Developing climate change coping capacity into adaptive capacity in Uganda

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The candidate confirms that the work submitted is her own, except where work which has formed part of jointly-authored publications has been included. The contribution of the candidate and the other authors to this work has been explicitly indicated below. The candidate confirms that appropriate credit has been given within the thesis where reference has been made to the work of others.

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The above articles form important elements of this thesis and have been generated as a result of my PhD research. I am lead author on these articles, having designed the methodologies, and collected and analysed the data used. The articles were co-authored with my supervisors whose roles were in the recommendations of revisions and edits to the manuscripts.

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Abstract

Communities across sub-Saharan Africa have been coping with the effects of climate variability for generations. Further, future projections show these areas will be affected by increased climate variability and changes in mean climate. Understanding how current coping strategies used by households in these communities will shape future adaptation choices remains limited. The aim of this thesis is therefore to examine household coping capacity and coping strategies to cope with climate variability and reflect on what this means for future adaptation to longer term climatic change in Uganda. Uganda is an appropriate country in which to examine these issues due to both the occurrence of climatic extremes such as floods and droughts, as well as the high dependence of the population on the natural resource base which is readily affected by these events. This research adopts an institutional perspective to explore issues of vulnerability, resilience and adaptive capacity: examining household level coping and adaptive capacities through to wider institutional analysis at the community, district and national level to provide evidence of the role institutions play in mediating the development of coping to adaptive capacities. Quantitative methods including social network analysis are combined with traditional qualitative methods in a mixed-methods approach to provide empirical evidence and new perspectives in adaptation research.

Results show household coping strategy depends on the customary and market-orientated nature of the village, and on the climatic hazard experienced: households without market access vary coping strategy by hazard whilst households with increased market access rely on economic activities regardless of hazard. Social network analysis identifies that support networks vary under different climatic hazards, and that these support networks do not show as many characteristics of bonding ties as previous literature suggests. The results also show that there are core households within each community that are central to the coping strategies of other's. These core households typically hold formal positions in village institutions, mediating access to both formal and informal support structures. Yet, many households still remain excluded from both formal and informal support, and they remain vulnerable to climate variability and change. This thesis takes a polycentric perspective to explore the institutional enablers and constraints to coping and adaptation

that exist across scales. Formal institutions play an important role in livelihood-specific coping strategies, whilst informal institutions underpin more general coping strategies. Positive and negative interplays between different institutions shape the opportunities for planned and autonomous adaptations. Institutional gulfs are present whereby institutions operate in relative isolation of others, or results in fragmented or sporadic adaptations.

Policy makers must develop policies that support communities to cope with climatic variability whilst targeting future adaptation demands. The evidence presented in this thesis suggests complex institutional structures exist in relation to household coping capacities, and reflecting on these institutional dynamics is necessary to consider the possible implications longer-term future adaptive capacity. Given uncertainty over future livelihood choices under a varied climate, institutions that shape non-livelihood specific coping strategies will become increasingly important to maintain livelihood and coping flexibility, and this must recognise the role of both autonomous and planned adaptation. Although specific to the evidence provided from Uganda, these results have lessons for wider coping and adaptation policy and planning across sub-Saharan Africa.

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List of Acronyms and Abbreviations

AIL	Adaptation, Institutions and Livelihoods
ANOVA	Analysis of Variance
AR4	Fourth Assessment Report
AR5	Fifth Assessment Report
BMU	Beach Management Unit
BTC	Belgium Technical Cooperation
CCU	Climate Change Unit
CFM	Collaborative Forest Management
FGD	Focus Group Discussions
FURA	Foundation for Urban and Rural Advancement
HDI	Human Development Index
IPCC	Intergovernmental Panel on Climate Change
KCCL	Kasese Cobalt Company Ltd.
NAADS	National Agricultural Advisory and Development Service
NAPA	National Adaptation Programmes of Action
NARO	National Agricultural Research Organisation
NGO	Non-governmental Organisation
NRM	National Resistance Movement (Leading Government in Uganda)
P-AIL	Adaptation, Institutions and Livelihoods viewed through a polycentric lens
PAR	Pressure and Release
PCA	Principal Component Analysis
PEAP	Poverty Eradication Action Plan
PES	Payment for ecosystem services

PFCC	Parliamentary Forum on Climate Change
PRSP	Poverty Reduction Strategy Paper
QAP	Quadratic Assignment Procedure (test in UCINET)
QENP	Queen Elizabeth National Park
SACCO	Savings and Credit Co-operative
SLA	Sustainable Livelihoods Approach
SLF	Sustainable Livelihoods Framework
SNA	Social Network Analysis
TAR	Third Assessment Report
UNCST	Uganda National Council for Science and Technology
UNFCCC	United National Framework Convention on Climate Change
UWA	Uganda Wildlife Authority
VSLA	Village Savings and Loans Association

Chapter 1 Introduction

Climate variability and change are predicted to impact on natural-resource dependent communities. Whilst these communities have coped with past climatic variation, both coping and adaptive capacities will be needed to respond to predicted increases in climate variability and longer-term climate change. Examining how these capacities are shaped by different institutions is important in order to understand how they may be constrained, and what factors can facilitate strengthening both capacities.

This chapter outlines the context, aims and objectives and overall approach of this research. Section 1.1 summarises the rationale behind this research including the importance of understanding the role of institutions in developing coping and adaptive capacities, as well as highlighting the key gaps in the literature that this research seeks to address. Section 1.2 then outlines the aims and objectives of this research, followed by a summary of key terms and definitions used in this research (1.3). The methodological approach used in this thesis is then summarised (section 1.4), before the concluding section outlines the overall structure of this thesis (1.5).

1.1 Research rationale

Variability is a natural element of the climate system. However, there is now unequivocal evidence that the climate system is changing at an unprecedented rate (IPCC 2014a). This is having a direct impact on the livelihoods of rural communities worldwide who largely depend on natural-resource systems that are increasingly sensitive to changes in climate. Such communities are at risk from both climate variability and climate change and adaptation is now a necessity (Boko *et al.* 2007; Smit and Wandel 2006; Parry 2009). In East Africa specifically, droughts are predicted to intensify and there is also a projected increase in heavy precipitation events (Niang *et al.* 2014).

Agricultural and fisheries systems are amongst some of the most sensitive livelihood systems to increasing climate variability (Handmer *et al.* 2012). Rural communities that rely on such systems have historically used a variety of coping strategies to respond to

environmental stresses. Several studies have now investigated the various coping strategies that are drawn upon in such communities (Chuku and Okoye 2009; Oyekale and Gedion 2012; Thornton *et al.* 2007; Mortimore and Adams 2001; Thomas and Twyman 2005). Household coping strategies are largely reactive to short-term shocks: households and individuals undertake autonomous strategies with little external input or support from planned adaptations (Berrang-Ford *et al.* 2011). Despite this plethora of research, much less attention has been given to the adaptive capacity required to deal with future climate change (Pahl-Wostl 2009), particularly as many future climatic changes are likely to be beyond the past experiences of rural communities (Parry 2009; Adger *et al.* 2003). A thorough study that investigates how current coping strategies shape future adaptation options can provide important knowledge and understanding to support and strengthen the future adaptation of such communities.

Factors that could enhance the capacity of vulnerable communities to adapt to future climate change have been investigated, such as the availability and access to resources, the governance structures of a system and the risk perceived by the communities (Brown *et al.* 2010b; Yohe and Tol 2002; Engle and Lemos 2010). However, few studies explicitly investigate how this capacity, and the ability to undertake adaptation in the long term, can be built on current coping strategies, which will become increasingly important with predicted changes to climate variability and change (Abel *et al.* 2006). Thus it remains unclear whether rural communities seeking to reduce their vulnerability to current climate variability through coping are fostering their capacity to adapt to future climate change. Adaptation and coping strategies are not always planned: coping is largely an autonomous and 'ad-hoc' activity (Brooks *et al.* 2009). Short-term strategies may unintentionally affect future options (Agrawala and Van Aalst 2008), and thus activities currently being undertaken by these communities may risk contributing towards maladaptation and a reduced capacity to cope in the future.

Considering how adaptation might build on coping is relatively new in climate change research. The majority of studies that have investigated household coping strategies adopt a vulnerability approach (Fussel 2007; Vincent 2004), yet increasingly the resilience approach to adaptation has gained interest (Folke 2006; Nelson *et al.* 2007). However, both approaches have given insufficient attention to the necessity of building adaptation on current coping capacity (WorldBank 2002). There is now wide recognition of the potential to link vulnerability and resilience approaches to help extend our understanding

of what shapes coping and adaptation (Janssen *et al.* 2006a; Nelson *et al.* 2007; Turner II 2010). It is this focus, and specifically the role of institutions in enabling these coping capacities to develop into more adaptive capacities that offers the potential to strengthen future adaptation options.

Coping and adaptive capacities have been conceptually linked within the literature (Béné *et al.* 2014; Brown and Westaway 2011). Relationships between the two capacities exist in relation to the temporal scale each refers to; the scale of change the capacity results in; and the institutional boundaries that the change occurs within (Lemos and Tompkins 2008; Pelling 2011; Yohe and Tol 2002). The need to adapt to change without reducing future adaptive capacity is essential given current and future changes in climate variability and change (Birkmann 2011). As such, the relationship between coping and adaptation merits greater attention in order to better understand the processes and relationships involved in how coping may shape adaptation.

Institutions are recognised to be important for coping: informal social and cultural norms and formal policies and institutions all affect how an individual, a household or a community is able to respond in the short term to climatic and other stressors (Young 2002). For this reason, institutions are also likely to be important for fostering adaptive capacity and strengthening adaptation (Adger 2003; Brooks *et al.* 2005; Leach *et al.* 2010). Coping strategies, as determined by a given level of coping capacity, have important cultural and religious dimensions and implications (Davies and Bennett 2007) but their usability and effectiveness may remain limited because of values, processes and power relations in society (Adger *et al.* 2009). Therefore, both short term coping and longer term adaptation will be needed in response to climatic changes (Lemos and Tompkins 2008) and a variety of institutions will shape them (Eakin and Lemos 2010; Gupta *et al.* 2010). Both social networks and institutions have been highlighted as possible factors that support adaptation, particularly in rural farming livelihoods in Africa (Osbahr *et al.* 2010). Social networks are themselves shaped by different institutions, and contribute towards a given level of social capital (Marshall *et al.* 2009). Different processes lead these factors to enable or constrain adaptation: social capital and collective action are important components of social networks and multi-scale institutions inevitably shape these networks (Fazey *et al.* 2010; Vasquez-Leon 2009). Therefore, in-depth empirical research is needed to explore the different ways such processes (institutions and networks) manifest in different situations.

The need to acknowledge institutions in adaptation is widely accepted. Jones *et al.* (2010) highlight assets, knowledge and information, innovation, and flexible and forward thinking decision making processes alongside institutions as being important in coping and adapting. Yet institutions affect each of these drivers. The role of institutions in shaping the capacities of rural households to respond to climate variability and change is gaining attention in adaptation research (Washington-Ottombre *et al.* 2010; Brown *et al.* 2010a; Upton 2012). However, these studies tend to remain focused on formal institutions. There has been an insufficient exploration of how institutions shape both coping and adaptive capacities, especially regarding informal institutions such as social norms and cultural traditions. This thesis aims to increase our understanding of this relationship, with particular reference to the institutional environment in Uganda. This thesis therefore contributes to current debates on adaptation and the role of institutions by providing further insight into determinants of household coping capacities and the different contexts that shape community support networks, and unpacking the different institutions and institutional interactions that form different coping capacities, and therefore shape different adaptive capacities.

1.2 Aims and objectives

The aim of this research is to understand the institutional dynamics that shape household coping strategies (to current climate variability), and to reflect on the possible implications this may have for adaptation. To achieve this, this thesis has the following four objectives:

1) To identify household coping strategies to climatic hazards such as floods and droughts in two communities in Uganda. *This objective provides evidence and information on household coping strategies from which the following objectives are able to draw upon. This is necessary to provide a context and evidence base on which the thesis can build from*.

2) To examine the network structures that exist in the two communities during floods and droughts. *This objective enables a network analysis at the village level to be undertaken and differing levels and arrangements of social capital to be examined and therefore provides complementary evidence for the later institutional analysis*.

3) To investigate the formal and informal institutions that affect household coping strategies, and the interplay between them. *This objective draws on the evidence obtained through objective 1 and 2, to examine the relationships across the institutional environment in relation to the household coping strategies in the two communities*; and

4) Using evidence from the previous objects, reflect on what the institutional dynamics of coping means for adaptation and adaptive capacity. *This objective brings together evidence from the previous objectives in order to identify the possible implications this work has for understanding adaptation and adaptive capacity.*

1.3 Definitions of key terms and concepts used

This thesis uses a number of terms that are widely contested within the literature. The definitions that are used in this study are presented below. Whilst chapter 2 provides the rationale behind the selection of these definitions and explores in more detail the different perspectives and framings that exist, the definitions are stated here to provide a reference point which can be referred back to throughout the thesis. Several of these definitions are taken from the Intergovernmental Panel on Climate Change Fifth Assessment Report (IPCC 2014a). Whilst these vary significantly from those definitions presented in earlier IPCC reports, they acknowledge advances in scientific understanding.

Adaptive capacity: the ability (of systems, institutions, or actors) to adjust to potential damage, take advantage of opportunities, or respond to consequences (IPCC 2014a; Engle 2011).

Climatic extreme: the occurrence of a climatic (or weather) event beyond the range of observed values. For simplicity, 'extreme weather events' and 'extreme climatic events' are referred to collectively as 'climatic extremes' (in line with IPCC 2012). Climate extremes often result in **climatic hazards** such as floods and droughts.

Coping capacity: the ability to draw on available skills, values, beliefs and resources to address, manage and overcome adverse conditions, in the short to medium term (ISDR 2009; IPCC 2014a).

Institutions: the formal and informal rules that shape how individual actors and organisations relate to and behave both together and independently (North 1990).

Resilience: the capacity of a social-ecological system to cope with a disturbance, responding or reorganising in ways that maintain its essential function, identity, and structure (IPCC 2014a)[1].

Vulnerability: the susceptibility of a system to be adversely affected (IPCC 2014a).

1.4 Methodological approach

This research is empirically grounded in Uganda, where a large proportion of the rural population are vulnerable to climatic hazards (Barihaihi 2010). This vulnerability is further increased due to Uganda's historical development: economic collapse, political instability and broad economic reforms have shaped current poverty levels in the country (Ssewanyana *et al.* 2011). Climate change is now recognised as a significant threat to Uganda's development. Despite the Government's efforts to address this issue, there are serious concerns about how well efforts are being enforced (Hepworth and Goulden 2008). The broad context of Uganda is considered within this research, but specific focus is given to two communities in the west of Uganda, Kigando and Kahendero, both in Kasese District. These case-studies are introduced in more detail in Chapter 3 .

