of multiple stakeholders between and among institutional levels to self-organise (Armitage, 2005). These processes can also be conducive to achieving procedural environmental justice. However, in Vietnam, environmental injustice was observed due to inadequate procedures of MSES governance that: created the unjust distribution of negative environmental impacts emanating from activities of government

and private actors to promote economic growth (i.e. aquaculture); and, lacked the necessary access of communities to information regarding the potential benefits, opportunities and costs of such activities (Braun, 2011).

Political and economic reforms have created incentives for local elites to capture the benefits of mangrove ecosystem services, while the marginalised are ostracised from decision making processes. The upward accountability of local governments, and their lack of awareness of local MSES issues, means there is no reason to suppose that they will perform well with decentralisation (Ribot et al., 2006). Adaptive capacity was found to be negatively impacted by newly devolved powers disproportionately benefiting local elites through: legal ambiguity regarding decentralisation (cf. Larson and Lewis-Mendoza, 2012); deconcentration of powers to government representatives (cf. Ribot et al., 2006); lack of consultation and poor communication leading to a policy vacuum (cf. Kamoto et al., 2013). Results show how the processes of participation were appropriated by local elites with more time and resources to participate. Similar findings from Berghofer and Berghofer (2006) lead them to question the assumption that local participation increases the legitimacy of decisions. Hence, efforts at local participation were typically found to reduce adaptive capacity through the reinforcing of pre-existing power relations and the maintenance of the unitary system of government. Social capital generated through the interaction of local elites has also reduced adaptive capacity of marginalised households due to coercion, corruption and elite capture. This has negatively affected adaptive capacity through reductions in trust and collaboration and increased inequality (cf. Pelling and High 2005). The lack of mechanisms of accountability - such as oppositional political parties or an effective judiciary, media, and civil society - means that residents have no means by which to hold those elites iniquitously benefitting from the transferral of power to account (cf. Kamoto et al., 2013). Governance regimes characterised by elite capture, unaccountability, and unequal power structures are often the result of ineffective formal institutions, and formal and informal institutions with conflicting goals (Armitage, 2008). This was highlighted in this research by strong environmental regulations that are not implemented in practice due to the conflicting duties of public officials regarding the public good and officials' family obligations. Elite capture and unequal power structures underlie and compound inequitable distribution of ecosystem services, and strengthen certain voices in decision-making at the expense of others (McDermott et al., 2013). The lack of ability of communities to challenge power structures means that they are often

discriminated against and not brought into the decision making processes that directly affect them (Adhikari, 2002). This lack of access to decision-making processes further shapes the unequal distribution of ecosystem services, and highlights the institutional processes through which distributional injustices are created and sustained (Young, 1990).

7.4.2 Entitlements

Changes in statutory tenure rights do not automatically translate into equivalent changes in mangrove system endowments, which have been distributed unequally among households with implications for the environmental justice aspects of adaptive capacity. The devolution of land management from central government to households through statutory tenure rights has resulted in the effective privatisation and conversion of mangrove system commons to aquaculture. Common areas are vital for the livelihoods of households from marginalised groups, which are largely female-headed. Such groups have not been able to make effective use of the opportunities provided by more secure tenure rights due to inability to mobilize other endowments, such as political, economic or human capital. In addition, formal and informal rules have created and reinforced unequal access to secure tenure rights (cf. Leach et al., 1999). Findings indicate that differences in household endowments of mangrove system land may originate from formal tenure rights issued by the state. Tenure rights serve to allocate and improve household endowments, and could contribute towards improving the situation of disadvantaged groups (Sikor, 2007). However, the devolution of land tenure rights is only one among numerous factors that contribute to adaptive capacity. A household's ability to take advantage of decentralisation processes depends on additional political, economic and human endowments, meaning that already disadvantaged households may in fact find themselves worse off due to better off households converting mangrove system commons to aquaculture (cf. Sikor, 2007). Informal institutions were also found to determine a household's mangrove system land endowments. In line with previous research, differences in household mangrove system endowments were found to be differentiated greatly by gender (Adger et al., 2007). Patriarchal structures were found to obstruct the access of female headed households to more secure tenure rights. With regard to environmental justice, the insecurity of land tenure is one of the key factors that contribute to the lower distribution of adaptive capacity to female headed households (Fordham, 2003).

Household mangrove system entitlements were found to be shaped by many factors besides a household's initial endowment set. Institutional processes at various levels of MSES governance caused differentiation in mangrove system entitlements, with negative impacts on the procedural justice aspects of adaptive capacity. Results indicate that, although women had statutory tenure rights, dominant patriarchal structures meant that female headed households were typically from marginalised groups, with high dependence on common-pool resources, and limited access to education, skills, information and land. Subsequently, their ability to access mangrove system entitlements was significantly constrained. Power structures were found to shape the ability of households to bundle endowments to create entitlements (cf. Leach et al., 1999; Sikor, 2007). Subsequently, significant variations were observed in mangrove system entitlements of households from different socio-economic groups. Households from higher socio-economic groups had greater recognition and influence with the power structures that allocate mangrove system land, and were able to turn their mangrove system land endowments into entitlements through conversion to aquaculture. This had negative effects on the entitlements of households from marginalised groups that depend on mangrove system commons for their livelihoods. This is in line with findings from forest user groups in Nepal, where variation among local households led to differentiated forest entitlements, even though forest endowments were distributed relatively equally (Malla et al., 2003). Results presented here indicate that the unequal access to resources caused by pre-existing power structures and institutional settings meant that households were differently positioned to take advantage of statutory changes to land tenure occurring at the national level. This reflects the influence of formal and informal institutional processes between and among various levels of governance (cf. Sikor, 2007). Smit and Wandel (2006) state that the adaptive capacity of households is shaped by various social, political, and economic processes occurring at higher levels of governance. Jones et al. (2010) also argue that the impacts of such processes typically fall disproportionately onto the most marginalised that lack access and entitlement to key resources and whose interests are seldom recognised in governance procedures. Hence, this has implications for the environmental justice aspects of adaptive capacity, as institutional processes and procedures occurring at multiple levels of governance create and sustain injustices in the distribution of entitlements. The negative impacts of such procedures fall disproportionately on households from marginalised groups, who are already vulnerable and least unable to take advantage of the processes of decentralisation.

7.5 Linking distribution, recognition and procedural environmental justice through capabilities

The capability of marginalised households to control their political environment is constrained by the lack of participation in the procedures of MSES governance. Those households able to participate in resource management processes were found to have inherent capabilities to adapt to complex social and ecological circumstances (cf. Adger et al., 2004). For example, successful aquaculture farmers 'participated' in MSES governance by lobbying local governments in order to block decisions that would negatively impact aquaculture productivity, such as the development of dams or irrigation infrastructure. Marginalised households were unable to participate in these processes due to lack of recognition within the political community and inadequate access to resources (such as economic, information, networks, and education). Such a lack of participation is disempowering and undermined their capabilities. The extent to which households have the right to be heard is shaped by institutional processes, which is a crucial component of adaptive capacity and shapes how households choose to respond to MSES change (Jones et al., 2010). Significant asymmetries in wealth and power produced large divergence in household capabilities. The lack of participation of marginalised households subverted environmental justice through procedures that misrecognised these households and caused unequal distribution in adaptive capacity. The capabilities component of justice thus reveals the interdependence of distribution, procedure and recognition (Schlosberg, 2007). Identifying and responding to institutional processes occurring at multiple levels of MSES governance that shape household capabilities is central to the formation of adaptive capacity (Armitage, 2008). Holland (2008) suggests that ecological systems have the capacity to sustain the conditions that enable capabilities. Hence, it is vital to consider how MSES connect the environmental impacts of divergent socio-economic groups, as these connections increasingly bring benefits to the wealthy and powerful at the expense of those from marginalised groups who are already vulnerable.

7.6 The contribution to knowledge of adaptive capacity

By analysing aspects of MSES change and the factors that shape livelihoods, social capital and institutional structures and processes, findings highlight the importance of considering how these interacting elements have shaped the environmental justice aspects of adaptive capacity. This study highlights important justice aspects of communities, such as inequality, discrimination and incapability, that point to divergence in adaptive capacity within communities, and which should be considered within environmental governance more widely.

Using a livelihood approach that provides a time dimension to analyses of household uses of MSPG, this study shows how household characteristics and the different points in time as aquaculture develops within the same local context shape the distribution of adaptive capacity within MSES. Results demonstrate that the increasing influence of market mechanisms creates inequity in the distribution of adaptive capacity. Pre-existing social, economic and political settings have meant that households able to access a wider range of resources (i.e. finance, labour, skills, networks and markets) have been able to take advantage of transition processes to establish successful aquaculture farms. The subsequent inequality in income has reinforced pre-existing power structures. These households are less dependent on the natural functions and processes supporting the provision of mangrove system goods to respond to change, and more concerned with altering these natural processes in order to respond to market dynamics external to the community. However, more marginalised households depend greatly on the natural provision of mangrove system goods for their livelihoods and to respond to change. Income inequality and the concentration of wealth among a few successful aquaculture farmers has directed the flow of resources to these households with a focus towards adapting to external market demands rather than local livelihood needs. This has diverted resources away from marginalised households and contributed to the degradation and loss of mangrove systems necessary for the livelihoods of these households. The inequitable distribution of adaptive capacity and the benefits and burdens of MSES change has implications for environmental justice. Marginalised households that are unable to take advantage of the opportunities presented by aquaculture are unduly burdened with the negative impacts of MSES change. Mangrove system degradation and loss reduces a crucial livelihood option for these households, locking them into vulnerable trajectories, whilst at the same time, these households contributed least to the degradation.