This thesis provides original case-study evidence on the role of institutions in shaping coping and adaptation. This research adopts a multi-method, multi-level case-study approach: different analytical approaches are combined in order to unpack the complexity in understanding the role of institutions in shaping coping and adaptive capacities. The research combines a local perspective gained from drawing upon the sustainable livelihoods approach, with network analysis and institutional analysis to understand how institutions across scales mediate household coping and adaptive capacities.

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[1] The IPCC Fifth Assessment Report extends the definition to include "…whilst maintaining the capacity for adaptation, learning and transformation" as defined by the Arctic Council (2013). This does not see resilience as transformation (as discussed in Chapter 2), but recognises that resilience does not reduce transformative capacity. The definition has been shortened for use in this thesis to provide clarity between resilience and transformation.

Quantitative methods are used to analyse household demographics and local social networks, with coping strategies and institutions analysed through more qualitative approaches. Two methodological contributions result from this approach. Firstly, social network analysis methodologies are applied to climate adaptation studies, a method which has largely remained in the wider sphere of natural resource management. Social network analysis is used to examine the informal support networks in the communities which is a relatively new technique within adaptation studies. A further contribution is made by extending Agrawal (2008) 'Adaptation, Institutions and Livelihoods' (AIL) framework which has been used to understand the role of institutions in adaptation and rural livelihoods. In this research, a polycentric lens is applied to the framework in order to explicitly address the need to consider informal institutions at the local level, and to clearly consider the institutional interplay and institutional gulfs that exist. The developed framework (P-AIL) provides an overarching approach to understand the role of institutions in shaping household coping and adaptive capacities.

1.5 Thesis structure and approach

This thesis is organised into eight chapters including this introductory chapter. Chapter 2 reviews past and current literature of relevance to this research. The review discusses the strengths and weaknesses of vulnerability and resilience approaches to understanding climate adaptation, and specifically how these perspectives shape our understanding of coping and adaptive capacity. An integrated vulnerability-resilience perspective is discussed, and in particular how this is best placed to explore how institutions shape both coping and adaptive capacities. However, there remains a challenge in operationalising the concepts of coping and adaptive capacities, and specifically how to investigate the role of institutions. The review thus argues that drawing upon existing frameworks, such as the Sustainable Livelihoods Framework helps to address this analytical challenge. The chapter critically discusses the current understanding of the role of institutions in adaptation and how livelihoods research can support operationalising coping, adaptation, and institutions, thus establishing the contribution this thesis makes to the academic literature.

Following the literature review, Chapter 3 describes the overall research approach used in this research. The chapter discusses the mixed-methods case-study approach which forms the overall methodological framework used in the thesis: a local-level focus which extends

to other levels prioritises the much needed focus on the local level to unpack the institutional environment. The chapter describes the justification for, and selection of, the two case-studies used in this study and specifically why the research was situated in Uganda. Interviews and surveys form the main data collection techniques, drawing on evidence from participants at multiple levels. Finally the mixed-method analysis is introduced: both quantitative and qualitative methods were used to identify, unpack and explain how institutions influence coping and adapting. Social networks provide complementary evidence for the institutional analysis. Using this combination of methods helps overcome the challenges of examining institutions (as outlined in Chapter 2).

Chapters 4, 5, and 6 present the main results of this research and are largely structured to follow the first three research objectives (1.2). Chapter 4 investigates what drives household coping strategies during two different climatic hazards (floods and droughts) in the two communities. The chapter also presents some preliminary analysis of livelihood strategies, and specifically how these livelihood strategies and household characteristics shape the coping strategies used. Coping strategy is observed to vary based on a combination of household characteristics and village characteristics. This analysis contributes towards broader debates on livelihood diversification as a coping and adaptation strategy, and supports arguments that diversification is only suitable in certain contexts.

Chapter 5 examines the social networks that exist in the two villages during floods and droughts, and how these compare to times of non-climatic stress. This chapter uses social network analysis (SNA) to analyse these network structures, and qualitative interview data to support the interpretation of these networks. The networks identified to exist during times of flood and drought are found to depend less on bonding relationships than the literature has previously suggested, and the chapter explores reasons behind this. Households that hold important positions within the network are also identified and their role within formal and informal support mechanisms are discussed. This analysis provides new insights into the support structures that communities draw upon during climatic hazards, which is important to recognise in policy strategies for local adaptation planning.

Finally, Chapter 6 explicitly investigates how institutions enable and constrain the coping strategies identified in Chapter 4 . Alongside formal institutions, this chapter also considers the informal institutions (such as the support networks identified in Chapter 5) and draws

on evidence from the local through to the national level. This chapter presents a framework – P-AIL – from which it is argued that a polycentric perspective is important to explicitly acknowledge the variety of local informal institutional drivers of coping and adaptation. The chapter also examines the different interplays that exist between different institutions, and the implications this has on shaping household capacities. This contributes towards the evidence base of how institutions interact with each other, specifically recognising the multi-level, multi-scale, multi-actor nature of adaptation.

Chapter 7 synthesises the empirical evidence presented in Chapters 4, 5, and 6 before addressing the fourth research objective, to assess what is needed to enable household coping capacity to contribute towards building adaptive capacity. This chapter proposes that whilst coping and adaptive capacities are useful theoretical concepts, the evidence gained in this thesis suggests an alternative framing around autonomous and planned adaptation is more useful to operationalise how coping can develop into adaptive capacity. If the dichotomy between planned and autonomous adaptation is to be useful in coping and adaptation debates, understanding the role institutions play within both planned and autonomous adaptation is important, and this is discussed. The chapter concludes by summarising the theoretical and social-political implications that arise from the research. Whilst the thesis provides novel empirical evidence from a Ugandan context, the analysis feeds into broader debates on adaptation and development in similar social-ecological systems.

Finally, Chapter 8 concludes the thesis by providing a summary of the theoretical, methodological and empirical contributions of this research. It also discusses the main limitations that must be considered when drawing upon the research presented, and outlines future research pathways that stem from this investigation of institutions within coping and adaptation.

Chapter 2 Coping capacity and adaptive capacity: the role of institutions in shaping current and future capacities[2]

2.1 Introduction

Vulnerability and resilience are recognised as two distinct approaches within the climate adaptation literature, yet both recognise the different capacities needed to address climate variability and change, namely coping and adaptation. This chapter reviews the past and current literature that has explored coping and adaptation in rural communities. Section 2.2 unpacks the use of vulnerability, resilience, coping capacity and adaptive capacity within this literature. This chapter suggests that a linked vulnerability-resilience approach can help to increase our understanding of the relationship between coping and adaptive capacity by drawing on the strengths of both approaches. The integrated vulnerability-resilience framing enables the role of institutions in shaping adaptive capacity to be explored by drawing on the actor-centred focus of vulnerability whilst recognising wider-system dynamics brought about through resilience perspectives. How institutions are understood to link the gaps between vulnerability and resilience and in the development of adaptation from coping are discussed in section 2.3. Existing frameworks, such as the Sustainable Livelihoods Framework (SLF), can be used as an approach to address the conceptual challenge that exists in investigating how institutions shape these capacities. The SLF is introduced in section 2.4 and our current understanding of how livelihoods research can support operationalising coping, adaptation, and institutions is discussed. Finally, section 2.5 summarises the chapter by highlighting the key gaps that have been identified throughout the review. Whilst this chapter provides a general review of current understanding in relation to the overarching thesis aim, specific literature reviews relevant to objectives 1, 2, and 3 (section 1.2) are found in chapters 4, 5 and 6.

[2] This chapter is developed from the publication "Berman, R.J., Quinn, C.H., and Paavola, J. (2012) The role of institutions in the transformation of coping capacity to sustainable adaptive capacity, *Environmental Development*, 2, 86-100

2.2 Climate change adaptation approaches: unpacking vulnerability, resilience, coping capacity and adaptive capacity

Climate variability and climate change are recognised as distinct phenomena. They have been distinguished based on their temporal aspects, the causes of change, and whether they are naturally or anthropogenically driven (Watson *et al.* 2001; Folland *et al.* 2001). There is therefore a need to cope with climatic variability in the short term and the resulting climatic extremes that are associated with this, whilst enabling adaptation to longer term changes in mean climate.

Both climatic variability and climate change have impacted social-ecological systems[3] through environmental changes that have both direct and indirect impacts on the system, and such impacts are predicted to continue into the future (Field *et al.* 2014). Rural communities who rely heavily on natural resources, such as those in Uganda and across sub-Saharan Africa, are sensitive to these impacts due to their high dependence on natural resources and their (generally) low levels of adaptive capacity (Olsson *et al.* 2014; Adger *et al.* 2003). The need for these communities to simultaneously cope with and adapt to climatic variability and change is now widely recognised, and both vulnerability and resilience studies have considered how the capacity of rural communities can be strengthened. Largely this research has focused on coping capacities, with less attention given to adaptive capacities. A focus on adaptive capacities is gaining ground (see for example Brooks *et al.* 2005; Kuriakose *et al.* 2009; Upton 2012; Ford and Goldhar 2012; Morand *et al.* 2012), yet there remain key gaps in our understanding. For example, it is not clear whether strengthening adaptive capacities will impact on abilities to cope, nor the extent to which institutions enable or constrain these capacities. This review now explores how climate change adaptation research has been approached, particularly through the lenses of vulnerability and resilience.

[3] Social-ecological system refers to the integrated concept of humans-in-nature, and is a term used to stress the relationship between social systems (governance, resources, world-views etc) and ecological systems (ecosystems) (Berkes and Folke 1998)

2.2.1 Vulnerability perspectives on climate change

Within climate change research, vulnerability is rooted in the hazards literature. This body of literature is focused directly on the risk from hazards (Lewis 1999), assuming that the magnitude of a disaster is determined by the biophysical conditions of the hazard (Liverman 1990). Blaikie *et al.* (1994) 'Pressure and Release' (PAR) model was a significant departure: they suggested the risk of a disaster could be reduced by addressing the political and economic systems that shape a society or community (Blaikie *et al.* 1994), and built on previous work which had highlighted how socio-political constraints controlled the ability of systems to respond to biophysical changes (Blaikie and Brookfield 1987). Climate change vulnerability studies were thus increasingly influenced by political ecology perspectives. Studies that followed explored the role of a variety of social factors in determining vulnerability (Adger 2003; Adger 2006; Brooks *et al.* 2005; Kelly and Adger 1999; Pelling 2003), thereby establishing the connection between vulnerability and wider social determinants. In attempts to synthesise this proliferating body of literature, McLaughlin and Dietz (2008) identify five distinct theoretical perspectives to climate change vulnerability research: biophysical, human ecological, political economy, constructivist and political ecology. Each perspective highlights different factors as being important in determining system vulnerability, such as ecosystem sensitivities, the way climate change manifests in a particular context, and the institutional and political arrangements within a system.

Considering these different perspectives, vulnerability has been conceptualised as "a function of the character, magnitude and rate of climate change variation to which a system is exposed, its sensitivity and its adaptive capacity" (IPCC 2007: 883). The different theoretical perspectives of vulnerability have explored different elements of this conceptualisation. Essentially, vulnerability is understood to be socially constructed: agency, culture, power and inequality shape the relationships between exposure, sensitivity and adaptive capacity even though each of these may not be socially constructed directly (McLaughlin and Dietz 2008). This is now implicitly recognised in the literature, and has led the IPCC most recently to conceptualise vulnerability simply as "the susceptibility of a system to be adversely affected" (IPCC 2014a). This thesis adopts this most recent definition of vulnerability, with the assumption that this is considered at multiple levels and multiple scales.

Vulnerability to a specific shock will vary in different situations. Through analysing how different social, ecological, economic and political factors have shaped the vulnerability of particular groups of people in past situations, it is possible to build our understanding of how people have coped with past changes. Past coping strategies to a particular hazard vary not only by place and social group, but also temporally (Chambers 1989). In fact, historical vulnerability studies are needed in order to fully understand the interaction between nature and society, and thus fully recognise the construction of vulnerability (Hilhorst and Bankoff 2004; Garcia-Acosta 2002). In urban flooding, for example, it has been shown that past land-use changes and policy responses greatly influence a particular level of vulnerability to future hazards (Bankoff 2003). By analysing the complex processes that have led to previous levels of vulnerability, it is possible to begin to understand and prepare for what may be experienced in the future. This thesis takes such an approach by exploring the strategies households have used in response to past floods and droughts.

Vulnerability approaches often focus on the assets and resources needed to reduce the impact of a stressor (Birkmann *et al.* 2009), and the different entitlements peoples have to access these resources (Sen 1981). In climate change adaptation research this is associated with a focus on livelihoods in order to investigate how rural communities respond to a shock. Assets can be human, natural, financial, physical and social, and a mix of assets will be used in daily activities and in times of stress (these are discussed in more detail in section 2.4). For example, in rural communities of sub-Saharan Africa, livelihood activities can depend on natural capital, such as land, which in turn affects crop yield and therefore the financial capital of a household (Reale and Handmer 2011; Scoones 1998). The rights customary and formal law associate with such resources determine the success and reliability of different livelihood activities (Reale and Handmer 2011). This is further explored in Chapter 4.

Actively supporting and promoting livelihoods could help reduce longer-term vulnerability, thereby contributing towards reducing the risk of unsustainable development. Essentially, adaptation seeks to reduce vulnerability (Pelling 2011). Vulnerability is therefore seen as a negative system component that should reduce as adaptive capacity increases. This demands that wider scale institutional and socio-economic factors are considered in order to understand how adaptive capacity can be built up. Whilst vulnerability is a useful perspective to identify those that are more susceptible to adverse changes, it has its limitations. Vulnerability is often identified as a static concept with limited focus given to

the temporal and changing dynamics a system might experience, as well as the how cross-scalar relationships can impact the system (Füssel and Klein 2006). Thus, vulnerability's actor-orientated approach gives limited consideration of wider systemic issues (Nelson *et al.* 2007). Vulnerability has been considered as the 'flip-side' to resilience, however the two approaches can jointly provide a more thorough understanding of social-ecological system changes (Miller *et al.* 2010). This review now discusses the extent to which the resilience approach contributes towards climate change adaptation debates (Engle 2011; Nelson *et al.* 2007).

2.2.2 Resilience perspectives of climate change

'Resilience' as a concept has been used to investigate environmental change within social-ecological systems (Adger *et al.* 2002; Gunderson and Holling 2002). The concept originated in ecological literature when Holling defined it as "the persistence of relationships within a system and a measure of the ability of these systems to absorb changes of state variables, driving variables and parameters, and still persist" (Holling 1973, p18). This has more commonly been referred to as engineering resilience, or in short, the ability to return to a steady state equilibrium (Pimm 1984). Whereas Holling's definition focused on the notion of equilibrium, resilience has since been understood as the extent to which a system can maintain its structure and function, self-organise and build and increase learning, adapting and transforming capacities (Berkes *et al.* 2003; Folke 2006). Therefore resilience as an approach gives attention to different systems and system components, and how they relate to each other (Berkes *et al.* 2003).

The resilience approach can be used to study complex adaptive cycles by recognising how different elements of a system are linked together at various temporal and spatial scales: changes in one system affect not only that system but also systems at other scales. This relationship, conceptualised and known as 'Panarchy' (Gunderson and Holling 2002) (Figure 2.1), is important when several adapting systems are linked through different scales, as is the case with complex social-ecological systems. Therefore panarchy helps explore and understand how adaptive systems are not static: they are complex systems that change and reorganise in response to shock (Fraser 2003). Therefore the resilience of such systems is determined at several different scales.

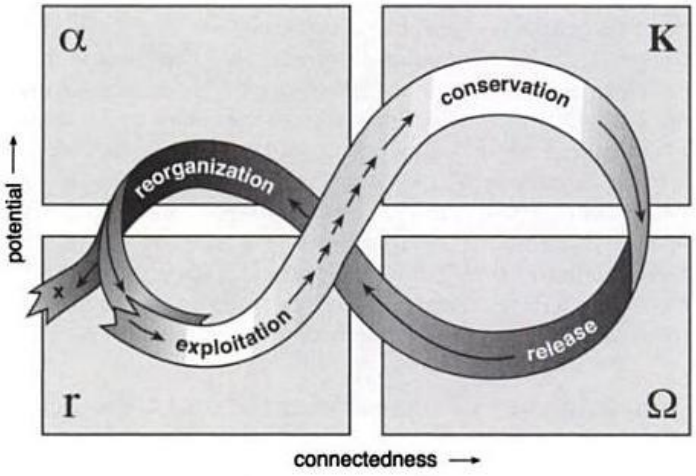

Figure 2.1. Panarchy framework: evolving hierarchical systems with multiple interrelated elements are interlinked in continual adaptive cycles of growth, accumulation, restructuring, and renewal (Gunderson and Holling 2002).

As Brown (2014) acknowledges, there has been a marked increase in the use of 'resilience' as a term within global environmental change literature. Several studies highlight the broad coverage of resilience within the literature including, but not limited to, the fields of social-ecological systems, disaster risk reduction, climate change and human development (Bahadur *et al.* 2011; Martin-Breen and Anderies 2011; Brown 2014). The concept has grown not only within academia, but also amongst practitioners and policy domains due to its broad definition and use which, as Béné *et al.* (2014) argues, brings different disciplines and communities of practice together. However, even within disciplines the term is contested, and different understandings of resilience prevail in the climate change literature (Engle 2011).

Traditionally resilience is viewed as a form of buffering in order to maintain a basic structure (IPCC 2007) whilst other studies consider it a process of transformation (Cutter *et al.* 2008). Although largely conceptualised around maintaining an equilibrium and recovery or persistence of a system, resilience is continually being redefined. Resilience is now argued to recognise deep systemic changes that may lead to system transformation (Béné *et al.* 2014). Pelling (2011) supports this 'transformation' view, arguing that conceptualising resilience as buffering, or equilibrium, leads to reinforcing existing practices. This in turn prevents the questioning of underlying assumptions and power relations.

This dispute about the relationship between resilience and transformation remains (O'Brien 2011; Pelling 2011) and increasingly the two are seen as distinct processes or states (Wilson *et al.* 2013). Within this debate, three capacities can be identified that lead to different outcomes: absorptive coping capacity leading to persistence, adaptive capacity leading to incremental adjustment, or transformative capacity that leads to transformational responses (Béné *et al.* 2014). Capacity, whether it is coping, adaptive or transformative capacity, remains a key overarching concept within the resilience literature (Brown and Westaway 2011). Coping and adaptive capacities are recognised as those drawn upon within existing system structures which enable adaptation, whereas transformative capacity recognises the need to move to a different system state, and go beyond adaptation.

In light of these discussions, this thesis views resilience as the capacity of a social-ecological system to cope with a disturbance, responding or reorganising in ways that maintain its essential function, identity, and structure. This is largely in line with the IPCC (2014a) definition but excludes reference to maintaining capacity for adaptation, learning and transformation, given the conceptual differences identified in the literature between resilience and transformation. Whilst there is a recognised need to understand what might contribute to transformation and transformational capacity (Marshall *et al.* 2012; Wilson *et al.* 2013), there is still a need to understand the factors that enable coping capacity to support the development of adaptive capacity. It is insufficient to focus on any one dimension of resilience (i.e. only coping) given the interdependencies between coping, adaptation and transformation (Béné *et al.* 2014). Therefore this thesis explicitly focuses on coping and adaptive capacities to unpack the complexity involving their relationship, before attempts can be made to understand the relationship between all three capacities.

2.2.2.1 The relationship between vulnerability and resilience

Several scholars recognise the potential that can be gained from linking vulnerability and resilience approaches (Janssen *et al.* 2006a; Nelson *et al.* 2007; Turner II 2010). Vulnerability approaches recognise the roles of actors and socio-political structures in determining the level of vulnerability of a nation (Brooks *et al.* 2005), within a sector (Smit *et al.* 1996) or in communities (Eriksen and Silva 2009). There is a distinct acknowledgement of agency or rather the factors that shape an individual's or household's

ability to respond to stress. Meanwhile, resilience approaches highlight the connections and interactions within and between social-ecological systems (Duit *et al.* 2010; Ostrom 2007). Miller *et al.* (2010) argue that joint resilience and vulnerability approaches have both theoretical and methodological advantages. Theoretically, integrating the two provides opportunities to draw upon the strengths of both systems thinking and actor-orientated approaches, with both focusing on the interaction of slow and rapid changes. Such integration moves us towards the methodological development of approaches that capture the diversity and variation in system dynamics (Miller *et al.* 2010).

Furthermore, commonplace between these approaches is that both identify adaptive capacity, institutions and governance as critical components of the ability to respond to an event (Engle 2011; Cutter *et al.* 2008). Moreover, Engle (2011) recently linked vulnerability and resilience through the concept of adaptive capacity. He argues that adaptive capacity is fundamentally shaped by individuals (actor-orientated vulnerability approach), but also as a feature of the wider system (resilience approach). Therefore, vulnerability and resilience are not only linked through adaptive capacity, but can also be linked through coping capacity. Coping strategies used to cope with current climate variability risk lock-ins to particular pathways (Schoon *et al.* 2011), thereby influencing present and future opportunities to build adaptive capacity (see Figure 2.2).

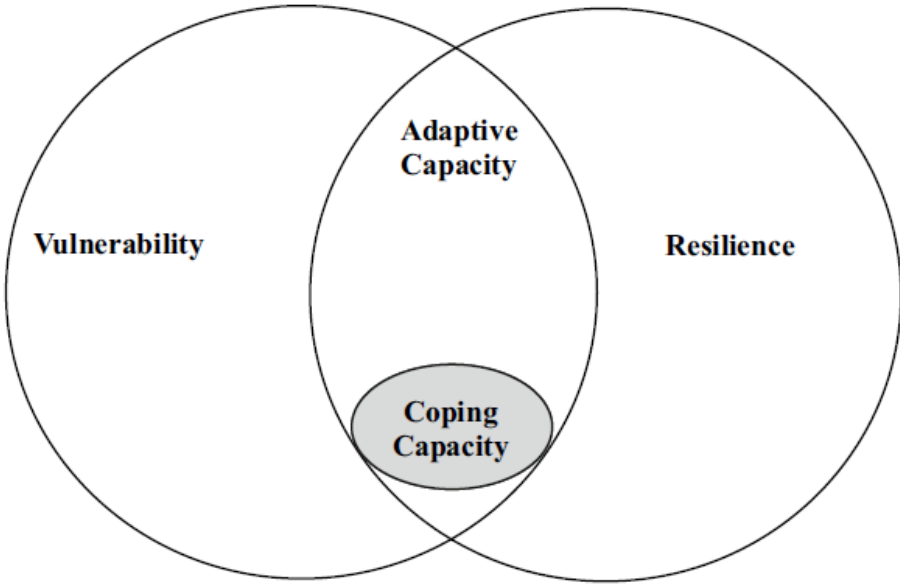

Figure 2.2. Integrated vulnerability and resilience framework linked through coping and adaptive capacity, whereby both vulnerability and resilience approaches recognise adaptive capacity. Together the approaches recognise that actions taken now, given available constraints, will shape future adaptive capacity. Developed following the work of Cutter et al (2008) and Engle (2011).

A linked vulnerability-resilience perspective contributes to helping increase our understanding of the relationship between coping and adaptive capacity. The resilience approach acknowledges how human systems are adapting to climate change in the long term (Folke 2006). How climatic hazards impact coupled social-ecological systems is increasingly understood, yet understanding the impact of (changing) governance structures and policies from a resilience perspective is more ambiguous (Duit *et al.* 2010). Key institutions, decision-making processes and their interactions across socio-ecological systems need to be understood to know how a system is vulnerable (Fraser 2007; Smit and Pilifosova 2001). Any change to the coping capacity and adaptive capacity of a system, and of individuals within that system leaves the wider resilience of the system subject to change (i.e. the remainder of the resilience sphere in Figure 2.2) (Berkes *et al.* 2003). Alongside this, the vulnerability approach focuses on the actor dynamics within the system that are important in understanding how institutions shape coping and adaptive capacity of households. This review now moves to consider how the conceptualisation of coping and adaptive capacities has evolved within the literature, and specifically how an institutional perspective helps to further understand the dynamics between coping and adapting.

2.2.3 Differentiating coping and adaptive capacity

Within the literature on climate change, both coping and adaptive capacities have been conceptualised within vulnerability and resilience approaches. Several conceptualisations exist resulting from the different fields that have adopted coping and adapting terminologies. Climatic hazards such as floods and droughts have traditionally been addressed through disaster risk management and coping, whereas adjusting to climatic changes, such as increased mean temperatures, has been the domain of adaptation (Agrawal 2008; Cutter *et al.* 2008). The increasing need to differentiate between the two concepts results from the mainstreaming of climate change adaptation into disaster risk reduction efforts and vice versa (Pelling 2011; Schipper 2009). This is not to separate one dimension from another (as argued in the previous section), but to ensure consistency in the use of terms between disciplines. This reduces the risk of misinterpretation arising through increased interdisciplinary work. While there is a broad agreement that both coping and adaptation can help to avoid adverse impacts, agreement has yet to be reached on how they should be defined (see Table 2.1) (Thomalla *et al.* 2006).

Although there are several conceptualisations of the relationship between resilience and adaptive capacity (for example Cutter *et al.* 2008), there is now broad agreement that they are closely related (Brown and Westaway 2011; Maclean *et al.* 2014). The resilience approach helps us understand the relationship between coping and adaptive capacity: measures and actions undertaken now will determine whether a social-ecological system has the ability to reorganise or whether it will collapse in the future (Abel *et al.* 2006). The ability to adapt to permanent change without reducing future adaptive capacity is, as Birkmann (2011) argues, essential in the face of current climate variability and future climate change.

Table 2.1. Development of coping capacity and adaptive capacity definitions within the broad climate change literature.

Reference	Coping capacity or coping strategies	Adaptive capacity or adaptation
Davies (1993)	Short-term response to an immediate and inhabitual decline in access to food.	Permanent change in the ways in which food is acquired
Kelly and Adger (2000)	Ability to respond to an occurrence of harm and to avoid its potential impacts.	Ability to transform structure, functioning or organisation to survive under hazards' threatening existence
Yohe and Tol (2002)	Range of actions available to respond to the perceived climate change risks in a given policy context.	Ability to change the set of available inputs that determine the level of coping capacity.
Eriksen *et al.* (2005b)	The responses that people employ to maintain wellbeing in the face of environmental stress within the existing structures	Changing the framework within which coping takes place.
Fabricius *et al.* (2007)	Short-term, immediate strategies that aim for survival. Often reactive and opportunistic with limited opportunity to learn through individual experiences and innovation.	Long-term strategies that evolve over generations, with the aim of both survival and sustainable management of SES. Often proactive and planned with extensive opportunity for learning though knowledge exchange, intergenerational transfer and institutional development.
Lemos and Tompkins (2008)	Design and implementation of risk management institutions – such as disaster preparedness plans – that can mitigate the most immediate climate impacts.	Socioeconomic and political reforms that addresses the inequalities at the root of differential vulnerabilities
Birkmann *et al.* (2009)	Immediate responses to hazards such as a specific flood event.	Medium- and long term strategies for changes in institutional frameworks
Pelling (2011)	The strategies used by those living with rapid onset disasters such as flash floods, and chronic disasters, including drought and food insecurity.	Change in those practices and underlying institutions that generate the root and proximate causes of risk, frame capacity to cope and further rounds of adaptation to climate change.

Reference	Coping capacity or coping strategies	Adaptive capacity or adaptation
IPCC (2014a)	The ability of people, institutions, organizations, and systems, using available skills, values, beliefs, resources, and opportunities, to address, manage, and overcome adverse conditions in the short to medium term.	Adaptation: adjustment in response to actual or expected climatic stimuli or their effects (with incremental and transformative adaptation differentiated). Adaptive capacity: the ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences. (This has changed from the definition in AR4 which concluded with…*or to cope with the consequences*).

Scholars working on food security, such as Davies (1993), distinguish between coping in the short-term and adaptation in the longer-term. Others consider coping as those responses an individual can take given existing structural constraints, while adaption requires changes to the structure, functioning and organisation of the system in question (Eriksen *et al.* 2005b; Kelly and Adger 2000). Whilst widely adopted in the literature to help measure coping capacity (see for example Vogel 1998; Brooks *et al.* 2005; Lemos and Tompkins 2008), this differentiation leaves it unclear as to how to identify and measure adaptive capacity as most studies have favoured focusing on coping.

Coping and adapting have more recently been differentiated based on institutional factors. Lemos and Tompkins (2008) and Pelling (2011) consider coping as the reduction of the worst effects of acute and chronic disasters, and adaptive capacity as shaped by institutions and the underlying causes of vulnerability. For Birkmann *et al.* (2009), coping includes strategies and actions undertaken within existing institutional settings, whereas adaptive capacity is associated with strategic actions that may require institutional change.

Different again is Yohe and Tol (2002) 'weakest link' theory; the weakest component of a system limits the level of coping capacity regardless of the strongest level of adaptive capacity. A focus on coping is shared with the IPCC definition of adaptive capacity as given

in the Fourth Assessment Report (AR4) (IPCC 2007) as enabling a system to 'cope'. In AR4, the IPCC did not define 'coping capacity' or 'coping' – no change had been made since the Third Assessment Report which referred to and defined a 'coping range'. Only in the Fifth Assessment Report (AR5) has the IPCC recognised the push from the academic community to explicitly separate coping and adapting (see Table 2.1). Indeed the definition of adaptive capacity in AR5 is the ability *to respond* rather than *to cope* with consequences, as was defined in AR4. This not only reflects the growing recognition of differences between the two capacities, but that adaptive capacity can be incremental adjustment, rather than just the persistence of a system state (Béné *et al.* 2014; Pelling 2011).