Using an approach to assess the impact of aquaculture on livelihoods and social networks, this study illustrated how these interacting elements shape the recognition of various groups in the governance processes that influence adaptive capacity. Wealthy households gain recognition in the novel governance networks focussed on external market forces at the expense of more marginalised households unable to access the resources necessary to establish aquaculture. Results demonstrate the influence of market mechanisms on social capital and levels of recognition among the MSES governance processes that shape adaptive capacity, with implications for environmental justice. Communities with less market influence are associated with stronger bonding social capital which: increases adaptive capacity through greater network connectedness and redundant ties; reduces adaptive capacity through smaller and dense networks that lack of access to external resource. Conversely, communities with greater levels of market influence are associated with weaker bridging social capital which: increases adaptive capacity through access to resources external to the community; reduces adaptive capacity through lower redundancy in network ties. Discrimination due to socio-economic identity and difference affects the recognition component of environmental justice in adaptive capacity. Communities with greater aquaculture activity and market influence are associated with more fractionalised communities based on the socio-economic characteristics. Consolidator households have been able to increase their adaptive capacity by using their influence, power, and access to MSES governance networks in order to develop successful aquaculture ventures. This further increases their adaptive capacity through greater affiliation and influence in MSES governance networks. Conversely, marginalised households that lack access to MSES governance networks have been unable to take advantage of the opportunities presented by aquaculture, losing adaptive capacity through becoming less affiliated with rapidly changing MSES governance networks.

Using an institutional approach that provides insights into the ability of households to gain legitimate access to MSPG, this study shows how institutional structures and processes at and among the macro and meso levels (i.e. international, national and local) have shaped adaptive capacity through MSPG entitlements at the micro level (i.e. household). This study demonstrates how the increasing influence of market mechanisms has shaped the MSES governance procedures, creating and maintaining inequity in distribution and recognition related to the environmental justice aspects of adaptive capacity. Transitional reforms implemented within weak formal institutional settings mean

that aquaculture has developed more rapidly than the institutional processes required for sustainable development to occur can respond. This process has increased the adaptive capacity of consolidator groups who have been able to capture the benefits of reforms through pre-existing power structures to establish successful aquaculture farms. The subsequent concentration of wealth has diverted resources toward this group at the expense of marginalised households. The loss of adaptive capacity for marginalised households has resulted from endowment loss through mangrove system degradation and loss, and entitlement failure through institutionalised limitations on the opportunities and rights to access MSPG. The institutional structures and processes that create divergent MSPG entitlements have implications for the procedural component of environmental justice in adaptive capacity. A one-party state system, combined with a lack of civil society and restricted media, means there is a lack of participation, accountability, and avenue for recourse within MSES governance processes. There is a lack of capability of marginalised households to participate in the political processes of MSES governance. This creates and sustains the unjust and inequitable distribution and recognition within the governance processes that shape adaptive capacity within MSES.

Building on the findings from the three objectives, this study shows that the rapid growth of aquaculture subsequent to transition is the key aspect of MSES change. Communities with greater aquaculture activity are associated with divergent socio-economic groups (i.e. consolidator, accumulator and marginalised) that are adapting to different sets of drivers, i.e. external (markets) and internal (mangrove system dynamics) to the community. Successful aquaculture farmers adapt to market forces that exist beyond the immediate community, and are thus becoming increasingly detached from the mangrove system resource base (Figure 7.1). Those with limited access to resources are able to gain employment on aquaculture farms are adapting to labour market demands, while also remaining somewhat dependent on MSPG to supplement their livelihoods (Figure 7.2). However, marginalised groups with severely limited access to resources remain highly dependent on MSPG and adapt to the daily dynamics of mangrove system functions and processes. They do this by diversifying their livelihoods and using networks comprised of strong bonding social capital to access the necessary resources (i.e. finance, labour, food) to respond to change (Figure 7.3). That groups within MRDC are adapting to different sets of drivers has implications for environmental justice. The concentration of resources among a small number of successful aquaculture farmers results in their ability to gain

control of resources which they employ to enable them to adapt to external domestic and international market forces, e.g. by cutting down mangrove trees to establish farms, modifying the landscape to increase the productivity of aquaculture farms, or modifying fields to maintain productivity during environmental changes. This has a negative impact on the livelihoods of those households that remain dependent of MSPG from mangrove system commons, either as a supplement or as the main livelihood activity, by reducing the livelihood options available to them. Furthermore, these households have been unable to establish aquaculture farms and hence have contributed least to the negative environmental impacts. They are bearing the undue burden of the negative impacts of MSES change and face reduced capacity to adapt to future MSES change.

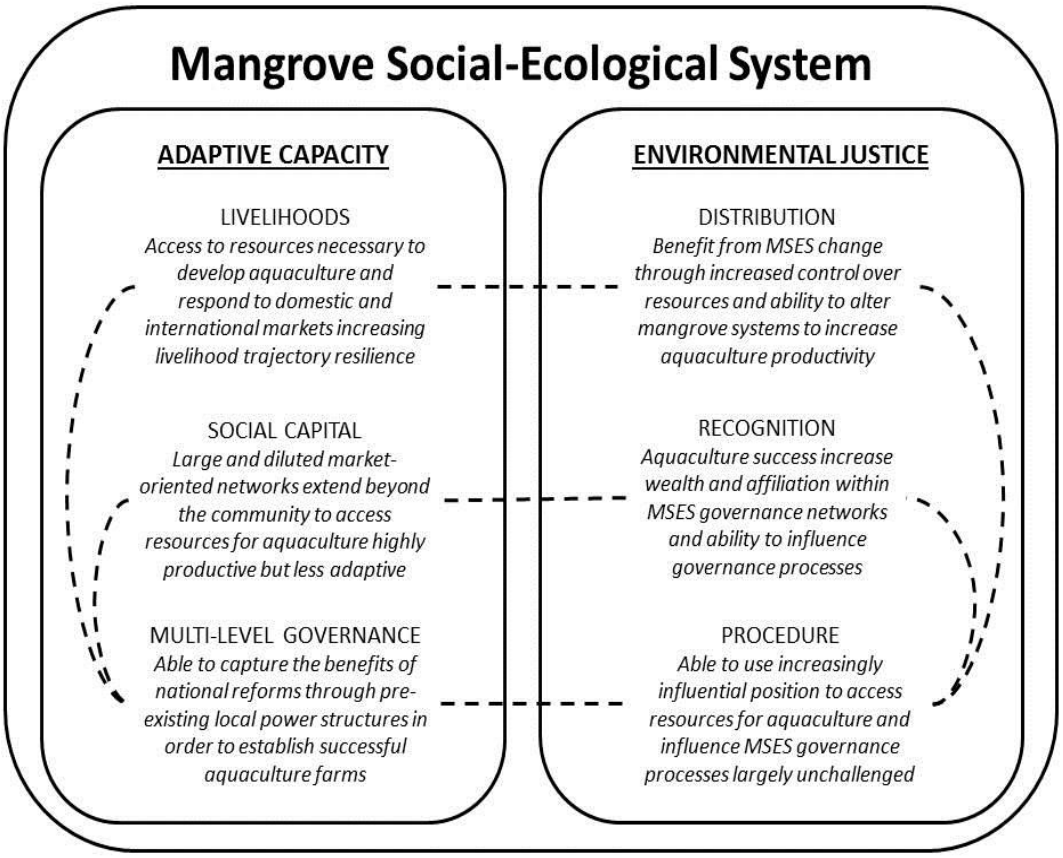

Figure 7.1: Link between adaptive capacity and environment justice regarding consolidator group

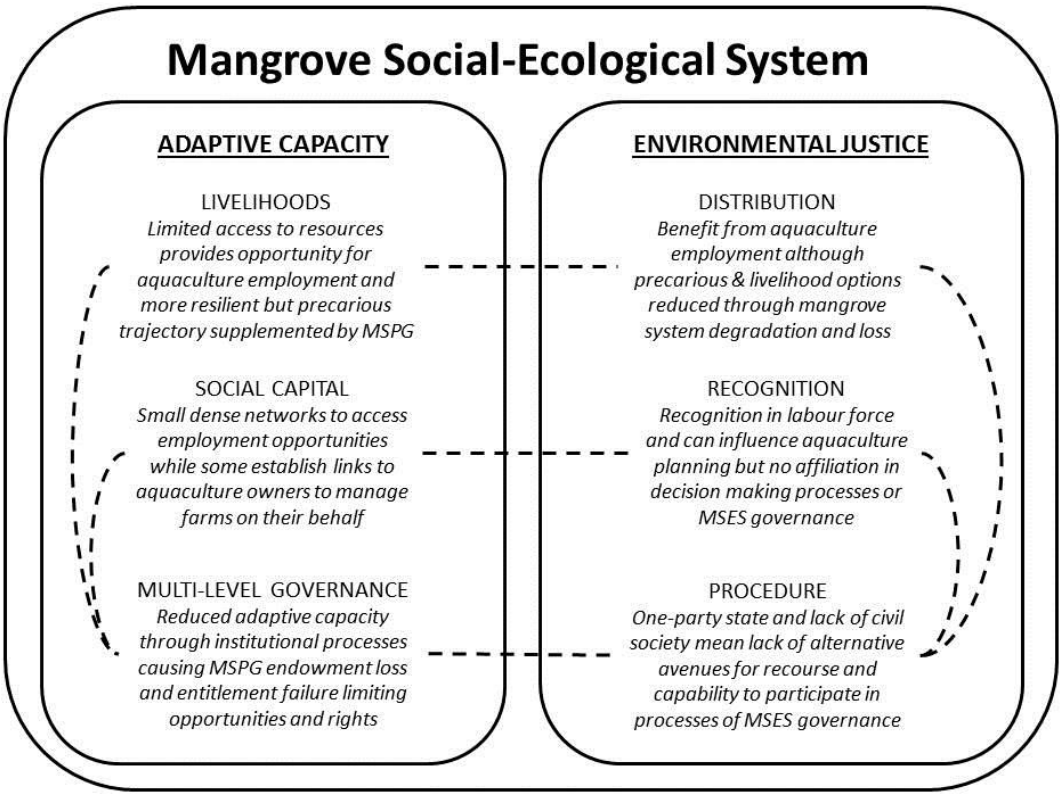

Figure 7.2: Link between adaptive capacity and environmental justice regarding accumulator group

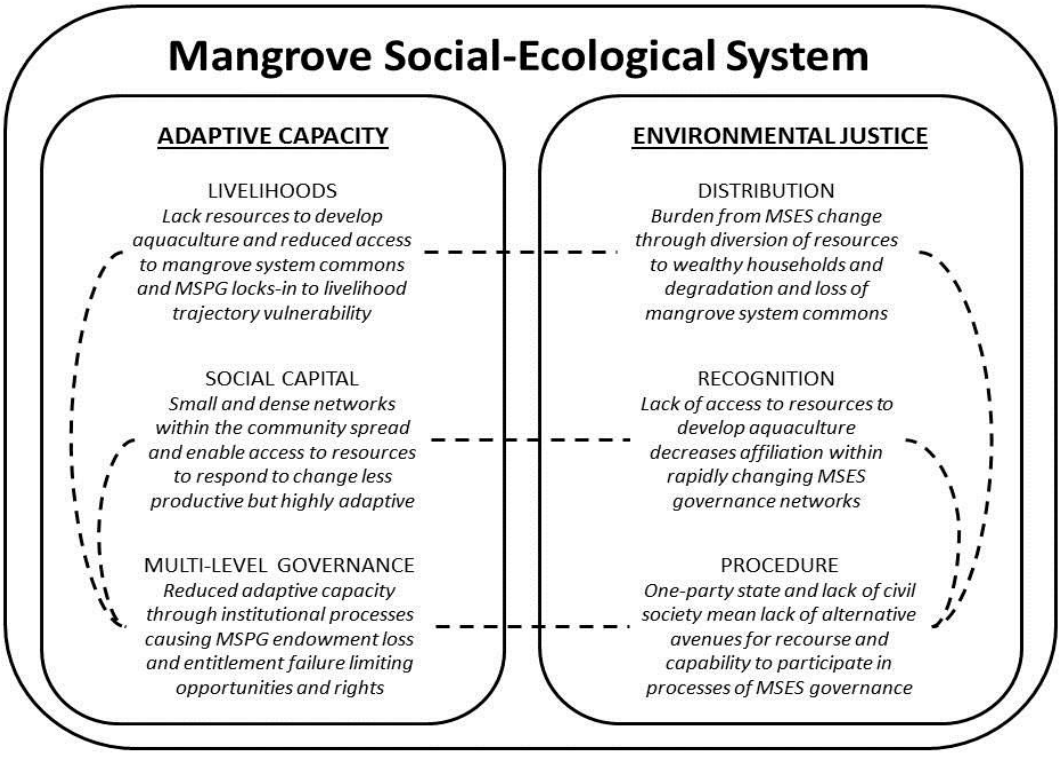

Figure 7.3: Link between adaptive capacity and environmental justice regarding marginalised groups

Key themes emanating from a synthesis of the results point to divergence in communities. Consolidator households (Figure 7.1) are being driven by external market factors and marginalised households (Figure 7.3) being driven by internal mangrove system factors, and the subsequent ways these interact with each other through their use of resources. This is not something that has been discussed in the literature and is a new way of thinking about adaptive capacity. This new way of thinking comes about through using an environmental justice lens to understand adaptive capacity within social-ecological systems.

Chapter 8 - Conclusions and priorities for future research

8.1 Introduction

This chapter presents a summary of this research, provides policy recommendations, outlines the academic contribution and highlights priorities for future research. To summarise, Chapter 1 presented the background and rationale for studying MSES, i.e.: the distribution of the impacts of mangrove degradation and loss on livelihoods and social networks, two vital components of adaptive capacity, is shaped by institutional structures and processes occurring at multiple levels of governance which will have implications for environmental justice. A justification for selecting Vietnam as an appropriate case study, along with the research aim, objectives and questions of this study were also presented. The aim of this study was to explore how MSES change has shaped the environmental justice aspects of adaptive capacity in coastal Vietnam. This was achieved through three research objectives: (1) analyse local livelihoods to assess the distribution of mangrove system services within MSES; (2) assess the impacts of key aspects of MSES change (i.e. aquaculture) on social capital; and, (3) explore how institutions and processes occurring at multiple levels of MSES governance are shaping local level entitlements to MSPG. Chapter 2 linked the natural resource management and environmental justice literature to guide a novel approach to analyse justice and equity in adaptive capacity in MSES, and identified three intended contributions of this research linked to the research objectives: (1) to analyse livelihoods in order to understand the distributional component of environmental justice in adaptive capacity; (2) to analyse social networks in order to understand the recognition component of environmental justice and what this means for adaptive capacity; and (3) to analyse institutions in order to understand the procedural component of environmental justice and what this means for adaptive capacity. The focus of each objective corresponds with a separate contribution (i.e. objective 1: livelihoods and distributional justice; objective 2: social capital and recognition justice; and, objective 3: institutions and procedural justice) (see section 8.3 for further detail). Chapter 3 outlined the research design processes, presenting justification for: the mixed methods case study approach, applied using grounded theory and guided by complex theory paradigm; study site selection; methods of data collection and analysis. Chapters 4, 5 and 6 detailed the results for objectives 1, 2 and 3 respectively. Chapter 7 discussed crucial aspects of MSES

change relating to livelihoods, institutions and social capital, and the implications for the environmental justice aspects of adaptive capacity within MSES.

8.2 General conclusions and policy recommendations

This research set out to explore how MSES change has shaped the environmental justice aspects of adaptive capacity within MSES in coastal communities of northern Vietnam. Integrating livelihood, social capital and institutional approaches provided an approach to explore three vital components of adaptive capacity and environmental justice: analysing MSPG use in livelihoods provided insights into the distributional component of environmental justice in adaptive capacity; analysing the association between different levels of aquaculture activity and social capital provided insights into the recognition component of environmental justice in adaptive capacity; and analysing institutional processes at multiple levels of MSES governance provided insights into the procedural component of environmental justice in adaptive capacity. This integrated approach to analysing the dynamic interactions between coastal communities and mangrove forests provides a more holistic assessment of adaptive capacity within MSES, and potential intervention points for enhancing environmental justice in adaptive capacity through improved mangrove management, which will now be considered.

In chapter 4, empirical evidence was presented on current MSPG use in livelihoods, and the drivers shaping livelihood trajectories and responses to MSES change. This provides a contribution to the evidence and knowledge base on mangroves and rural livelihoods. MSPG dependency was found to be differentiated between communities with different levels of aquaculture activity. At the aggregate community level, communities with high levels of aquaculture activity are less dependent on MSPG, while within communities MSPG dependency is differentiated among socio-economic groups, with marginalised groups more dependent in all communities. Aquaculture was observed to reduce household adaptive capacity through reductions in livelihood diversity. Marginalised groups with greater MSPG dependence were found to be disproportionately burdened with the negative environmental impacts from the conversion of mangrove system commons to aquaculture, which are crucial to these groups in responding to MSES change. The lack of ability of these groups to take advantage of opportunities emerging from political and economic change, and the erosion of MSPG they rely on for their livelihoods, means that

they are locked into livelihood trajectories that leave them more vulnerable and increasingly marginalised. This has implications for the distribution component of environmental justice, as ecosystem services are utilised by aquaculture farmers to increase productivity, while the negative environmental impacts are disproportionately felt by households from marginalised groups with greater dependency on MSPG. In addition, it is these groups that have contributed least to MSES change caused by aquaculture, but are the most negatively affected.

In chapter 5, social capital was assessed by exploring the influence of differing levels of aquaculture activity on social networks. Communities with higher levels of aquaculture activity were found to have less adaptive capacity due to larger and more diluted networks with less network redundancy. Although such networks are able to gain access to additional resources external to the community, and are more conducive to increasing productive capacity through increasing effectiveness of networks, the ties of such networks are weaker and vulnerable to change. Communities with lower levels of aquaculture activity had greater levels of adaptive capacity from high levels of redundancy due to small and dense social networks. Such networks are more conducive to adaptive capacity by fostering trust and are therefore stronger. However, networks that are too dense may result in homogeneity in knowledge and be unresponsive to change. The association between high aquaculture activity and larger, more diluted networks highlights that networks are more fragmented. This has implications for the recognition component of environmental justice as households from higher socio-economic groups gain increased recognition in MSES governance networks, whilst those from marginalised groups are increasingly discriminated against and marginalised. A balance of bonding and bridging ties may be required in order to increase network diversity, and hence adaptive capacity. Furthermore, this may enable increased recognition in MSES governance networks for marginalised households.