Reviewing this literature on vulnerability and resilience perspectives to climate change shows the importance of recognising both the institutional and temporal difference between coping and adapting. This thesis therefore defines coping as an immediate response to climate variability, and adaptation as preparation for expected future climate change. Coping capacity is the ability of actors to draw on available skills, resources and experiences as an immediate response to adverse stress or shocks brought about by climate variability (ISDR 2009). Adaptive capacity in turn is the ability to prepare in advance for stresses and changes and to adjust, respond and adapt to the effects caused by the stress associated with future climate change (including the impact on climate variability) (Engle 2011; Smit and Pilifosova 2001). Through this conceptualisation of coping and adaptive capacity, this research seeks to unpack how institutions mediate households' capacity to react to immediate shocks and prepare for future stress.

Although coping and adaptive capacities differ, the literature suggests that the two are connected (Figure 2.2). Yet the processes that connect the two, thus enabling coping capacity to support adaptive capacity, are still unknown. Fabricius *et al.* (2007) have suggested that three different types of communities can be identified based on their capacity to adapt: *powerless spectators*, *coping actors* and *adaptive managers* (Figure 2.3). Essentially, *powerless spectators* are incapable of responding to external threats, or if they can, they can only respond with great difficulty; *coping actors* deal with adversity through reactive coping strategies but have not evolved long-term adaptive strategies; and *adaptive co-managers* constantly invest in their own, and the ecosystem's capacity in order to deal with change (Fabricius *et al.* 2007). *Coping actors* are therefore connected to *adaptive managers* (Figure 2.3), and whilst they can be perceived to have the same level of adaptive capacity (as seen by their position on the y-axis in Figure 2.3), the ability of

adaptive managers to draw upon this adaptive capacity is shaped by the level of governance capacity, or rather the institutional environment they are situated within (as shown by the position on the x-axis of Figure 2.3).

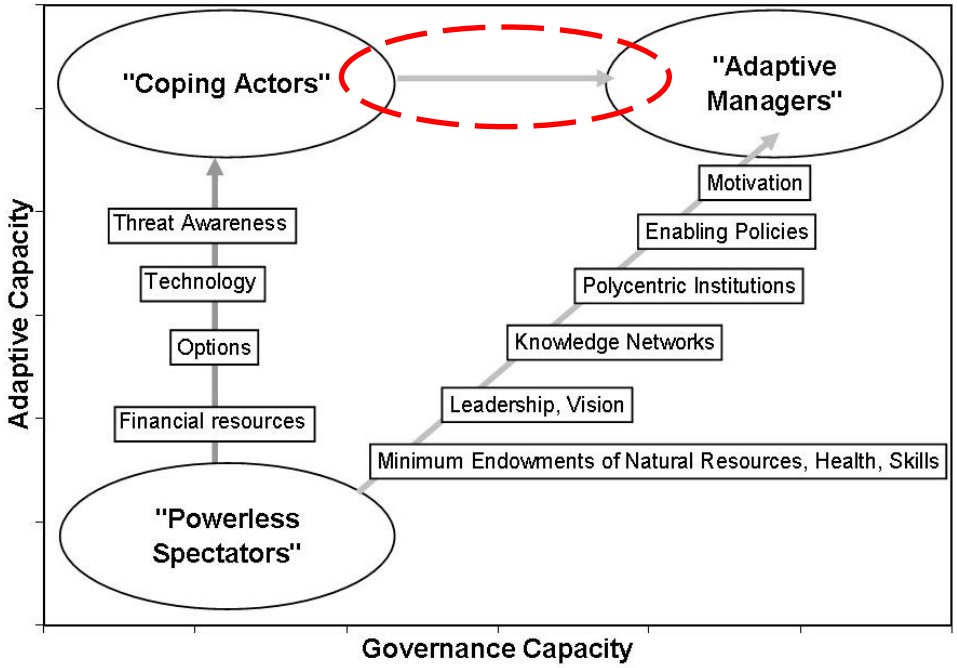

Figure 2.3. Three types of adaptive communities along gradients of adaptive capacity and governance capacity (Fabricius *et al.* 2007). The highlighted arrow represents the under-investigated relationship between coping and adaptation.

Evident from conceptualisation in Figure 2.3, there is no specific focus on how to move from *coping actors* to *adaptive managers* (the highlighted arrow in Figure 2.3). This will likely involve elements of the process that leads from *powerless spectators* to *adaptive managers*. However, the exact aspects involved and how they are combined remains uncertain. By examining coping and adaptive capacities as defined in this chapter, this thesis is able to explore how rural communities can simultaneously cope and adapt to climatic variability and change, and specifically examine the role institutions have moving from *coping actors* to *adaptive managers*. Different resources, be these assets, information or skills are important for coping and adaptation, and the transition between the two, and institutions are important in mediating access to these resources (Smit and Pilifosova 2001; Prowse and Scott 2008; Fabricius *et al.* 2007).

2.3 Institutions

This section reviews institutions in the natural resource management and environmental governance literature more broadly, before specifically focusing on how institutions support an integrated vulnerability-resilience approach in understanding coping and adaptive capacities.

According to Scott (2001), rules, norms and cultural beliefs are the central components of institutions: by defining legal, moral and cultural boundaries, Scott argues that institutions both support and empower activities and actors, yet can also prohibit and constrain them. Scott identifies three central building blocks of institutional structures: regulation, normative systems and cultural-behavioural (Scott 2001). The importance of the regulative role of institutions is a viewpoint most often held by economists. For example, North describes institutions as "the rules of the game" or more formally, "the humanly devised constraints that shape human interaction" (North 1990, p3). In contrast, the normative classification of institutions focuses most on associations, for example through religious systems, voluntary associations and kinship and is a view held most commonly by sociologists, for example March and Olsen (1989). Finally, the cultural-behavioural pillar that Scott identifies is based around common beliefs and shared understandings. Predominately adopted by anthropologists, this viewpoint recognises the role that culture plays in influencing our behaviour (Berger and Luckmann 1967). Formal and informal institutional aspects of regulation, normative systems and cultural-behaviour are all shaped at various levels.

There are different ways of classifying institutions, especially surrounding their degree of formality (formal or informal). Leach *et al.* (2007) distinguishes between formal and informal institutions with formal being those backed by law and thus implying enforcement of rules by the state, whilst informal institutions are those upheld by mutual agreement, or by relations of power or authority. Therefore whilst formal rules are enforced through official processes, informal institutions can be largely self-enforcing (de Soysa and Jütting 2007). This has led Ostrom to refer to informal institutions as 'rules in force' as opposed to just rules in books (Ostrom 2005). The difference between formal and informal institutions has also been considered as canonical and shadow (Pelling *et al.* 2008). Therefore this is to not so much describe the institution itself, but the relationships

between different institutions. For example, Stacey (1996) use 'shadow system' to describe the interactions that interact with, but lie beyond, formal institutions.

The emphasis on both formal legal rules *and* informal social and cultural norms that is found within the literature on institutions supports the local level focus of this research. In this thesis formal institutions are defined as officially recognised regulations (laws, policies etc) and the associate bodies responsible for their implementation, and informal institutions are those recognised through socially approved norms of behaviour.

Explicitly recognising more informal institutions is important in understanding local level dynamics: institutions enable and maintain certain practices, whilst at the same time they can exclude certain actors or constrain practices. This means how individuals within a community behave and interact with each other, combined with the policies and processes that are determined by external agents (individuals and organisations) will all influence how any one individual within a community responds to a particular event, such as a flood or drought. It is thus important to consider the way that rules and norms (or institutions) at different scales interact with each other. For example, development projects increasingly need to recognise not just the immediate issue they seek to resolve, but how future system-wide changes, be that political or environmental, will subsequently impact economies. Moreover, policies, laws or regulations at a national or sub-national level can impact on local level activities. As Ostrom (2010b) argues, relying on addressing issues at one scale will not enable successful policies to be created and implemented, especially for complex problems such as climate change adaptation.

2.3.1 Relationship with social networks and social capital

'Social capital, 'institutions' and their relationship are discussed in the literature on norms and connections between individuals and organisations. For example, Knowles (2006) argues that the notion of social capital is similar to North's notion of informal institutions, as social capital refers to degrees of trust, co-operative norms, and networks (discussed in more detail in Chapter 5). Knowles (2006) proposes that social capital can be viewed as part of a continuum of institutions as North himself recognised that institutions cannot always be classified as either formal or informal: they are situated along a continuum with customs and traditions at one end and policy, law and constitutions at the other (North 1990).

Nooteboom (2007) in turn sees social capital as "…the ties, features of such ties, conditions for their functioning and their outcomes. It includes formal or informal groups of many kinds, and connections between such groups. Its possible features include the composition, structure, content, and type of ties, strength of ties, and trust, rules, shared norms of conduct, or values underlying such norms. The conditions for its existence include formal and informal institutions and trust….to define social capital as contributing to the goal achievement of actors on the basis of relationships." (p31).

There is clearly a significant overlap between social capital and institutions, especially in light of North's definition of institutions as "humanly devised constraints that shape human interaction" (North 1990 :3). The literature on social capital has explicitly stressed the importance of networks as potential indicators of social capital (Knack and Keefer 1997; Putnam 1993), with some suggesting that social capital can be traced back to work on institutions (Lehtonen 2004). There is clearly a link between social capital and institutions. Baliamoune-Lutz (2011) argue that social capital and political institutions in Africa complement each other. Therefore, rather than being substitutable for each other, they are separate concepts that can help us to understand more about the other, and overall about individual and societal interactions.

The interactions between different individuals can be examined through the investigation of social networks. Both Woolcock (2001) and Adger (2003) highlight that social networks are embedded within a wider institutional context which will overall determine an individual or communities' access to social capital. Therefore social capital and institutions, particularly informal institutions, explore similar areas of research: the concepts differ, but are complementary. Nooteboom (2007) has suggested that social capital usually refers to informal rather than formal ties. Investigating the social networks that exist between individuals provides opportunity to examine these ties. Therefore research is needed that investigates social networks alongside institutions in order to provide complementary evidence that enhances specific institutional analyses.

2.3.2 Institutions and adaptation

A growing literature investigates what role institutions play in shaping the outcome of individual behaviours in small-scale common-pool resources settings. This body of research has examined institutional dynamics within water resources (Deneke *et al.* 2011;

Kadigi *et al.* 2007), fisheries (Haller and Merten 2008; Basurto and Coleman 2010) forests (Perez-Verdin *et al.* 2009) and farming systems (Frost *et al.* 2007; Quinn *et al.* 2003). Yet, institutions also influence how societies respond to hazards and environmental stress (Brondizio *et al.* 2009), and thus understanding how institutions structure power, rights and entitlements at multiple levels of governance is integral to understanding adaptive capacity of a community or society. Despite the above body of research on institutions, their role in shaping response capacities is less well researched. How institutions have been studied within wider adaptation research is covered in more detail in Chapter 6 , with the following focusing on the conceptual links between institutions, coping and adaptation.

Institutions underpin the functioning of markets, local resource governance and land tenure and access (Ellis 2000), all of which are important for daily coping strategies of rural communities. Public, civic, and private institutions are all relevant to local adaptation (Agrawal *et al.* 2008). They are often interlinked and shape not only how households and communities are impacted by climatic variability and change, but also how they are able to respond. Institutions link local systems to larger spatial systems (Agrawal 2008), thus institutions at all levels influence the ability of a community to respond through short term coping, as well as to adapt over the longer term. For example, Mauyo *et al.* (2007) found that informal cross border trade between Kenya and Uganda was more common than formal trade, due to the lengthy and expensive bureaucratic processes associated with the latter. Whilst formal trade allowed storage of crops when there was an influx of supply to the market, the private, informal trade was not able to access these facilities. Alongside lack of storage, this reduced the price producers expected to receive on their crop, thereby increasing vulnerability in times of low crop yield. Ostrom (2008a) also suggests a need to consider how social and ecological systems link not only across scales, but also across different sectors, such as agriculture and forestry.

Cooperatives, savings and loans associations, and producer organisations are examples of civic institutional solutions that support members during times of stress (Agrawal *et al.* 2008). For example, producer groups can support individuals accessing markets to sell their produce, whilst savings and loans associations can support those who may not have access to more formal loan arrangements, such as banks. In addition, local legal systems, administrative authority and customary and social mind-sets all influence land access and thus livelihood activities (Reale and Handmer 2011). However, how these and other

institutions affect current coping strategies and associated adaptive strategies to climate change in the longer run remains underexplored.

An alternative perspective from to examine coping and adaptation is to consider how and why people are entitled to undertake particular strategies. Sen defined entitlements as "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). Sen applied this 'entitlements approach' to argue famines result from the ability, or entitlement, or people to access food, rather than a reduction in food itself. The entitlements approach does have limitations. Devereux (2001) argues the approach fails to recognise individuals as embedded within society, as well as failing to recognise the political triggers of famines alongside economic shocks or natural disasters. Furthermore, there is a need to recognise not just what people are entitled to as a result of formalised rules, but that in many contexts additional rules will exist that are outside the formal rule system (Sohlberg 2006).

The entitlements approach explicitly investigates famine, and as Fine (1997) argues, this is how it should be understood. The framework has since been developed to be applied elsewhere, such as the environmental entitlements framework developed by Leach *et al.* (1999). The environmental entitlements framework focuses less on particular endowments, entitlements and capabilities of an individual actor, and instead moves towards considering the relationships between various forms of institutions (between different scale levels) that mediate these factors. This thesis does not directly apply Sen's entitlements approach, or the environmental entitlements framework[4]. However, by drawing upon the ideas presented through these approaches the vulnerabilities of households can be considered whilst situating the analysis in the wider social-political context.

Examining recent studies on the relationship between institutions and adaptive capacity (for example Tol and Yohe 2007; Tucker *et al.* 2010; Anderies *et al.* 2004) highlights three key challenges in relation to understanding the role of institutions in the development of

[4] The Sustainable Livelihoods Framework (SLF) is drawn upon to a greater extent than the entitlements approach given the utility of the SLF in helping link household level analysis to the wider context, whilst focusing on the different livelihoods undertaken in the case-studies rather than focusing on specific natural resources required for different livelihood activities (such as would be afforded by applying the environmental entitlements framework).

coping and adaptive capacity: 1) the concealed nature of adaptive capacity; 2) temporal trade-offs between coping and adaptive capacity; and 3) the limited focus and lack of empirical evidence in research to date on rural communities (Table 2.2). This review now moves to explore how a combination of vulnerability and resilience approaches should enable progress towards overcoming these challenges (Figure 2.4). Considering both approaches provides the opportunity to examine the social assets and relations that exist between households, and how these are impact within the wider-system, as is not discussed in relation to each of the three challenges.

Table 2.2. Summary of vulnerability and resilience perspectives within the three key challenges for understanding the role of institutions in supporting coping and adaptive capacities.