In chapter 6, empirical evidence was provided on the institutional processes operating between and among multiple levels of MSES governance that shape mangrove system entitlements. Formal structures were found to be top-down, weak, poorly coordinated, competitive and lacking effective communication, reducing adaptive capacity through lack of flexibility and ability to effectively reorganise in response to change. Informal structures were found to discourage engagement and participation (particularly of

women) in public affairs, and placed constraints on the ability of women to gain access to secure tenure rights, significantly reducing their adaptive capacity by forcing them to subsist on marginal land. Subsequent to political and economic reforms, the priority for economic growth via exploitation of natural resources at the macro level, and deconcentration of power and wealth at the meso level, has resulted in reduced adaptive capacity through an uneven balance of power among interest groups and constrained options during periods of reorganisation in response to MSES change. At the micro level, household entitlements have been reduced due to: endowment failures resulting in the effective privatisation of mangrove commons; entitlement failure due to lack of complementary endowments to bundle (such as labour, capital, information etc); and failure in capabilities arising from a lack of ability to participate in the political process. Hence, institutional processes at multiple levels of MSES governance influence the procedural component of environmental justice.

Turning now to policy recommendations, if policies to sustainably manage mangrove systems are to be successful, they must consider: (1) the divergence in communities between households adapting and being driven by external market factors and those households adapting and being driven by internal mangrove system factors; (2) the subsequent ways these interact with each other through their use of resources. Embedded within these considerations are issues relating to environmental justice which can be tackled by assessing the impact of aquaculture on: local livelihoods (distribution justice); social networks (recognition justice); and environmental entitlements (procedural justice). First, targeted livelihood support to those who need it most can reduce inequalities and promote distribution justice, and be achieved by identifying the characteristics of those households most dependent on MSPG and vulnerable to change. Further research will be necessary to identify the specific kinds of support vulnerable groups require, in addition to their desire for greater voice in decision-making. Policies aimed at increasing access of marginalised households to mangrove system resources can reduce income inequalities whilst increasing livelihood diversification opportunities, therefore increasing resilience. However, increasing the access of marginalised households to mangrove systems will only work if other groups are not degrading mangrove system commons. Hence, the impact of aquaculture on the environment and dependent livelihoods should be considered in coastal planning. In addition, in order to support those households most dependent on MSPG, livelihood diversification options outside of their

dependence on mangrove systems should be developed. Further research is necessary to understand the institutional structures and processes within which the limits and constraints for increasing access to mangrove system resources exist.

Second, targeting support in order to foster social capital and resilience can foster recognition justice and be achieved through understanding how aquaculture impacts the structure of social networks. This study shows that networks alter in response to MSES change, and that productive capacity through social networks is increased for some (i.e. advantaged households relying on novel networks to adapt to external market forces) and adaptive capacity is maintained for others (i.e. marginalised households relying on tradition networks to access livelihood resources in response to internal mangrove system change). Hence, tools to build and/or support networks through the transition must be developed in order to achieve recognition justice for those households unable to access or influence changing MSES governance networks. This could take the form of developing networks that draw divergent groups within communities together through a diversity of bonding and bridging ties, able to access a diversity of information and resources for the benefit of all stakeholders. Building and supporting diverse networks among MRDC can also foster shared understanding between mangrove system stakeholders on the challenges and issues facing mangrove systems, and facilitate self-organisation to effectively manage and respond to external shocks. This is crucial in transition economies as the state is rolled back and traditional community networks (i.e. bonding capital) are replaced by external networks (bridging capital) oriented towards markets and commerce. Civil society could play a crucial role in providing a platform for various stakeholders to interact. Civil society groups such as INGOs and VNGOs could also act as a crucial intermediary between households and higher levels of government which are presently absent. Another recommendation is therefore not just targeted (i.e. who gets support), but more specific support that better meets needs (i.e. the form of that support). Further research will be necessary to identify the specific kinds of support communities will need, and also to understand the structure and role of networks that extend beyond the community and across governance levels.

Finally, the institutional structures and processes at and among various levels of MSES governance shape the potential for procedural justice through the opportunities and

rights to mangrove systems for the most marginalised. Results demonstrate that the Vietnamese experience may not be conducive to multi-level governance of MSES due to the legacy of top-down central state formal institutions, and informal institutions that reinforce pre-existing power structures at the local level. It is informal institutions that operate most strongly at the local level, and these are determined by tradition. Ways to instigate projects that engage with these informal institutions, but also challenge and change them so that they move away from the male dominated, family orientated biases of the past, are required in order to achieve procedural justice. Although this is difficult, the recent opportunities open to civil society could be one way to achieve this through creating a platform for challenging procedural injustice in MSES governance. Further research is required to identify the specific institutions to foster participation in governance process. However, policies that provide all stakeholders with the capability to influence the political aspects of MSES governance, support institutions which foster accountability in governance processes and offer alterative avenues of recourse, encourage civil society and the opportunity and ability to participate in decision making processes, are all useful starting points for achieving greater environmental entitlements.

8.3 Academic contribution and priorities for future research

This thesis has drawn on natural resource management and environmental justice literatures in order to contribute knowledge on adaptive capacity of SES in three main ways (see section 2.8). This section discusses these contributions as well as highlighting priority areas for future research.

8.3.1 Academic contribution

Applying livelihood, social network and institutional approaches increased our understanding of the ways in which MSES change has influenced the environmental justice aspects of adaptive capacity. The application to a case study in Vietnam provided the opportunity to investigate crucial issues pertaining to adaptive capacity and MSES change in the under-researched context of a rapidly growing transition economy. The three main contributions of this research to the adaptive capacity literature correspond with the three research objectives, and the insights obtained from each will be crucial in achieving sustainable MSES management.

NRDC respond to SES change through their livelihoods, which are shaped through their ability to access natural resources, and are hence an important component of adaptive capacity. Little research has assessed the specific use of ecosystem provisioning goods in NRDC livelihoods, or the implications of this for environmental justice. Regarding objective 1 of this research, chapter 4 integrated ecosystem service and livelihood trajectory approaches in order to contribute knowledge by: building on the SLF by addressing its limitations (i.e. narrow focus on social aspects at the local scale and in the short-term); and, to understanding the distributional component of environmental justice and what this means for adaptive capacity within MSES. This research established the current use of MSPG between and within MRDC livelihoods, and identified household characteristics of those households more dependent on MSPG for their livelihoods (see sections 4.3.2 and 4.3.3). Livelihood trajectory analysis provided a time dimension to livelihood analysis to increase our understanding of the drivers that shaped past livelihood decisions in response to MSES change (see section 4.3.4). Integrating ecosystem service and livelihood trajectory approaches also provided the opportunity to assess the distributional component of environmental justice through: the current distribution of adaptive capacity within MSES through current MSPG use; and, consideration of how aspects of MSES change have shaped access to mangrove goods and services over time, and led to current differentiation in adaptive capacity within MSES (see section 7.2 for further discussion on livelihoods and the distributional component of environmental justice). Aquaculture was found to be the main aspect of MSES change, with a majority of the other identified aspects of change embedded within the rapid development of this sector. Those most reliant on MSPG for their livelihoods stand to lose the most from MSES change through reduced access to mangrove commons, with the subsequent constraints on livelihood decisions in response to MESE change creating path-dependency. The current unequal distribution of adaptive capacity, shaped by unequal access to mangrove goods and services over time, has implications for environmental justice, as the already vulnerable face disproportionate burdens from MSES change while contributing least to mangrove degradation and loss.

Social capital is a crucial component of adaptive capacity, and the ability of NRDC to respond to SES change is embedded within and available to them through social networks. However, little research has studied how SES change impacts the structure of

NRDC social networks, or the implications of this for environmental justice. Regarding objective 2 of this research, chapter 5 used social network analysis in order to contribute knowledge on the influence of MSES change on social capital within MRDC by: assessing the impact of different levels of MSES change (i.e. aquaculture) on livelihood context and social network structures; and, understanding the recognition component of environmental justice and what this means for adaptive capacity within MSES. This research identified divergent social network structures associated with differing levels of aquaculture activity (see section 5.3.2). This provided the opportunity to assess the recognition component of environmental justice by linking social network structure to the level of affiliation households have within MSES governance networks (see section 7.3 for further discussion on social capital and the recognition component of environmental justice). Results from chapter 5 build on those from chapter 4, by exploring the association between different livelihood contexts and household social networks, and identifying aspects of diversity and redundancy within social networks that contribute to the shaping of adaptive capacity. High levels of aquaculture activity were associated with larger and less dense networks, as aquaculture markets extend networks beyond the community, increasing the access to additional resources and the influence of external private actors. The adaptive capacity is reduced in these communities due to lower redundancy in network ties. This has implications for environmental justice as the greater influence of external private sector actors could mean that marginalised households with little access to aquaculture networks have lower recognition in MSES governance networks.

Institutions are an important component of adaptive capacity because they shape the rules that govern behaviour and the response of NRDCs to SES change. However, there remains a lack of understanding of how institutional processes occurring at multiple levels of SES governance shape adaptive capacity and the implications for environmental justice. In relation to objective 3, chapter 6 applies the EEF to contribute knowledge on the institutional processes and structures that shape the MSES governance and MSPG entitlements, by: exploring how institutional processes at multiple levels of MSES governance shape household MSPG entitlements; and understanding implications for the procedural component of environmental justice and what this means for adaptive capacity within MSES. This research demonstrated how institutional processes and structures at multiple levels of MSES governance have reinforced the concentration of power and wealth among local elites, reducing MSPG entitlements and the capabilities of the marginalised to

participate in MSES governance (see section 6.3). This provided insights into the procedural component of environmental justice by analysing how institutions shape the capabilities of MRDC to participate in MSES governance (see section 7.4 for further discussion on institutions and the recognition component of environmental justice). Results indicate that formal and informal institutional processes and structures discourage the participation of communities in public affairs, which is exacerbated by top-down processes of a one-party political system, lack of recognition of civil society, and severely limited press freedom. Subsequently, local authorities are unaccountable to the communities that they represent, and marginalised households face limited ability to reorganise in response to MSES change due to limited recognition in the institutional process and structures of MSES governance.

Integrating livelihood, social network and institutional approaches has provided a holistic understanding of adaptive capacity, through analysis of three crucial components in its creation and allocation within MSES. Independent analysis of these components would result in only partial understanding of the processes and structures that shape adaptive capacity in MSES. This research demonstrates that detailed empirical and context-specific research can add to our understanding of MSES change, particularly the subsequent rapid growth of the aquaculture industry, the implications for environmental justice and what this means for adaptive capacity within MSES. Results indicate that within the context of Vietnam, were top-down structures prevail within a one-party political system and power and wealth are concentrated at the local levels of government, the typical context amenable to MLG is not observed, restricting the formation of adaptive capacity within MSES. Therefore, in order to ensure equitable and just MSES governance, institutions are required that raise the awareness of MRDC of their rights regarding access to mangrove resources and recognition within the processes and structures of MSES governance. Although the results presented here are context-specific, exploring how MSES change has influenced the environmental justice aspects of adaptive capacity within MSES is vital to increase our understanding of what will shape the environmental justice aspects of adaptive capacity within similar SES to future change.

8.3.2 Priorities for future research

While specific results from this research are not generalizable to other SES due to the context-specific nature of the research, the theoretical implications of these findings make

a valuable contribution to our broader knowledge of the factors that shape adaptive capacity. This can provide useful insights to guide policies and the development of management planning of MSES in both Vietnam and developing country contexts more widely. Nevertheless, critical areas for future research remain. Emanating from the insights gained from this research, in order to better understand the influence of MSES change on the environmental justice aspects of adaptive capacity, future research should focus on three main areas.

First, although this research has highlighted those household characteristics that influence the use of MSPG in coastal livelihoods, results indicate the need to better understand the influence of gender in shaping mangrove system access, use and response to SES change. Despite issues of gender, power and collective action having being alluded to as being crucial components influencing adaptive capacity within MSES, a deep understanding of the factors that shape these issues is lacking. Such research would guide national policy, mangrove governance, and the development of locally appropriate mangrove management, which would help Vietnam to contribute towards wider goals such as MDGs and sustainable development. Second, although this research provides an institutional analysis of multi-level MSES governance, future research would benefit from a deeper understanding of the cultural aspects that shape and are shaped by the institutions of MSES governance. Such research is crucial as it provides the opportunity to consider how experiences, beliefs, values, attitudes, meanings and communication among people are linked to the institutions of MSES governance. This would help to develop more appropriate management planning that is more conducive to local contexts. Third, whilst this research provides an ego-network analysis, an area under-researched in SES contexts, future research would benefit from a whole network approach that includes ties between and among different levels of governance. Such research would be challenging as placing boundaries on SES is inherently difficult, but would be useful in highlighting the structure of governance networks. This would provide a broader analysis of governance networks in order to identify those areas requiring support in order to build adaptive capacity.

The above points call for detailed future research building on the evidence presented in this thesis. Ethnographic research into MSES could be utilised to further contribute to integrated and holistic understandings of the factors that shape local knowledge, perceptions, values and meanings of mangrove system use and management at

the local scale. Such research would feed into national policies on mangrove management and project development in order to ensure equity and justice in MSES governance.

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Appendix 1 – Original household survey

General information	
Village number:	Household ID:
Years lived in village:	Total number of individuals living in the household:
Would you be willing to participate in a further semi-structured interview at a later date? **YES / NO**	

- See separate sheet for details of respondents willing to participate in semi-structured interviews.

Part 1 (a). Individuals within the household contributing towards household livelihood activities:

Household member		Age	Gender M/F	Main occupation	Total number of years contributing to household livelihood	Education	
						a. Total years of schooling	b. Highest qualification ***(no education-0, primary-1, secondary-2, higher secondary or technical-3, bachelor-4, master-5)***
1							
2							
3							
4							
5							

Part 1 (b). Contribution made by each individual towards household livelihood portfolio:

List of livelihood activities household engages in	Household member - number of working days per week for each livelihood activity															
	Individual 1		Individual 2		Individual 3		Individual 4		Individual 5		Individual 6		Individual 7		Individual 8	
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet

Part 1 (c). Transport and communication assets within household:

Do you have access to any of the following:		How important is this to your mangrove related activities? *(**1** = not at all, **2** = not very much, **3** = don't know, **4** = quite important, **5** = very important)*	How important is this for you to give/receive knowledge about mangroves? *(**1** = not at all, **2** = not very much, **3** = don't know, **4** = quite important, **5** = very important)*
TV			
Radio			
Telephone			
Mobile phone			
Internet			
Vehicles			
Bicycle			
Other			

Part 2 (a). List of goods households collect from mangrove forests and their frequency of use

Uses		y/n	Household usage	Sell for cash	Frequency									
					Never		Times per day		Times per week		Times per month		Times per season	
					Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Wood uses	Fuel													
	Construction													
	Fishing													
	Household													
	Craft													
	Other													
Food	Fish													
	Shrimp/crab													
	Molluscs													
	Leaves/fruit													
	Cooking oil													
	Honey													
	Other													
Other	Medicines													
	Compost													
	Glue/wax													
	Other													

Part 3 (a). Participation in particular mangrove project of interest.

Decision making	Yes/no	Dates of position held
Have you ever participated in the _____ mangrove project?		
Have you ever been a member of the coordination team?		
Have you ever been a member of the steering committee?		
Have you contributed to setting the project goals?		
Have you contributed to the project design?		
Have you been involved with the implementation of projects?		
Have you been involved in the day-to-day running of the project?		
Have you contributed to the monitoring of the projects?		

Part 3 (b). Please list any other mangrove restoration projects you have been involved with or are aware of in the community:

Project name	**Implementing organisation**	**Duration of project** *(start/finish date, ongoing?)*	**Were you involved** *(y/n)*	**Success compared to mangrove project of interest?** *(i.e. more successful, less successful, the same)*

Part 4 (a). Please list all the other environmental benefits not mentioned above that mangroves provide to you and the community:

Part 4 (b). What do you consider to be the main factors that have changed the mangrove forests since *..... ?

Part 4 (c). How has the mangrove project changed the mangrove forest and the benefits they produce (e.g. what positive or negative changes have occurred)?

Part 5 (a). Please list the people with whom you have talked to about matters relating to mangrove management before and after the project commenced

List the people with whom you discuss matters relating to mangrove management and the organisation they belong to			
Individual	Organisation/group/social position	**In relation to project:**	
		Before (y/n)	After (y/n)

Part 5 (b): For each individual listed above, please fill in the following:

Name of individual	Relation to you (*e.g. family, friend, colleague*)	Is this person from your village? *(y/n)*	How long have you known this person?	How important is this person? *(1, not at all – 5, very)*		How reliable is this person? *(1, not at all – 5, very)*		How often do you communicate with this person?									
				B	***A***	***B***	***A***	**Daily**		**Weekly**		**Monthly**		**Per season**		**Annually**	
								B	***A***	***B***	***A***	***B***	***A***	***B***	***A***	***B***	***A***

- ***B*** = before mangrove project, ***A*** = after mangrove project

Part 5 (c). List of people from whom you receive knowledge and information from relating to mangroves

List the people from whom you receive knowledge/information from relating to mangroves and the type of knowledge/information they provide	
Individual	Type of knowledge received ***(i.e. changing condition of mangroves, day-to-day actions, livelihood opportunities, ecological services)***

Part 5 (d). List of people to whom you provide knowledge and information to relating to mangroves

List the people that you provide knowledge and information to relating to mangroves, and the type of knowledge/information you provide	
Individual	Type of knowledge provided ***(i.e. changing condition of mangroves, day-to-day actions, livelihood opportunities, ecological services)***

Part 6 (a). How has the number of ways that you can earn an income through mangroves changed as a result of the project:

A lot less ☐ *A little less* ☐ *No change* ☐ *A little more* ☐ *A lot more* ☐

(b). How has the mangrove project reduced damage or contributed to protecting you from storms and floods:

A lot less ☐ *A little less* ☐ *No change* ☐ *A little more* ☐ *A lot more* ☐

(c). How has your ability to change the way you manage mangroves day to day changed since the project started:

A lot less ☐ *A little less* ☐ *No change* ☐ *A little more* ☐ *A lot more* ☐

(d). How has your ability to share information and knowledge with others changed since the project started:

A lot less ☐ *A little less* ☐ *No change* ☐ *A little more* ☐ *A lot more* ☐

(e). How has your willingness to work with others on issues relating to mangroves changed since the start of the project:

A lot less ☐ *A little less* ☐ *No change* ☐ *A little more* ☐ *A lot more* ☐

(f). How has your willingness to work with others on environmental issues other than those relating to mangroves changed since the start of the project:

A lot less ☐ *A little less* ☐ *No change* ☐ *A little more* ☐ *A lot more* ☐

(g). How has your ability to influence policy or decisions relating to mangroves changed as a result of the project:

A lot less ☐ *A little less* ☐ *No change* ☐ *A little more* ☐ *A lot more* ☐

Appendix 2 – Revised household survey

General information	
Commune number:	Household ID:
Name of village:	
Years lived in village:	Total number of individuals living in the household:
Would you be willing to participate in a further semi-structured interview at a later date? **YES / NO**	

- See separate sheet for details of respondents willing to participate in semi-structured interviews.