Institutional challenge	Vulnerability perspective	Resilience perspective
Concealed nature of adaptive capacity	Adaptive capacity as a determinant of vulnerability. Analogue case study methods focus on measuring levels of adaptive capacity.	Identifies where changes are occurring at present in other systems characteristics, which may act as proxies for changes in concealed adaptive capacity.
Trade-offs between coping and adapting	Focus on coping with current climate variability. Longer term vulnerability considered through the concept of maladaptation	Spatial and temporal trade-offs aided by a whole-systems perspective
Limited focus and lack of empirical evidence on rural communities	Vulnerability assessments have been undertaken at the local level but building of capacities omitted. Focus on assets. More empirical research is needed, particularly at greater spatial scales (done in resilience research)	Rural communities depend on natural resources, ecological considerations are highlighted, as well as how institutions link governance systems across scales. Local level empirical research is needed (cf. vulnerability) to complement a systems perspective.

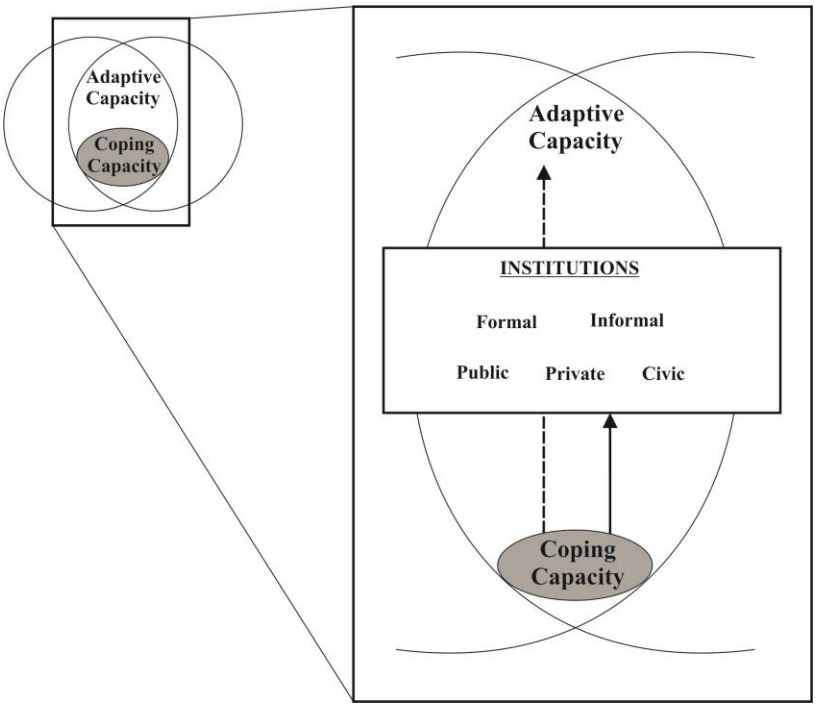

Figure 2.4. Conceptualisation of how institutions shape the development of coping capacity into adaptive capacity within the proposed vulnerability-resilience framing. Formal and informal public, private and civic institutions influence the development of adaptive capacity and should recognise existing coping capacities. These institutions are often interlinked with each other. Source: author

Engle (2011) considers that a key challenge for understanding how institutions affect the development of coping into adaptive capacity is that while current coping capacity is readily assessed, adaptive capacity is not as easily observed. Some studies suggest that adaptive capacity is often only apparent post-event (Ford *et al.* 2010; Engle and Lemos 2010; Adger and Vincent 2005): meaning past adaptations must be studied to understand how adaptive capacity was mobilised. Examining assets and functions that support adaptive capacity has been undertaken in some studies to assess what determines a certain level of adaptive capacity (Brown *et al.* 2010b; Yohe and Tol 2002). These few studies have tended to view adaptive capacity as a determinant of vulnerability (IPCC 2007), where institutions play a mediating role in determining adaptive capacity. Whilst asset-based studies may help identify general characteristics of adaptive capacity, they reveal less about the processes that enhance adaptive capacity and how coping capacity can develop into adaptive capacity. The resilience approach uses systems analysis to identify where adaptive capacity could be concealed in a system and how coping capacity (dependent on ecological resources) may develop into adaptive capacity. This

development can be linked to changes in the ecological components of the system, or to social structures and institutions (Nelson *et al.* 2007). In other words, institutional change can be used as evidence that other system characteristics have changed and whether coping capacity has become transformed into adaptive capacity. As Leach *et al.* (2007) suggest, bridging vulnerability-resilience perspectives through institutions helps address the challenge of 'hidden' adaptive capacity.

The second challenge is the temporal dimension between short-term coping capacity and longer-term adaptive capacity. Despite being acknowledged in the literature (Boyd *et al.* 2009) there remains insufficient evidence on how adaptive capacity shapes strategies that help address both short term variability and long term climate change (Molnar 2010). Both are important. Climate change is not the only factor that must be considered in understanding system responses – how the different time scales interact and what trade-offs they pose are also important (Leach *et al.* 2007). Vulnerability approaches have mostly focused on coping with current climate variability (Chuku and Okoye 2009; Jabeen *et al.* 2010; Eriksen *et al.* 2005b). Longer-term perspectives have been considered through the concept of maladaptation (Ulsrud *et al.* 2009), defined as actions that risk current and future increases in adverse climate-related outcomes, vulnerability to climate change, or reduced welfare (IPCC 2014a). This suggests issues of path-dependency: present coping activities may unintentionally affect the future adaptive capacity of a system (Agrawala and Van Aalst 2008), thus locking households into particular pathways (Wilson 2014). Coping capacity that enables strategies that maintain existing livelihood systems can undermine long term climate change adaptation (O'Brien *et al.* 2008), and vice-versa. For example, in Uganda charcoal is an important fuel source for many rural communities, as well as providing a source of income during times of drought. Yet, from a longer temporal perspective for example, policies that are designed to conserve forests thereby limiting the production of charcoal can undermine the very coping strategies that these communities use in times of drought (Corner 2011).

The third challenge to understanding the role of institutions in shaping adaptive capacity results from a lack of locally focused empirical evidence. Whilst the broader climate adaptation literature has prioritised research at the local community level (Ford *et al.* 2010) most research has focused on climate variability and coping strategies rather than on specific longer term adaptations to climate change (Tucker *et al.* 2010). Research has typically focused on vulnerability assessment and thus does not adequately explore the

factors that shape coping and adaptive capacity (Kuriakose *et al.* 2009; Adger *et al.* 2009; Keskitalo 2008). There remains a lack of empirical evidence regarding the generation of adaptive capacity. Agrawal's (2008) typology of local rural institutions draws upon cases from the United Nation Framework Convention for Climate Change (UNFCCC) database and various National Adaptation Plans of Action (NAPAs), and identifies civic, public, and private institutions. Whilst the typology focuses on how institutions facilitate adaptation, it does not include detailed empirical analysis of the role of institutions in shaping coping and adaptive capacities. Additionally, there is less focus on informal institutions whereby institutions are recognised "primarily in their formal, but where relevant, also informal form" (Agrawal 2008: 24). Understanding the role of traditional knowledge and cultural factors in coping and adaptive strategies is important in order to acknowledge and support the large proportion of autonomous adaptation that is occurring in rural communities (Smit *et al.* 2000; Bryan *et al.* 2009; Urquhart 2009)

Simultaneously, where research has explicitly focused on the role of institutions, this has been at the national level (Tol and Yohe 2007), across different sectors (Gupta *et al.* 2010) or on the capacity of an institution itself to adapt (Brown *et al.* 2010a; Milman *et al.* 2013). There is much less evidence on how institutions influence adaptive capacity of individuals or communities (Anderies *et al.* 2004). Vulnerability perspectives identify how assets, capitals and livelihood activities shape adaptation without sufficiently examining the role of institutions. In contrast, resilience approaches focus on the dynamic nature of institutions, including how they reorganise, transform or collapse in response to stresses or shocks depending on their own adaptive capacity (Wakjira *et al.* 2013; Amaru and Chhetri 2013). There remains little investigation into how institutions shape levels of adaptive capacity amongst rural communities.

Institutions, including those associated with values, skills and behaviours, are important in coping with climate variability (Osbahr *et al.* 2008; Patt *et al.* 2010; Chuku and Okoye 2009; Fazey *et al.* 2010; Paavola 2008). Recognising how these factors contribute to current coping capacity can contribute towards longer-term adaptations: the extent to which adaptation to climate change is limited by values, processes and power relations in society is, to an important degree, shaped by both formal and informal institutions (Adger *et al.* 2009; Eakin and Lemos 2010; Gupta *et al.* 2010). These processes can only be properly understood through developing an empirical evidence base that helps us understand the role of institutions in these complex systems (Segnestam *et al.* 2006; Cash *et al.* 2006;

Brondizio *et al.* 2009). Therefore, a combined vulnerability-resilience approach helps to shed light on how institutions influence the development of coping capacity in turn helping to understanding the development of adaptive capacity and how this impacts on local communities. As argued in the previous section (2.3.1), examining social networks can provide complementary evidence to unpack the complexity surrounding institutional analysis. In this thesis, this is addressed through SNA (see objective 2 and Chapter 5) to provide a specific handle on informal local institutions to complement the institutional analysis. The nature of informal relationships and networks has previously led to institutional analyses focusing on more formal relationships. For example as Poteete *et al.* (2010) argue, it is difficult to collect data on informal institutions due to the often lacking the appropriate language skills and understanding of the local context. Therefore, by analysing the village networks that exist under different climatic hazards, a SNA helps provide an alternative evidence base from which to support institutional analyses.

2.4 Rural livelihoods for coping and adaptation: focusing on institutions and social capital

Several studies have identified the importance of understanding how formal and informal rules shape what adaptation strategies people undertake (Eakin and Lemos 2010; Gupta *et al.* 2010), and it is now widely accepted that institutions are integral to adaptation. From the above review, there remains the challenge of operationalising the concepts of coping and adaptive capacity in order to assess how institutions influence them. One solution to address this analytical challenge is to focus on rural livelihoods at a local level in order to explore how institutions affect local level coping and adaptation. The term “livelihood” is now widely used and defined (see for example Carswell 1997; Scoones 1998) with most of the literature adopting the definition provided by Chambers and Conway as “the capabilities, assets (stores, resources, claims and access) and activities required for a means of living” (Chambers and Conway 1992, p6).

Livelihoods research is well documented in the literature, and approaches to study the complexity of livelihoods have been well developed. The Sustainable Livelihoods Approach (SLA) and the corresponding Sustainable Livelihoods Framework (SLF) is one of the most used conceptual tools in livelihoods research (Figure 2.5) (Scoones 1998; DFID 1999).

Using this framework, studies have explored the context within which households experience shocks or stresses, the mix of assets households have, the processes that shape access and use of these assets, and the resulting strategies that form the household's livelihood.

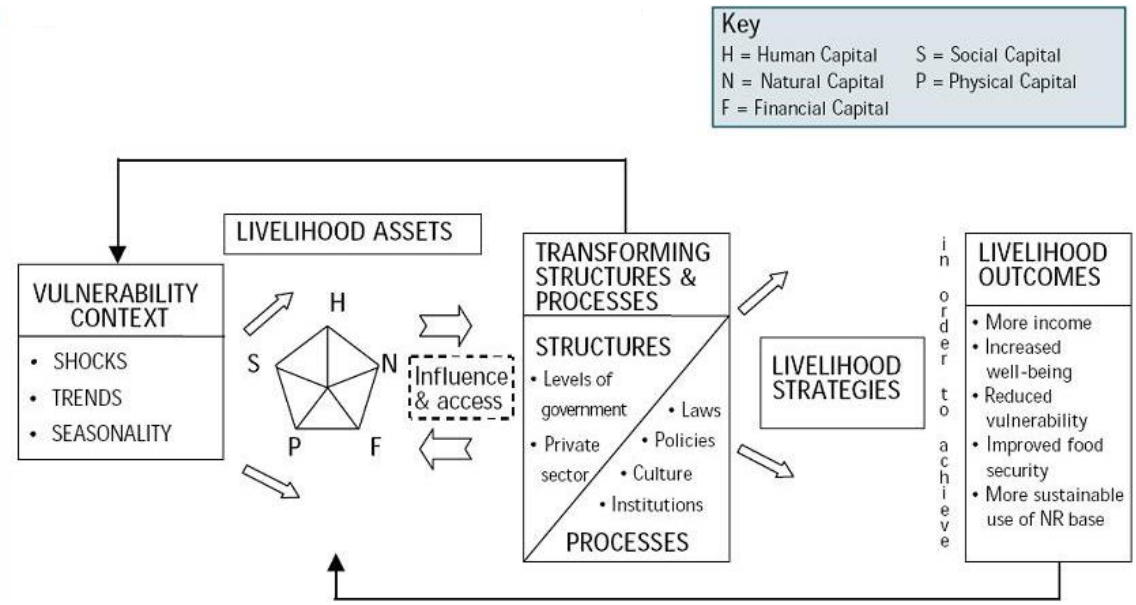

Figure 2.5. The Sustainable Livelihoods Framework (SLF) (DFID 1999)

Livelihood assets are represented by five types of capital: human, natural, financial, physical and social. Although all five capitals are important in terms of adaptation, social capital has been argued to differ from the others: it directly affects all other capitals, as well as being the only one that is not tangible (Bebbington 1999). Essentially, social capital refers to the relations of trust, reciprocity and exchange between people (Adger 2003; Woolcock 2001; Lyon 2000). Social capital, as a concept, is recognised through its ability to be considered across scales, and therefore for its use in linking social and ecological systems analysis with the household level (through the use of the SLF) (Goulden 2006).

Social capital, despite the increasing use of the concept, remains subject to a number of critiques. Indeed Fine (2002) identifies eight separate criticisms, as supported by others. These include the lack of analytical rigour in the concept; the lack of accounting for social context; the explicit connection with economics and the market through the use of 'capital' and the limited consideration of issues of power (Fine 2002; Harriss and De Renzio 1997; Sobel 2002; Stirrat 2004). Where the concept is criticised however, scholars interested in social capital seek to engage with the debate and re-define the concept. As

Fine (2002) states social capital "absorbs any criticism by the refinement of adding another variable or ten" (p1). The concept still remains widely used (likely as a result of its broad interpretation). Andriani (2013) have warned that empirical work on social capital must therefore explicitly consider the variable and methodology applied. A more detailed discussion and critique of social capital is provided in Chapter 5 .