Part 1 (a). Individuals within the household contributing towards household livelihood activities:

Household member		Age	Gender M/F	Main livelihood activity	Education	
					c. Total years of schooling	d. Highest qualification *(**0**-no education, **1**-primary, **2**-secondary, **3**-higher secondary or technical, **4**- bachelor, **5**-master)*
1						
2						
3						
4						
5						
6						

Part 1 (b). Contribution made by each individual towards household livelihood portfolio

List of livelihood activities household engages in	**Livelihood information**				
	Individual (number)	*Time committed to activity*	*Yield / quantity*	*Income*	*Household use*
Rice cultivation *(yield per crop)*					
Other cultivation *(yield per crop)*					
Wetland exploitation / mangrove activity *(e.g. public forage for clam, shrimp, crab)*					
Aquaculture *(e.g. clam filed, shrimp pond owner)*					
Waged labour *(e.g. aquaculture employee, construction labourer)*					

List of livelihood activities household engages in	**Livelihood information**				
	Individual (number)	*Time committed to activity*	*Yield / quantity*	*Income*	*Household use*
Livestock					
Fishing					
Industry *(e.g. salt production, manufacturing)*					
Service *(e.g. shop, taxi, restaurant, rental etc.)*					
Migration/remittances					
Other					

Part 2 (a). List of goods households collect from mangrove forests and their frequency of use

Uses		y/n	Household usage	Sell on market	Frequency of activity	
					Hours per day	Days per week
Wood uses	Fuel					
	Construction					
	Tools/ equipment					
	Household/ furniture					
	Handy craft					
	Other					
Food	Fish					
	Shrimp/crab					
	Molluscs					
	Leaves/fruit					
	Cooking oil					
	Honey					
	Other					
Livestock	Duck					
	Cows					
	Chicken					
	Other					
Other	Tourism					
	Medicine					
	Fertilizer					
	Other					

Part 3 (a). Transport and communication assets within household:

Do you have access to any of the following: *(y/n)*		**How many are in the household?**	**How important is this to your mangrove related activities?** ***(1*** *- not at all,* ***2*** *- not very much,* ***3*** *- quite important,* ***4*** *- very important,* ***5*** *- I'm not sure)*
1. TV			
2. Radio			
3. Public radio			
4. Telephone			
5. Mobile phone			
6. Internet			
7. Car			
8. Motorbike			
9. Bicycle			
10. Motor boat			
11. Manual boat			
12. Other			

Part 4(a). Participation in mangrove projects

Decision making	**Yes/no**	**Please list all the other mangrove related projects you are aware of in this space** *(project name and organisation)*
Are you aware of the mangrove project?		
Are you aware of the aims and objectives of the project?		
Have you ever been involved in the project?		
Have you ever contributed to decision making and planning of the project?		
Have you ever been involved in the implementation of the project?		
Are you aware of any other mangrove related projects?		

Part 5(a). Please list the people with whom you have talked to about matters relating to mangrove management

List <u>ALL</u> the people with whom you discuss matters relating to mangroves and the organisation they belong to *(e.g. project workers, Union or Association members, provincial/district or commune authority figures, neighbours, friends)*	
Individual	Social position and **<u>contact number or address</u>** *(e.g. NGO representative, Union or Association member, provincial/district/local authority figure, neighbour, friend)*
(1)	
(2)	
(3)	
(4)	
(5)	
(6)	
(7)	
(8)	
(9)	
(10)	
(11)	
(12)	
(13)	
(14)	
(15)	

Part 5(b): For each individual listed in section 5(a), please fill in the following:

Number of individual	**How long have you known this person?**	**Is this person from your village?** *(y/n)*	**Is this person from your commune?** ***(y/n)***	**Did you discuss mangroves with this person before or after the project started, or both?**		**Approximately how often do you communicate with this person about mangroves?** *(1- never, 2 - sometimes, 3 - often, 4 - quite often, 5 - always)*	**Do you communicate with this person about mangroves more, less or the same since the project started?** *(write M, L, S or leave blank if you did not know them before the project)*	**Do you receive or provide information relating to the mangroves to this person?**	
				Before	*After*			Receive	Provide
(1)									
(2)									
(3)									
(4)									
(5)									
(6)									
(7)									
(8)									
(9)									
(10)									
(11)									
(12)									
(13)									
(14)									
(15)									

Appendix 3 - Expert semi-structured interview themes

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1. **Overview**

- Drivers of mangrove change
- Importance of mangroves (e.g. compared to agriculture, aquaculture)
- Aquaculture and impacts on: wetland environment; coastal communities

2. **Policy and institutional framework**

- Changing role of government bodies
- Current policy and institutional frameworks for mangrove management and their effectiveness (e.g. coordination, communication, effectiveness between governmental bodies)
- NGOs had any significant influence on mangrove management
- NGOs and government relations
- Local level institutions (such as local government and Mass Organisations)

3. **Project design**

- Mangrove projects locations, why?
- Stakeholder involvement in design and implementation (Universities, NGOs, donors, communities)
- Participation, criteria?
- Mangrove project outcomes/monitoring

Appendix 4 - Household semi-structured interview themes

Environmental change

- Aquaculture
- Agriculture
- Population
- Wood and trees
- Coastal erosion
- Climate variability/change
- Ecosystem goods and services
- Mangrove projects

Household

- Family
- Livelihood change
- Cooking
- Fuel/energy
- Water

Farming

- Land
- Crops
- Yields
- Water/irrigation

Off-farm

- Employment
- Industry
- Construction
- Migration
- Teaching

Community

- Change (e.g. trust, interaction, cohesion)
- Groups/associations
- Activities
- Social relations/networks
- Mangrove projects/perceptions/experiences

Support

- Local/national government
- Extension services
- Support groups
- Infrastructure/roads
- Community
- Mass organisations

Appendix 5 – Ethical approval

Performance, Governance and Operations
Research & Innovation Services
Charles Thackrah Building
101 Clarendon Road
Leeds LS2 9LJ Tel: 0113 343 4873
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UNIVERSITY OF LEEDS

Steve Orchard
PhD Research postgraduate
Centre for Climate Change Economics and Policy (CCCEP)
Sustainability Research Institute (SRI)
University of Leeds
Leeds, LS2 9JT

AREA Faculty Research Ethics Committee
University of Leeds

24 June 2015

Dear Steve

Title of study: **NGO mangrove restoration and rehabilitation interventions and their influence on social capital: implications for climate change adaptation in coastal villages of Vietnam**

Ethics reference: **AREA 11-057**

I am pleased to inform you that the above research application has been reviewed by the ESSL, Environment and LUBS (AREA) Faculty Research Ethics Committee and following receipt of your response to the Committee's initial comments, I can confirm a favourable ethical opinion as of the date of this letter. The following documentation was considered:

Document	*Version*	*Date*
AREA 11-057 Ethics review response 2.docx	1	23/11/11
AREA 11-057 Ethics review response.docx	1	09/11/11
AREA 11-057 Steve_Ochard_Ethical_Review_Form.doc	1	14/09/11
AREA 11-057 Ethics - information letter.docx	1	14/09/11
AREA 11-057 Ethics_Consent_Form.docx	1	14/09/11

Please notify the committee if you intend to make any amendments to the original research as submitted at date of this approval. This includes recruitment methodology and all changes must be ethically approved prior to implementation.

Please note: You are expected to keep a record of all your approved documentation, as well as documents such as sample consent forms, and other documents relating to the study. This should be kept in your study file, which should be readily available for audit purposes. You will be given a two week notice period if your project is to be audited.

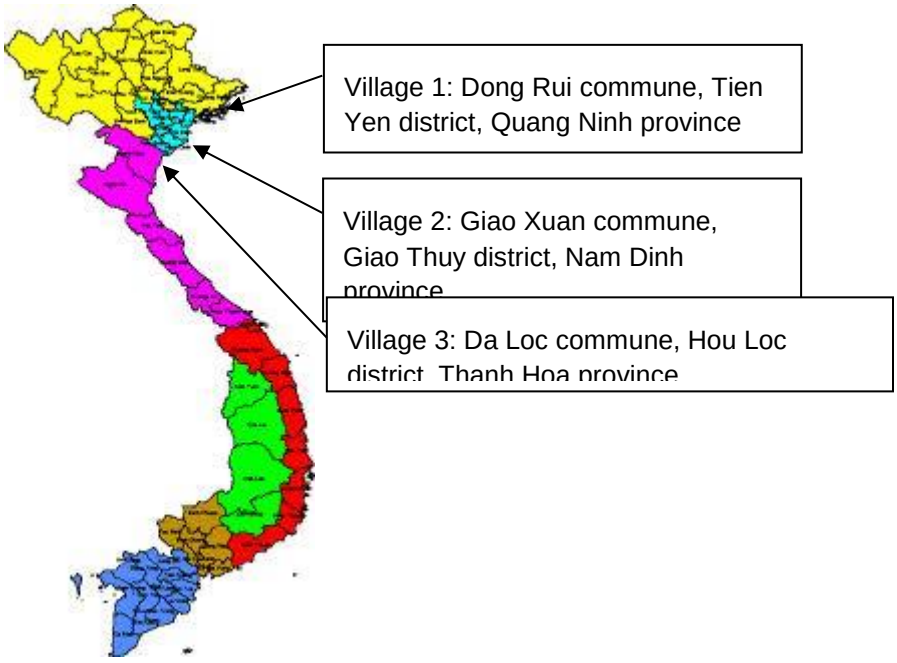
Yours sincerely

Jennifer Blaikie
Senior Research Ethics Administrator
Research & Innovation Services
On behalf of Dr Anthea Hucklesby
Chair, AREA Faculty Research Ethics Committee