Whilst the central focus of this research is not specifically on analysing livelihoods, it is important to understand the way the literature on livelihoods, and social capital specifically, conceptualises and supports that of institutions. Within the livelihoods framework, institutions can both restrict and enable livelihood options for different households. Whilst the SLF distinguishes between social capital and institutions, both shape how individuals are able to access different assets. A household may appear to have the same asset portfolio of another household, but the ability to combine assets in different ways (influenced by institutional processes) can result in varied livelihood strategies (Scoones 1998). Livelihood strategies therefore reflect the activities and choices that households make in order to achieve particular livelihood outcomes (DFID 1999). It is now widely acknowledged that rural livelihoods are subject to multiple stressors (Quinn *et al.* 2011; O'Brien and Leichenko 2000). In addition to increased climate variability and longer term shifts in climate, economic stresses relating to local and global markets (Minten *et al.* 2009), food insecurity (Hadley *et al.* 2011) and poverty (Krishna *et al.* 2006) all have the potential to affect rural households' livelihoods. A more detailed review of rural livelihoods and coping is provided in Chapter 4 .

Social capital and institutions contribute towards how individuals interact, both through the cultural and social norms of a community, as well as more formal institutions that connect across scales. Changes in institutions and social capital lead to changes in adaptive capacity (Gupta *et al.* 2008). In the context of climate change, this can lead to positive and negative changes in adaptation. As Pelling argues, social learning developed through strong social capital is a central component of adaptive capacity: "it can be the difference between important experiences being overlooked, forgotten or translated into enhanced capacity" (Pelling 2011, p113). Livelihoods and institutions together shape social networks, or rather the interactions between community members, that enable given levels of social capital (Adger 2003; Marshall *et al.* 2009).

There is still uncertainty as to exactly how institutions influence social capital and structure social relations, and this will have implications for how institutions influence adaptive capacity (Hodgson 2006). Adger (2003) has argued it is within these multi-scale connections that social capital can most influence adaptive capacity. The vertical networks between individuals in a community and institutions that operate at greater spatial scales are suggested as important links between social capital and adaptive capacity. By investigating these wider institutional links, as well as the social networks within a local community, this research will extend our knowledge on the processes that develop the adaptive capacity of a local community. A more detailed review of literature relevant to social networks and institutions are provided in Chapter 5 and Chapter 6 respectively.

Resilience studies highlight how institutions link governance systems across scales (Brondizio *et al.* 2009), whilst vulnerability approaches focus more on social capital and collective action and therefore on informal networks (Vasquez-Leon 2009; Fazey *et al.* 2010; Ostrom 2010c). Vulnerability assessments acknowledge social capital as an asset, whilst resilience approaches focus on institutions and how they reorganise themselves. The combined vulnerability-resilience approach utilises the link between social capital and institutions. This combined approach could help investigate how institutions mediate access to social capital and vice-versa (Brondizio *et al.* 2009; Adger *et al.* 2009), thereby generating evidence on the role they play in transforming coping capacity into adaptive capacity. Biermann (2007) has argued that formal and informal rule systems, and the networks of actors at different scales influence how human and environmental systems interact and evolve. Vulnerability studies have long argued for the need to consider processes at greater spatial scales (Wilbanks and Kates 1999) and these cross-scale dynamics are increasingly found in resilience research to be shaped by institutions (Cash *et al.* 2006; Olsson *et al.* 2004).

Many frameworks exist for exploring natural-resource governance issues, such as forestry, agriculture and fisheries management, that are all sensitive to climate variability and change. Whilst not directly synonymous with institutions, governance has strong links with how individuals behave. Hooghe and Marks (2001) identify multi-level governance, multi-tiered governance, polycentric governance, and multi-perspectival governance, amongst others, as frameworks used to explore such issues. These multiple frameworks result from a recognised need to develop approaches that acknowledge the multiple governance scales that are involved in efforts to deal with climate variability and climate change (Hill

and Engle 2013). Studies also acknowledge that there are a variety of actors and networks at different levels and scales that are involved in coping and adaptation (O'Neill *et al.* 2013; Ostrom 2010a). Hence there has been an increasing focus on the value a polycentric lens has within climate change adaptation research (Ostrom 2010c), largely in response to investigating alternatives to mono-centric frameworks and their recognised limitations. Polycentric approaches recognise the multi-actor, multi-level, multi-scale challenge of climate adaptation, but also force consideration of ideas of agency.

The complexity of rural livelihood systems requires issues of power to be considered (cf. Boyd *et al.* 2007). Changes in power structures and institutions will alter the resilience of a system to climate change and its impacts, as well as the coping and adaptive capacity of involved actors (Eakin and Wehbe 2009). A resilience perspective considers that flexible institutions capable of reorganising themselves are needed to address future climate change (Folke *et al.* 2002). Where institutions have been studied within the environmental governance literature (Young 2010; Ostrom 2008b), it has been noted that they can remain relatively static in some situations, whilst becoming transformed in others (Young 2010). Such approaches acknowledge (for example) how a local village disaster management committee is connected to the wider landscape of disaster risk policy. However, this system-wide focus does not give sufficient attention to individual agency (Nelson *et al.* 2007). Indeed the social networks that connect individuals, and how these networks are shaped by institutions, are important for the resilience of a socio-ecological system to stresses and shocks (Fraser 2007; Pretty and Ward 2001). A combined vulnerability-resilience perspective focuses on the interaction between individuals within a system, thus providing the opportunity to explore the implications of different trade-offs (Turner II 2010).

The SLF acts as a framework to guide the interrogation of rural livelihoods systems. In particular, Scoones (2009) has stressed the value of the framework in linking across different disciplines. However the SLF has been critiqued, particularly for over-emphasising capital substitution and insufficiently engaging with politics and power (Ashley and Carney 1999; Scoones 2009). Other criticisms include limited consideration of long term stresses such as climate change, and a lack of consideration for future risks and changes (Scoones 2009). Despite this, the SLF's focus on assets and institutions can provide a useful guiding point for research within rural communities: the way individuals and households access different resources can determine their ability in coping and adapting

to different stresses (Kelly and Adger 2000). Adopting the focus that the SLF places on the local, whilst integrating the framework within a bridged vulnerability-resilience approach, supports the exploration of how local institutions shape coping in rural communities, itself situated in a wider institutional analysis.

2.5 Conclusions

There is no consensus on what short-term changes to current livelihoods and institutions might be needed to adapt to long-term climate change. Focusing on the institutional dynamics of coping capacities, and what these means for adaptation offers an opportunity for understanding how rural communities can avoid adverse impacts of present day hazards and climatic variability whilst recognising their ability to adapt to long term climatic change. Adaptive capacity is an important enabler of adaptation to future climate change. To date, efforts in resilience research have focused on characterising the socio-ecological system features that will foster adaptive capacity. Vulnerability research has in turn demonstrated how some communities are successfully coping with current climate variability by drawing on a range of traditional coping strategies. Further research is now needed to understand what processes contribute to the development of coping capacity and what factors hinder that development, particularly in natural resource dependent rural communities in the developing world where livelihoods are highly sensitive to both climate variability and change. By understanding these processes, the possible implications for adaptive capacity can be identified, and a research agenda that is able to take these forward to better understand adaptive capacity can be developed.

Increasingly, it is acknowledged that institutions shape the level of household capacity to respond to changes caused by climatic variability and change. This review has outlined how institutions have the potential to impact both current coping capacity and longer-term adaptive capacity and that combining vulnerability and resilience approaches to climate change adaptation could help us explore the processes in more detail (Gaillard 2010). The three challenges (the concealed nature of adaptive capacity, the temporal trade-offs between coping and adapting, and the limited focus and lack of evidence from rural communities) highlight key gaps within the literature that this thesis aims to address in order to understand the role of institutions in shaping coping capacity. Debate over coping-adaptive capacity and vulnerability-resilience issues remains in the literature. This

review suggests that a focus on social assets and relational methodologies to help unpack the complexities surrounding associated institutional dynamics is needed.

This thesis draws on the strengths of both vulnerability and resilience approaches in order to develop a methodology that supports the objectives of this research. Combining vulnerability and resilience approaches will help deliver adaptation research that is more informative than either approach on its own. This review has suggested that by focusing on institutions, the strengths of both vulnerability and resilience approaches to adaptation studies can be combined. Yet operationalising how both approaches support understanding institutions, particularly at the local level is challenging. This chapter suggests that using the SLF is one solution to this analytical challenge. Given the limitations that have been identified within the SLF, integrating the SLF with a stronger focus on institutions utilises the framework's strengths. Explicitly focusing on the wider system dynamics that a resilience approach can bring, as well as on ideas of agency brought through vulnerability perspectives helps to explore the role of institutions in shaping rural households capacity to cope and adapt to climate variability and change. Drawing on these arguments, Chapter 3 will outline the methodological approach that this thesis uses to address these challenges.

Chapter 3 Research design and methods

The previous chapter discussed the conceptual challenge that exists in trying to operationalise how to better understand institutions' role in coping and adapting. Explicitly focusing on institutions and social capital within the SLF was argued as a solution to address this challenge. This chapter introduces and explains the research design and methods that are used in this thesis, and specifically how they offer a solution to the current challenge of understanding the role of institutions in shaping household coping and adaptive capacities.

The first section details the research design that was adopted in this study, mainly the case-study approach, with section 3.1 discussing the rationale behind the selection of case-studies before describing the case-studies themselves. Section 3.2 then describes the data collection methods and the rationale for the inclusion and exclusion of particular methods given the research questions that are asked. Section 3.3 then discusses the data analysis methods. Some data collection and analysis methods are specific to particular results chapters and whilst these will be introduced here, further detail is provided in the relevant results chapter. There are inherently limitations to this study in relation to the research design. These are discussed in reference to each of the methods used throughout the chapter, but specific issues related to positionality and ethics are discussed in section 3.4, before section 3.5 summarises the chapter.

3.1 Research approach and design

This thesis adopts an interdisciplinary approach, drawing on literature and methods from different disciplines (i.e. development studies, environmental science, social science). As such it is important to explicitly acknowledge the research paradigm that frames this work. This thesis adopts a critical realist approach in order to access and understand the complex processes that impact and shape household coping and adaptive capacities. Bhaskar *et al.* (2010) suggest that:

> *[Critical realism] takes an inclusive, pluralistic approach to methodology, so that the basic and very important insights gained through statistical analysis, surveys, ethnographies, social constructions and deconstructions are preserved and woven into our understandings of how the real world operates, including both the natural and social worlds" (p103)*

It is increasingly recognised that climate change cannot be adequately addressed with approaches associated with traditional 'systems' thinking (O'Brien 2008). Critical realism supports the articulation of interdisciplinary frameworks for trying to understand the complexities around societal responses to climate change phenomena (Forsyth 2003; Castree and Braun 2001).

This research draws upon both deductive and inductive reasoning, which both fit within a critical realist philosophy. The deductive approach tests the theoretical framing presented in Chapter 2 that institutions are important in shaping adaptive capacity. However, whilst this forms the focus of the research, themes and issues were allowed to emerge as directed by the data rather than specifying issues based on pre-existing literature. This inductive reasoning enables specific conclusions about the role of institutions in shaping adaptive capacity to be developed.

From this critical-realist perspective, the case-study approach used in this thesis adopts a multi-method, multi-level strategy combining both quantitative and qualitative approaches. Research approaches that use quantitative and qualitative research methods are increasingly recognised as legitimate in social research (Robson 1993) and as such have often been used in studies of social-ecological systems (Goulden 2006; Grist 2005). A mixed-methods approach enables the investigation of the research objectives set in Chapter 1 , acknowledging that different objectives will require different methods to be used, with one methods' strength counter-balancing another's weakness (Robson 1993).

As was argued in Chapter 2 , the SLF provides a useful guiding framework which this thesis draws upon to examine local level factors. A multi-method, multi-level approach supports the unpacking of the complex institutional environment, as well as different methods assisting in the triangulation of results, thereby providing more thorough and valid research (Creswell 2009). Drawing on evidence collected across different levels explicitly

recognises how multiple levels shape coping and adaptation decisions at any one level, and captures evidence from that level, rather than just multi-level perspectives from one level. Quantitative approaches are used to analyse pre-determined variables (household demographics, livelihood strategies and social networks) as these are directly measurable. Yet, qualitative approaches are also required given the importance of understanding the context within which coping strategies, networks and institutions occur, especially given how vulnerability (to climate change) is socially constructed (Adger *et al.* 2009; Blaikie *et al.* 1994). The specific mix of methods (both data collection and analysis, as discussed in sections 3.2 and 3.3) contributes towards understanding the complex institutional environment surrounding household coping and adapting. Social capital and institutions are complementary concepts (see discussion in 2.3.1). Analysing social capital through social networks (objective 2) and placing tangible measurements on different social support structures provides complementary evidence that enhances the evidence gained through the institutional analysis (objective 3).

3.1.1 Case-study approach

A case-study approach enables the context-specific nature of vulnerability and adaptation to be explored (Baxter and Jack 2008; Ford *et al.* 2010). Case studies have been described as "an empirical enquiry that investigates a contemporary phenomenon in depth and within its real-life context" (Yin 2009, p18). This approach allows sufficient exploration of the formal and informal institutional processes that contribute towards adaptive capacity in rural communities. Case study methodology also provides a means to address the multiple scales and levels involved in the issues addressed by this research.

Case-studies have been criticised within the literature due to concern over lack of rigour within the methodology, as well as their limited applicability for making broader generalisations (Yin 2009; Robson 1993; Noor 2008), a critique which has led to arguments pertaining to the limited value of case studies in scientific research (Pope and Mays 2009; Ford *et al.* 2010). However, the case-study approach provides the means to research a range of situations and events within the same context, with the case-study acting as a framework within which specific data collection methods are situated (Blaikie 2000).

This research draws on evidence from two villages. Both village case-studies are within the same district, thus providing opportunity to explore how high level institutions are related to local level institutions, and how this manifests in shaping coping and adaptive capacities given different village contexts. Thus both specific processes at the village level, and higher level institutional processes that contribute to these local level decisions and actions can be investigated. Conducting one case-study (i.e. a particular livelihood activity in a particular village) would have provided the opportunity to explore these processes in more detail, but it would have limited the applicability of the research findings. Therefore two different case-villages were selected to improve the wider-applicability of this research, and to explore why differences might be occurring between cases. Although further case-villages would provide even deeper understanding, practical considerations of time and resources limited this to only two villages to still enable sufficient in-depth data collection and analysis to occur.

3.1.2 Case-study selection

Case-study selection was undertaken through a purposive sampling approach (Seawright and Gerring 2008). Through knowledge of potential case-study sites, purposive sampling enables the selection of sites based on their suitability in meeting the research objectives (Babbie 2008). For this research, site selection was considered at a range of levels: (1) nationally (which country to study); (2) sub-nationally (which district/sub-region to study); and (3) locally (which individual villages to conduct local-level research in). The criteria for country and district selection focused on the occurrence of climatic hazards and current climate variability, and the predicted impact of future climate change (Table 3.1).