CC: Student's supervisor(s)

Appendix 6 - Fieldwork Risk Assessment (High Risk Activities)

Fieldwork Project Details

Faculty School/Service	School of Earth and Environment, PhD research for Centre for Climate Change Economics and Policy (CCCEP).
Location of Fieldwork	Vietnam Dong Rui = 21°20'N 107°25'E Giao Xuan = 20°13'48"N 106°31'00'E Da Loc = 19°44'0"N 105°48'0"E 
Brief description of Fieldwork activity and purpose *(include address, area, grid reference and map where applicable)*	The aim of this fieldwork visit is to collect data for my PhD thesis. This will involve conducting household surveys and semi-structured interviews in three rural villages of coastal Vietnam (in Dong Rui, Giao Xuan, and Da Loc communes). In addition, semi-structured interviews will be conducted with loca authorities, NGOs, and community-based organisations (e.g. Farmers Unions, Womens Unions etc). The three villages are all located in the northern region of Vietnam, and I will be based in Hanoi when not in villages. This fieldwork trip is being supported by: Vietnamese NGO Marinelife Conservation and Community Development (MCD), CARE International Vietnam, and National Institute for Science and Technology Policy and Strategy Studies (NISTPASS). The dates of travel are January 2012 to June 2012
Fieldwork itinerary *e.g. flight details, hotel address*	Flights are yet to be booked. Please see attached tentative work plan for details of movements and actions while conducting fieldwork visit. When I arrive in Hanoi, I will initially stay at: Prince V Hotel

	15 Trung Yen Lane ~~Dinh Liet Street~~ Hanoi Vietnam 09341 21 11 Other accommodation for long term stays is being sourced by the relevant supporting organisation in each village. Once identified, this will be communicated (with dates and contact details) to my supervisors.
Organiser Details	**Contact details** *Name, Email, Telephone*
Fieldwork Activity Organiser / Course Leader	Dr Claire Quinn c.h.quinn@leeds.ac.uk +44(0) 113 34 38700 Dr Lindsay Stringer l.stringer@leeds.ac.uk +44(0) 113 34 37530
Departmental Co-ordinator	Dr Andy Dougill a.j.dougill@leeds.ac.uk +44(0) 113 34 36782
Nature of visit *Size of Group, lone working, staff, postgraduate, undergraduate*	PhD dissertation/postgraduate/fieldwork Some lone working during village visits. Site visits to rural communities will be undertaken with institutional support and interpreters. This is the second fieldwork visit and forms part of my ongoing PhD research into mangrove resource management, the influence of NGOs on social capital as a result of their mangrove projects, and the implications of this for adapting to climate change. The intention of this visit is to gather data in the form of household surveys with mangrove resource user's, and semi-structured interviews with selected households, NGO representatives, government representatives and community based organisations. This will involve spending extended periods of time in the three selected villages to allow for data to be comprehensively obtained. Although I will be working alone on the research, I will be supported by a number of institutions and organisations that work in each area, who have already agreed to support my research following a scoping study in Vietnam earlier in April/May 2011. This scoping study provided the opportunity to make many friends, colleagues and other contacts in the area before fieldwork commences. The main collaborators for this fieldwork visit are Marinelife Conservation and Community Development (MCD), CARE International Vietnam, and the National Institute for Science and Technology Policy and Strategy Studies (NISTPASS).
Participant Details *Attach information as separate list if required*	**Contact details** *Name, Address, email, telephone, Next of Kin contact details*
	Steve Orchard 1 Burchett Place Woodhouse Leeds West Yorkshire LS6 2LN 07944182962 eeseo@leeds.ac.uk **Passport ID**: 800449484 **Travel insurance number**: to be obtained when flights have been arranged

	Next of kin: Margaret Bosomworth 34 Knoll Wood Park Horsforth Leeds West Yorkshire LS18 4SH Home tel: 01132284777 Mob tel: 07808709641

HAZARD IDENTICATION

Identify all hazards specific to fieldwork trip and activities, describe existing control measures and identify any further measures required.

HAZARD(S) IDENTIFIED		CONTROL MEASURES ***(e.g. alternative work methods, training, supervision, protective equipment)***
Nature of the site *School, college, university, remote area, laboratory, office, workshop, construction site, farm, etc* Hotels, offices, rural coastal villages, cities, public areas		- **Personal security** – will be maintained by minimising incidents of walking alone while in cities, and making sure any valuables are discretely stored in a money belt. Other valuables will be securely stored in the hotels or rented accommodation where I shall be staying during village visits or while in Hanoi. - **Working space** – either at hotel accommodation or supporting organisation office while in Hanoi, or at supporting organisation office at village site. All safety guidelines and procedures will be checked and followed, and all personal belongings will be kept in a safe place. - **Communication** – mobile phone with Vietnamese sim card will be carried at all times, and the colleagues and organisations supporting the research will be informed of all movements. Network coverage available at all three sites. All villages have electricity so the phone can be charged at regular intervals. - **Expert meetings** – will be carried out in headquarters/office/place of work in selected villages or in Hanoi, all during office hours. All expert interviews are with reputable organisations (i.e. CARE, MCD and NISTPASS) and their health and safety guidelines will be followed while on their premises. - **Data collection sites (Vietnam)** – rural coastal villages, relatively low levels of development. Household surveys and semi-structured interviews will be conducted at participants home or organisation headquarters. Permission to conduct surveys and semi-structured interviews will be gained from household members, supporting organisation and local authorities. I will be accompanied with an interpreter recommended by the supporting organisation, and supporting organisation representatives will help with all arrangements and be fully aware of my actions and location at all times. Supporting organisations will also brief me regarding village customs, codes of behaviour and expectations.
Environmental conditions *Extremes of temperature, altitude, exposure to sunlight, potential weather conditions, tidal condition etc* North Vietnam – January/June end of dry season, moderate transition period to wet season.		- **Coastal regions** – while visiting coastal sites I will follow all guidance and advice provided by supporting organisations, and I will consult the following website to be fully aware of tidal and weather information: http://www.myforecast.com - **Weather exposure** – Sun protection will be worn (cream and clothing), waterproof clothing worn in rain, sweaters in cool times and evening. Sufficient

		quantities of water will be consumed throughout the day.
Site specific conditions *e.g. cliffs, screes, bogs, featureless landscapes, local endemic infectious diseases, zoonoses etc* Coastal, tides		- **Disease** – there is very low risk of malaria in all of the potential sites in Vietnam. To mitigate the risk of dengue fever in Vietnam, I will avoid environments that are known to harbour mosquitoes and insects repellent will be applied to skin and clothing to enhance protection. - **Medical** – first aid kit will be carried to on all field site trips. Ample water, sun screen and provisions also taken.
Process *Operating machinery, electrical equipment, driving vehicles, handling or working with animals etc* Data collection, household surveys, meetings, semi-structured interviews.		- I will be in constant contact with a colleague from Earth and Environment (SRI), Dr Elisabeth Simelton, who has lived and worked in Vietnam for many years. She is well versed in the environment, hazards, language and culture, and has professional and social contacts in Vietnam, especially in the Hanoi region. - Household surveys and semi-structured interviews will be conducted either in participant's homes or, as with expert meetings, conducted in the security of official buildings with adequate safety features, or in village community centres. - While conducting data collection, I will follow the safety guidance of the institution or organisation involved. - I will have a local helper/interpreter with me for all field site visits. However, if the situation arises that I am alone, I will provide a location to my local contact and have a call in procedure at regular intervals. - When conducting any field visit I will get briefed locally about the correct etiquette and behaviour and customs to respect while in each village.
Transport *Mode of transport while on site, to and from site, carriage of dangerous goods etc* Aeroplane, taxi, bus, train		- On arrival, I will get a taxi from the airport to my accommodation in Hanoi. - I will use reputable and licensed taxis to transport me from A to B while in Hanoi or other cities. I will travel to field sites outside Hanoi with transport provided by institutions/project leaders. If a situation arises where transport is not provided I will use reputable guide and travel organisations and reliable bus and train companies suggested by colleagues who have extensive experience travelling around Vietnam. I will notify colleagues of all my movements throughout my trip and carry a mobile phone with me so that I can maintain contact with them at all times.
Equipment *manual handling risks, operation of machinery, tools, use of specialist equipment etc*		- Personal laptop, mobile phone & local sim card. These will be kept in a safe place at all times, whether in a safety deposit box in a hotel, at an office, or kept on my person at all times while in public.

Violence *potential for violence (previous incidents etc)*		- **Very low hazard** – I will be staying at secure accommodation provided by my hotel in Hanoi, that will also provide safety deposit box if required. When travelling alone I will be travelling with reputable bus and taxi companies. I will avoid putting myself into insecure situations. As a measure I will conduct all my interviews in the day time and in my respondents' work offices. Since I am being greeted by various friends, acquaintances and colleagues made during a previous scoping study, as well as the supporting organisations, who have lived and worked in Hanoi for many years, they have professional experience, and will advise me on the social and professional environment I will be interacting with. This familiarity will improve my capacity of reaction and perception toward any potential hazard that might occur.
Individual(s) *medical condition(s), young, inexperienced, disabilities etc*		- I will use the experience of my colleagues and supporting organisations to minimise risks. - As I suffer from mild asthma, I will carry sufficient medicine with me and a prescription form at all times. - I will use my previous experience of conducting a scoping study in April/May 2011, and additional experience relevant to conducting research in a different community as part of Masters research, as well as extensive experience of travelling alone in Southeast Asia and other regions.
Work Pattern *time and location e.g. shift work, work at night*		- All travel (where possible) will take place during daylight hours. Household surveys and all semi-structured interviews will be conducted in daylight between 08:30 to 18.30. The interviews will be arranged before hand with the interviewees.
Permissions Required *Contact details, restrictions and details of permissions*		- I am obtaining a Research Permit for Vietnam, available through the Social Labour Department in Hanoi. The application is being supported by Marinelife Conservation and Community Development (MCD). - Although I have visited Vietnam in a previous scoping study back in April/May 2011, I will re-introduce myself to the relevant people on arrival to prevent any uncertainty about the research being undertaken.
Other Specific Risk Assessments *e.g. COSHH, Manual Handling, Lone Working if so what is identified in these assessments? Are there training requirements? (cross reference where appropriate)*		- No other specific assessments have been identified to be required.

Health Questionnaire Completed *Is it required and has it been completed, who by and where is it recorded*		- Previously completed as part of Masters study within the department. I am fit and well and have no pre-existing medical conditions.
Health Surveillance Required *Is it required and has it been completed, who by and recorded*		- To be completed by Dave Banks (if required)
Vaccinations Required *Obtained and certificate where applicable*		- I have made arrangements to have all necessary vaccinations at the Leeds Student Medical Practice before I leave for the trip.
First Aid Provision *Requirement for first aid or specialist first aid equipment, access to medical equipment and hospitals*		- I will carry a comprehensive first aid kit with me at all times. - **Main hospital**: Hanoi hospital (04) 3934 0666. Provides 24hr emergency medical and dental advice and treatment - Pharmacies and clinics also available in all village sites. - I will have comprehensive medical insurance for this trip, which I will purchase when flights and itinerary have been finalised

Additional Supporting Information		
Pre-departure Briefing *Carried out and attended*		- I will be attending numerous supervisory meetings in preparation for this scoping study. Discussed will be the details on this form, confirmation of my travel plans, and contact arrangements throughout the trip. - I will arrange to have regular contact with your supervisors in Leeds, including weekly skype calls to report progress. - Any accidents or incidents will be reported back to Leeds ASAP
Training *Identify level and extent of information; instruction and training required consider experience of workers, details of relevant training*		- I have read extensively on how to plan and conduct qualitative research throughout my academic career. As I have qualifications relating to development and climate change adaptation issues, this will facilitate my ability to engage and communicate with the chosen institutions and foster trustful relationships. Conducting dissertations for previous undergraduate and Masters degrees, and using qualitative methods that I learned from specific research modules, has equipped me with key skills for conducting meetings and discussions relating to fieldwork. - Having previously conducted a scoping visit to Vietnam back in April/May 2011, I have gained valuable experience in conducting work in this area.

FCO advice *Include current FCO advice for travel to the area where applicable*		- Vietnam – (no travel restrictions for this area) http://www.fco.gov.uk/en/travel-and-living-abroad/travel-advice-by-country/asia-oceania/vietnam
Supervision *Identify level of supervision required e.g. full time, Periodic telephone/radio contact*		- I will carry a mobile phone at all times for communication. I will also have a local sim card. - Networks and electricity are available throughout. - Communication will be maintained with supervisors in Leeds - Supervisors will be provided with a full list of contacts including names, addresses and phone numbers of friends, colleagues, hotels etc I will be at during the trip (all provided on this form). Contingency plans will be in place in the event I fail to make communication (e.g. contact colleagues, associates, friends, family and British Embassy). - Constant communication with family in the UK will inform them of my safety and location from day to day.
Other Controls *e.g. background checks for site visits, embassy registration*		- I will register with the FCO LOCATE service which registers me with the British High Commission (https://www.locate.fco.gov.uk/locateportal/). - The collaborating institutions and organisations were selected during a previous scoping study, where professional relationships have been established with organisations internationally renowned for their work. - Dr Elisabeth Simelton is a close colleague who held a research fellow post at Earth and Environment (SRI) for some time, is known well by my supervisors and other department staff, and has published widely in the area of climate change adaptation in Vietnam. She has vast experience in the area and dialogue will be maintained with her throughout my stay.
Identify Persons at Risk *This may include more individuals than the fieldwork participants e.g. other employees of partner organisations* *Copy of other Organisation's risk assessment attached?*		- Interpreters that I hire to assist me with case-study visits. I will provide these individuals with a copy of this risk assessment and discuss any potential hazards with them before site-visits commence.
Additional Information *Relevant to the one working activity including existing control measures; information instruction and training received, supervision, security, increased lighting, emergency procedures, access to potable water etc.*		***Marinelife Conservation and Community Development (MCD)*** Suite 3104, Level 31, Building 34T Hoang Dao Thuy Street, Cau Giay District, Hanoi Tel: +84 4 2221 2923 Fax: +84 4 2221 2924 ***CARE International (Vietnam)*** 92 To Ngoc Van Street Tay Ho District Hanoi Tel: +84 4 3716 1930 Fax: +84 4 3716 1935

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Residual Risk *Is the residual risk acceptable with the identified controls?*		Yes	
		No	

Assessment carried out by	Name:	Steven Orchard
	Signature:	
	Date:	15/11/2011
Names of person(s) involved in Fieldwork *N.B: This can take the form of a signed class register when large group work*	Name:	Steven Orchard
	Signature:	
	Date:	15/11/2011
Fieldwork Activity Organiser / Course Leader *e.g. PI, etc*	Name:	Dr Claire Quinn
	Signature:	
	Date:	

Appendix 7 – Respondent information letter

Exploring the adaptive capacity of mangrove social-ecological systems in rural Vietnam

You are being invited to take part in a research project. Before you decide if you want to participate it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this.

Recently there has been a rise in mangrove restoration projects with the aim of increasing the protection of coastal areas to the impacts of natural hazards, events that are projected to increase with climate change. However, the success of such projects is disappointing when compared to the quantity of mangroves that have been planted. The reason for this could be that many projects overlook the social aspects of such actions. Hence, this study aims to investigate the influence of NGOs on social capital, and specifically the role they play in linking local and non-local actors, and the extent to which this can contribute to tackling the impacts of climate change.

Vietnam has been selected for case-study research as it ranks high in those countries most vulnerable to climate change. This issue is particularly important in coastal areas that are highly exposed to the impacts of climate change due to an extensive coastline, a high dependence on climate sensitive agriculture, and relatively low levels of development. Research will be conducted in three villages of Da Loc, Giao Xuan, and Dong Rui communes.

You have been invited to participate in this study because of your involvement in research and practice in the study area, or because you live and work in one of the three study villages.

It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep (and be asked to sign a consent form). You can withdraw from the study at any time. You do not have to give a reason if you decide to withdraw.

If you do decide to take part we will ask you a series of open-ended questions about farming and climate, including adaptation strategies and their limitations, which will take approximately 1-2 hours to complete. If you live and work in the study village you may also be invited to take part in a workshop to be held in the village to map the activities that people undertake to cope with hazards and climate change. This will last no more than 2 to 3 hours. These questions and the workshop will help us understand the role of mangrove systems in your village, the extent that NGOs influence the management and social relations of the village regarding mangrove resources, and the implications of this for adapting to climate change.

Whilst there are no immediate benefits for those people participating in the project and we cannot offer any payment for your participation, it is hoped that this work will inform future mangrove and climate adaptation policies.

All the information that we collect about you during the course of the research will be kept strictly confidential and anonymous. You will not be able to be identified in any reports or publications.

The results will be published initially in a field report which will be made available to participating organisations by the beginning of 2013. The results of the research will be used in academic publications and reports. The data may also be used in subsequent research in anonymised form.

The research is funded by the UK Economic and Social Research Council through the Sustainability Research Institute at the University of Leeds, and is affiliated to the Centre for Climate Change, Economics and Policy.

If you would like further information please contact:
Steve Orchard

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(m)+44 7944 182962
(eeseo@leeds.ac.uk)

Sustainability Research Institute,
School of Earth and Environment,
University of Leeds,
LS2 9JT, UK

Please keep this information sheet and a copy of the accompanying consent form.

Thank you for taking part in this project.

Appendix 8 – Respondent consent form

Exploring the adaptive capacity of mangrove social-ecological systems in rural Vietnam

Name of Researcher: _Steven Orchard_____

Initial the box if you agree with the statement to the left

1 I confirm that I have read and understand the information sheet dated June 2011 explaining the above research project and I have had the opportunity to ask questions about the project. ☐

2 I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without there being any negative consequences. In addition, should I not wish to answer any particular question or questions, I am free to decline. ☐

3 I understand that my responses will be kept strictly confidential. I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the report or reports that result from the research. ☐

4 I agree for the data collected from me to be used in future research ☐

5 I agree to take part in the above research project.

_____	_____	_____
Name of participant (*or legal representative*)	Date	Signature

_____	_____	_____
Name of person taking consent (*if different from lead researcher*)	Date	Signature

To be signed and dated in presence of the participant

Copies:

Once this has been signed by all parties the participant should receive a copy of the signed and dated participant consent form, the letter/pre-written script/information sheet and any other written information provided to the participants. A copy of the signed and dated consent form should be kept with the project's main documents which must be kept in a secure location.