Table 3.1 Case-study selection criteria at national and sub-national levels

Level	Purposeful sampling criteria	Research context
National	1) Vulnerability to climate change and variability; 2) High dependence on natural resources; 3) Predicted impact of future climate variability and change; 4) Researcher knowledge of context	Uganda has a high level of vulnerability to climate change and variability. A high proportion of the population are dependent on natural resources, and Uganda is expected to be impacted by future climate change and variability (Hepworth 2010). The researcher has previously lived and travelled in the country which provides some background knowledge about society and culture.
Sub-National (District)	1) The occurrence of floods and droughts; 2) Suitability for research to be conducted there (livelihoods; access); 3) Researcher safety – stability within the district.	National government reports document the occurrence of floods and droughts in the Rwenzori sub-region (Bwenvu 2010). There is a range of agricultural and fishing activity within the sub-region. The area remains relatively politically stable (FCO 2011): there is a) limited complex social causes of vulnerability such as war and conflict beyond that which has historically affected much of Uganda, and b) limited risk of the research being affected due to political instability.

For the village level, sites were considered based on their suitability to meet the research objectives, as well as logistical criteria to enable the timely completion of the research. The criteria for village selection are outlined in Table 3.2. In June 2011, a scoping study was undertaken to short-list and visit potential case-study communities.

Table 3.2 Case-study selection criteria at village level

Research criteria	Logistical criteria
Community has experienced a flood or drought in last 5 years to enable a good, reliable recall of the issues the event presented, and to increase the likelihood of households that experienced such events still residing in the village.	**Community is connected with a local organisation** (i.e. NGO) – this would help access into the community and with dissemination of findings.
Flood or drought events are beyond the 'norm' of what the community usually experiences.	**Community is not experiencing research fatigue** from other research projects.
Communities should be of similar size to ensure size is not a factor that influences different network structure in the social network analysis, especially if investigating the structure for different hazards (Allcott *et al.* 2007).	**Village chairperson is willing and agrees to the research taking place** in the village, and village members agree at a village meeting: the majority of the village community must also agree to the research in order to enable a good SNA.
Community should be no larger than 300 households to enable a complete survey of the village for the SNA.	**Access and transportation considered for health and safety reasons** (aware of potential bias for research).

3.1.3 Case-study description

3.1.3.1 Uganda

Although the results from this research must be understood as case-specific, there is wider applicability to much of sub-Saharan Africa whereby there are similar broad scale determinants of vulnerability (Blaikie *et al.* 1994) as well as the occurrence of both flood and drought events (IPCC 2007). Similar to large parts of sub-Saharan Africa, Uganda has a high level of vulnerability to climate related hazards, and therefore disaster risk (Barihaihi 2010) and is prone to both flood and drought hazards.

Uganda is located on the East Africa Rift, and straddles the equator. The majority of the country has a bimodal rainfall regime, with long rains in March-May and short rains coming in October-December, with this tending towards a uni-modal rainfall regime towards the north of the country. Topography is a key influencing factor in the regional climates of Uganda. Mountain ranges such as the Rwenzori Mountains in the West and Mt Elgon in the East have a significant effect on micro-climate. Lake Victoria and other major

lakes in the country such as Lake Edward, George, Albert and Kyoga also affect local climate.

Extreme weather and climatic variability are not new to Uganda. Extreme rainfall events have been recorded in 1961/62, 1997/98 and 2007, and episodes of severe drought in 1993/94 (Hisali *et al.* 2011). There is also evidence to suggest there has been an overall increase in seasonal mean temperatures over the last 50 years (Funk *et al.* 2012). McSweeney *et al.* (2010) report an annual rainfall decrease of 3.5% since the 1960s. However, there is a lack of consensus on rainfall observations, and projections of future climate change in Uganda are varied, including both projected increases in temperature and more erratic rainfall patterns (Hepworth and Goulden 2008).

Many livelihoods within Uganda depend on natural-resources. Both agriculture and fishing are significant economic activities and employ a large proportion of Uganda's economically active population. In 1999, agriculture contributed to over 40% of the GDP, but accounted for more than 80% of the total economically active population (Mwebaze 1999), and now over 90% of the population depend on rain-fed agriculture (UBOS 2009). Both agriculture and fisheries are threatened by climate change. It has been estimated that up to 34% of crop damage in the country is caused by climate induced stimuli including reduced rainfall (Hisali and Kasirye 2008), and overall warming trends threaten important exports such as coffee (Jaramillo *et al.* 2011). However, only 0.1% of land in Uganda is irrigated, and therefore changes in rainfall and temperature risk hampering broader development objectives that agriculture could address (James 2010).

Although land locked, numerous lakes and associated wetlands in Uganda support a large in-land fisheries economy. Fisheries not only support those households involved directly in fishing, but numerous related activities such as smoking and processing fish for market, carpentry for making boats etc. Due to the historical climatic variability in the country, households whose livelihoods depend on these lakes will have previous experiences of fluctuations in lake resources (Goulden 2006).

Additional factors that result in Uganda's vulnerability to climate variability and climate change include high levels of poverty, lack of disaster management skills and equipment, and limited financial resources (Twinomugisha 2005). These factors have contributed to Uganda being ranked 161 out of 186 countries in the 2012 Human Development Index

(HDI), with an index score of 0.456 (UNDP 2013), which is in line with the average HDI across sub-Saharan Africa (0.475).

Uganda's development has been impacted by economic collapse, political instability and conflict during the late 1960s to 1980s. Since, a series of macroeconomic reforms including the poverty reduction plan implemented in 1997 led to Uganda becoming one of the few sub-Saharan African countries to have halved extreme poverty before the Millennium Development Goal deadline of 2015, from 56.4% in 1992-1993 to 24.5% in 2009-2010 (UNDP 2013). However, there is now growing income inequality which has significantly slowed this rate of poverty reduction (Ssewanyana *et al.* 2011).

Climate change is now recognised as a further threat to Uganda's development. Uganda is a party to the UNFCCC and Kyoto Protocol. In an effort to meet these commitments, the Government has established the Climate Change Unit which has overall responsibility to coordinate climate change activities. In addition, Uganda has finalised a National Adaptation Programme of Action (NAPA), created a Parliamentary Forum on Climate Change (PFCC) and a Climate Change Policy Committee, formed a National Agricultural Advisory and Development Service (NAADS) and formed the National Agricultural Research Organisation (NARO) (GoU 2007; Osbahr *et al.* 2011; GoU 2013) and most recently the Government approved the National Climate Change Policy (CCU 2013). However there is concern about how well these have supported development in practice (Hepworth and Goulden 2008).

3.1.3.2 Kasese District and case-study villages

Kasese district was selected for the research based on the criteria identified in Table 3.1. Following the scoping study in June 2011, two villages, Kigando and Kahendero, were selected (Figure 3.1) based on key-informant interviews and visits to the villages to assess them against the criteria in Table 3.2. Kigando and Kahendero have a mix of livelihood activities within different market-contexts and therefore are representative of the wider Kasese district. Table 3.3 characterises the two villages.

Kasese District is one of 111 districts in Uganda (MoLG 2010). Kasese boarders Kabarole, Bundibugyo, Kamwenge and Bushenyi districts and the Democratic Republic of Congo. The district is divided into two counties, Bukonzo and Busongora, and has 22 sub-counties. Kasese and Kahendero villages are within Maliba and Muhokya sub-counties respectively.

Various livelihood activities are undertaken in Kasese, with agriculture being undertaken by over 80% of the population (Calvi Renno *et al.* 2012). Fishing is undertaken by a large percentage of the population who live around Lake George and Lake Edward. Just under 40% of the total land area in the district is habitable, with over 60% being lakes, or statutory recognised conservation areas such as Queen Elizabeth National Park (KDLG 2005).

Rural poverty in Kasese reduced from 52% in 1992 to 48% in 2005, yet it remains above the national average of 31% (UBOS 2008). According to a report by the Belgium Technical Cooperation in 2012, almost half of the district's residents have perceived a decline in wealth over the past 5 years, with this predominantly resulting from high commodity prices, lack of capital, food shortage, drought and illness (Calvi Renno *et al.* 2012). In addition to these factors, the report also stresses that households are vulnerable due to unpredictable weather patterns, the breakdown of family structures, social norms and networks (Calvi Renno *et al.* 2012).

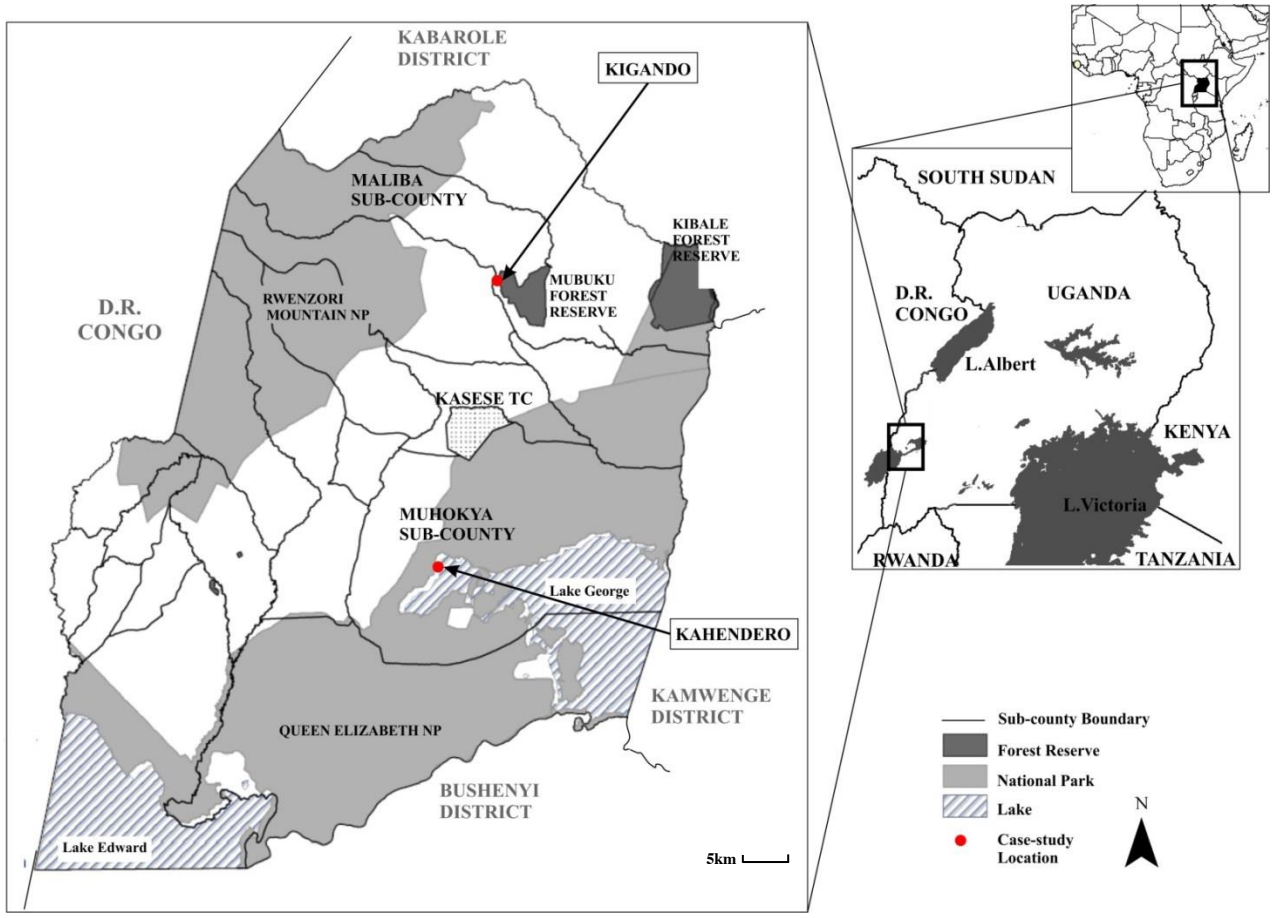

Figure 3.1 Location of selected study sites in Kasese District, Uganda.

Table 3.3. Key features of case-study villages (Source: Village Local Chairpersons (LC1) and villagers, June 2011 and March 2012)

Village	**Kigando, Mubuku parish in Maliba sub-county.**	**Kahendero (I), Kahendero parish in Muhojya sub-county.**
Size	112 households	250 households
Livelihoods	Subsistence agriculture (beans, maize, cassava), some cash crops (cotton, coffee); some trading of food stuffs; small ruminant keeping (goats); only a few members own cattle	Fishing (Lake George); subsistence agriculture (beans, maize, cassava), some cash crops (cotton); market-activity (trading, restaurants, shops).
Hazard event and impacts.	Regular flood and drought events: 2011 reported as worst flood, and 1992 reported as worst drought.	Regular flood and drought events: flooding from upland areas, as well as increase in overall level of lake. Drought events perceived by villagers to be increasing
Socio-economic changes that may influence research	1997 – forced to migrate for approximately 1 month because of ADF rebel insurgency. Some villagers left because of drought and migrated to Mubende district for farming, have not yet returned.	1997 – forced to migrate for approximately 1 month because of ADF rebel insurgency.
Additional notes	Vehicle access constrained during flood, access by foot only.	Village lies inside Queen Elizabeth National Park (QENP) Protected Area (PA).

3.1.4 Timing of research activities

The research was conducted over two main phases: a scoping study was undertaken to identify case-study villages and to identify and connect with key-informants at local, district and national levels, and a main data collection phase was then undertaken from January-June 2012. The activities undertaken during the main fieldwork phase are outlined in Table 3.4.

Table 3.4. Schedule of activities during main fieldwork phase.

Phase	Activity
1) 'Acclimatisation' (January 2012)	In-country set-up, identification and training of research assistants.
2) Research set-up - Kigando (January 2012)	Community meetings, introductions, preliminary testing of questionnaire.
3) Data collection – Kigando (February-March 2012)	a) Survey whole village with questionnaire b) Preliminary analysis of survey results to sample for interviews c) Semi-structured and key-informant interviews within village and sub-county.
4) Research set-up – Kahendero (March 2012)	As phase 2
5) Data collection – Kahendero (March-April 2012).	As phase 3
6) Data collection – District (-May 2012)	a) Preliminary analysis of village data to identify themes to follow up at district level b) Interviews with district key informants. c) Return to villages and sub-counties for follow up interviews and closing meetings.
7) Data collection – National (May - June 2012)	a) Preliminary analysis of district and village data. b) Interviews with national key informants.

3.2 Data collection

This section introduces and describes each of the primary data collection methods used in this study. These are summarised in Table 3.5 in relation to the different data needs of each of this study's research objectives. Table 3.5 also summarises the associated data analysis techniques which are introduced in section 3.3.

The particular mixed-methods strategy adopted within this thesis' case-study approach is necessary to enable sufficient exploration of the institutional environment around household coping and adapting. Key-informant interviews (section 3.2.1), household survey (section 3.2.2) and semi-structured interviews (section 3.2.3) are the main methods of data collection used in this research. Whilst key-informants are identified separately from household-level interviewees, essentially they both form the multi-level participation within this research.

Increasingly common within climate vulnerability and adaptation studies are the use of focus group discussions (FGDs). FGDs were not used in this research despite their recognised value in providing a variety of perceptions and attitudes, and in validating findings generated through other methods, such as surveys (Krueger and Casey 2008; Condrason 2005). It was decided that FGDs would place an increased time demand on participants given the need to survey every household for the social network analysis and undertake detailed semi-structured interviews with selected households. Furthermore, the number of questionnaires undertaken, combined with the interviews, enables sufficient confidence in the triangulation of data.

The term 'household' describes various groupings of people and functions, and therefore a universal definition of 'household' is impossible (Beall and Kanji 1999). The definition of a household used in this thesis is in line with that used by the Uganda Bureau of Statistics, and is "a group of persons who normally live and eat together… living in the same house or compound" (UBOS 2001: p5)

Table 3.5. Research objectives and the corresponding data collection and analysis techniques.

Main research objective	Research questions	Data required	Data collection method	Data analysis method
1) To identify past and present household coping strategies to floods and droughts in two communities in Uganda. ***(provides evidence/ information on past coping strategies from which later objectives are based upon).***	a) What are the coping strategies used by households in response to floods and droughts?	List of different coping strategies used by households in the village.	i. Survey's to illicit different activities households undertake; ii. Semi-structured interviews to explore coping strategies.	i. Thematic coding to identify strategies used.
	b) What are the factors that influence the choice of strategy?	Information on different livelihoods and household demographics, including why households choose particular strategies (cultural or behavioural aspects).	i. Survey's to capture household demographics and activities; ii. Interviews to explore constraints and enablers of different activities and strategies.	i. Statistical analysis to identify strategies used by particular socio-economic groups; ii. Thematic coding to identify non-demographic drivers
	c) What does this mean for adaptation policy in rural communities?	Information on the long-term implications of current coping strategies.	i. Interview data to identify household perceptions; ii. Interviews and secondary data to identify future risks.	i. Thematic coding and reflection on secondary sources.

Main research objective	Research questions	Data required	Data collection method	Data analysis method
2) to examine the network structures that exist in the two communities during floods and droughts. *This objective enables social capital to be quantified, and therefore provides complementary evidence for the following institutional analysis*.	a) How do network structures vary under different climatic hazards and how does this vary from the daily network?	Network data during climatic (flood and drought) and non-climatic stress (daily).	i. Household survey.	i. Network analysis using UCINET and network visualisation using NetDraw (Borgatti *et al.* 2002).
	b) What are the relationships that characterise these network structures?	Network data during climatic (flood and drought) and non-climatic stress (daily), and demographic data of households in network.	i. Household survey; ii. Interview data to identify context of different relationships.	i. Network analysis using UCINET and network visualisation using NetDraw (Borgatti *et al.* 2002). ii. Thematic coding to qualify relationships.
	c) Who are the key households within the networks and what characterises them?	Network data during climatic (flood and drought) and non-climatic stress (daily), and demographic data of households in network.	i. Household survey; ii. Interview data to identify context of different relationships.	i. Network analysis using UCINET (Borgatti *et al.* 2002); ii. Thematic coding to qualify relationships.

Main research objective	Research questions	Data required	Data collection method	Data analysis method
3) to investigate the formal and informal institutions that affect household coping strategies, and the interplay between them. ***This helps to examine the relationships across the institutional environment in relation to the household coping strategies in the two communities***	a) What are the institutions that enable and constrain household coping strategies?	List of different institutions (formal and informal) that influence household strategies.	i. Semi-structured household interviews to explore the institutions that shape household strategies; ii. Key-informant interviews.	i. Thematic coding to identify institutions, and how they impact different households.
	b) What interplay's exist between these different institutions?	Information on the relationships between different institutions (explicit and/or implicit).	i. Key-informant interviews to explore how different institutions impact each other; ii. Policy review to examine different legal restrictions.	i. Thematic coding to identify institutional interactions, and how they impact households and each other.
	c) What does this mean for future household coping and adaptation?	Information from other studies and the literature about how different institutions operate	i. Different institutional activities; ii. Formal policies and agreements; iii. Literature search.	i. Thematic coding to identify institutional interactions and reflection on literature.
4) to assess what is needed to enable household coping capacity to support the development of adaptive capacity.		Previous results from objectives 1, 2 and 3.		i. Reflection on results and what this means for theory and practice.

3.2.1 Key-informant interviews

Multi-level key-informant interviews were undertaken at three main stages of the research: during the scoping study to inform case study selection, with village representatives and local sub-county officials of each village to explore in detail the factors that shape livelihoods and coping strategies in the two villages, and at the district and national level to explore the factors at wider scales that influence household coping and adaptive capacities. As with the semi-structured interviews (section 3.2.3), an interview protocol was developed to ensure key lines of enquiry were followed (Appendix 2). However, the protocol for key-informant interviews was interview specific: specific key questions for each interviewee were identified prior to each interview rather than following a general guide. These ensured key areas of interest relevant to the research questions could be explored whilst providing flexibility to enable the interviewee to raise issues of importance to them.

Within the villages, key-informant interviews were undertaken in Lutooro and Lukonjo as with the semi-structured interviews. Interviews at the district and national level were conducted in English (with approval of the interviewee).

Key-informants were selected based on their role within the local community, or in district and national government offices and organisations. This process was supported through a preliminary analysis of policies, and targeting government ministries, traditional leaders, NGOs, and researchers identified through online searches and personal networks. From those initially interviewed, snowball sampling was then used to help identify further interviewees (Valentine 2005). Table 3.6 shows the type and number of key-informants interviewed (excluding the scoping study).

Table 3.6 Local, District and National Key informant interviewees

Type of organisation	Local (village or sub-county)	District	National	Total
Government	6	8	4	18
Civil Society (NGO, religious groups)	3	6	5	14
Private sector/Industry	-	3	-	3
Research	-	-	2	2
Total	9	17	11	37

All interviews during the main fieldwork were digitally recorded (with permission of the interviewee) except on two occasions when the interviewees requested not to be recorded. In all interviews, notes were also made during the interviews to both highlight key areas of the discussion for later reflection, and to note any behaviours exhibited by the interviewee that needed to be reflected upon during analysis, for example, whether the interviewee seemed anxious or nervous, or uncomfortable about the topic, and therefore whether the conversation may not serve as an accurate account of the issues being discussed.

3.2.2 Household survey

Surveys are best suited to building descriptive data about a situation, rather than exploring how, or why something has occurred (Robson 1993). To survey households, questionnaires were used in the case studies in order to collect data on household characteristics, livelihood activities and relational data to construct the social network analysis (section 3.3.1). The household was selected as the preferred unit for analysis as, according to Ellis (2000), individual action cannot be interpreted without the context of the social and residential space, or in other words the household that is occupied by that individual. The household is also a widely accepted level for analysis, especially within research on the human dimensions of climate change (Thomas *et al.* 2007; Sallu *et al.* 2010; Antwi-Agyei *et al.* 2012). Questionnaires were conducted with the household head to provide information from across household members (Jansen *et al.* 2006). If this was not possible another adult household member was interviewed.

The household questionnaire that was developed and employed in this research is provided in Appendix 1. The questionnaire was structured so that where possible questions about livelihoods were asked first before asking about climatic events so as to not bias the respondent into focusing on climate issues, or in a particular direction (Kitchin and Tate 2000). The questionnaire comprised four main sections:

Section A: *Demographic* information to determine the composition of the household, dependents, economically active, etc. This provided context to the responses given in later sections, and supported the development of the social network (section 3.3.1).

Section B: *Livelihoods and assets* - this section investigated the types and levels of assets that the households have including amount of land, as well as activities undertaken including the types of crops grown and/or fish caught as well as how these vary during floods or droughts.

Section C: *Social network* data was collected through a series of questions that predominantly made use of recall methods rather than recognition of village members (Crona and Bodin 2006). This ensured a complete network was generated from the individual's perspective, as well as providing space for respondents to detail any networks that extend beyond the village level. Respondents were asked to provide the names and strength of ties for each of these relations during times of stress, and during an absence of stress.

Section D: *Climate variability and change* - this section asked about what changes had been observed in the weather over the last 20 years.

Early analysis was undertaken on questionnaire data to support the selection of respondents for semi-structured interviews (section 3.2.3). The questionnaires were conducted with every household within the village, to ensure as complete a social network as possible could be constructed (section 3.3.1). Issues specific to the social network analysis questions are discussed in Chapter 5 .

During phase 1 and 2 of the main data collection (Table 3.4) questionnaires were translated in Lutooro and Lukonjo by the team of research assistants. This involved an iterative process whereby a question would be translated by one assistant, with a second assistant translating it back into English without seeing the original question to check for accuracy and meaning in the translation. Preliminary testing of the questionnaire resulted in refinement to some of the questions before conducting the questionnaire with the rest of the community.

3.2.3 Semi-structured interviews

Semi-structured interviews were conducted with selected households in each community. Section A and B of the household questionnaire captured data that was used to select households for interviews. Livelihood characteristics are acknowledged in the literature as an important factor in shaping household vulnerability and adaptive capacity, and

therefore support the stratification of respondents into cohorts for sampling (Paavola 2008; Sallu *et al.* 2010). Livelihood strategies were created by compiling the different combinations of activities each household undertook, and then generating groups with a similar (mix of) activities. The livelihood strategies and the mix of activities included in each strategy along with the number of households included in that strategy are shown in Table 3.7.

Table 3.7 Household livelihood strategies and number of households sampled for interviews.

Strategy	Activities	Number of households†	Number of interviews‡
Kigando			
Crop	Crop	28 (25%)	2 (4)
Diversified Crop	Crop and a natural-resource related activity or livestock keeping	69 (64%)	14 (10)
Service	Crop and a natural-resource related activity or livestock keeping, and a service-based activity.	11 (11%)	1 (1)
Total	**-**	**108**	**17 (15)**
Kahendero			
Fish	Fishing	30 (16%)	3 (3)
Diversified Fish	Fishing and crop and/or a natural-resource related activity	82 (43%)	9 (9)
Crop	Crop and/or natural-resource related activity	24 (13%)	2 (3)
Service	Service based activities (maybe supported by crop, natural-resource of fishing activities	51 (27%)	5 (5)
No activity	No activity (rely on remittances or support).	3 (2%)	0 (0)
Total	**-**	**190**	**19 (20)**

†Parentheses show percentage of all households in the village.
‡Parentheses show targeted number of interviews for that cohort.

Households were selected in order to capture in-depth information relating to the research questions (Creswell 2009). In Kigando, 15 households were targeted and in Kahendero, 20 households were targeted. Sampling was designed to ensure a representative sample of households in both villages was selected (Table 3.7). During the household questionnaire, it was noted whether a household was willing to participate in further interviews. Sample sizes were calculated based on livelihood strategies, and

households were purposefully selected for interview based on their availability, livelihood strategy, and willingness to participate in the next stage of data collection. In addition, households were selected to include a mix of male and female household heads, different ages of household heads, and households from across the wealth profile of the village (based on the PCA detailed in section 3.3.1). Household absence during the interview phase also meant some households were not available to be interviewed, thereby accounting for the difference between targeted and actual number of household interviews, as shown in the right-hand column in Table 3.7.

Semi-structured interviews provided more detailed, context-specific information on livelihoods, coping strategies and the different institutions that affect what households do (Dunn 2005). An interview protocol was developed to ensure all households were asked about the same topics, however open questions were used so to enable respondents to raise issues and direct the interview to issues most relevant to them (Valentine 2005). Interview protocols are provided in Appendix 2.

Household interviews were conducted in Lutooro or Lukonjo. Whilst the research assistants had been trained on the research project, the need for follow-up questions to be asked during these interviews meant the interview was translated *in-situ*: I would ask a question to the respondent which would be translated directly to them, they would respond and their response would be translated back into English by the research assistants. Whilst this process interrupted the flow of the interview, it enabled interesting lines of enquiry to be followed up immediately. There is however a risk of interviewee-translator rapport developing through this process, and efforts such as me introducing myself in Lutooro or Lukonjo were used to help support an interviewee-researcher relationship to develop (Smith 2003).

3.2.4 Document and data collection

In addition to the household surveys and interviews, various policy documents and plans were reviewed. The research did not undertake a full review of these plans, but instead used them to add context and assist in interpretation of the data collected elsewhere, and to inform the interview protocol for key-informants.

Plans reviewed included:

1) NAPA (National Adaptation Programmes of Action) (2007)
2) PEAP (Poverty Eradication Action Plan) (2004/5-2007/8)
3) PRSP (Poverty Reduction Strategy Paper) (2010)
4) The National Disaster Preparedness and Management Policy (2010)
5) National State of the Environment Report (2008)
6) District State of the Environment Reports (for Kasese District) (2004)

3.3 Data Analysis

Data collected through the methods described above were analysed using a variety of different techniques. Broadly speaking, quantitative data were analysed separately to qualitative data, with the results from both being integrated during interpretation of the results. Largely, each objective required its own specific analysis technique (Table 3.5): the specific analysis required for objective 1 is detailed in Chapter 4 (section 4.3) and Chapter 5 describes in detail the social network analysis (SNA) techniques that were undertaken in order to meet objective 2 (section 5.3). The analysis undertaken to meet objective 3 (as reported in section 6.2,) is largely qualitative content analysis of interview data undertaken with NViVo software Version 10 (QSR 2012).

3.3.1 Quantitative data analysis

Preliminary data analysis was conducted in the field to enable the stratified sampling of households for in-depth semi-structured interviews. This used SPSS (Version 20)(IBM 2011) to support the selection of households, and to undertake the PCA to develop the relative wealth ranking, which is used for analysis in Chapter 4 and Chapter 5 . SPSS was used to undertake frequency analysis and descriptive statistics on questionnaire data. Chi-square tests for independence were used to determine relationships between household characteristics and livelihood and coping strategies, and are discussed in Chapter 4 .

3.3.1.1 Principal Component Analysis (PCA)

Given the level of subsistence activity in the villages, it was not appropriate to directly record mean income within the household survey. Participatory wealth ranking exercises,

whilst argued to be more accurate than assessing wealth through a questionnaire of household assets (Chambers 1994), were not undertaken due to the time demand already placed on households (see section 3.2). Instead, estimated wealth levels were computed using asset indicators to create a relative wealth index, a method recommended when income and consumption data is not available (Filmer and Prtichett 2001; Córdova 2008), for example, in rural livelihoods research it is difficult to get exact income and wealth information given the subsistence nature of livelihood activities. Although asset-based measures are better at reflecting long-term household status (Booysen *et al.* 2008) rather than short-term fluctuations that might result from coping with shocks, this remains a suitable method to use when income and wealth information is not available: several studies now adopt this method to estimate wealth levels (Muhumuza *et al.* 2009; Liebenow *et al.* 2012).

Following these studies, this research used a Principal Component Analysis (PCA) in order to assign weights to a range of household assets that were asked about in the household survey. These weights form an index of assets that was used to generate a proxy for wealth, referred to as a '*wealth index*'. This process enabled assets that vary the most across households to be assigned a larger weighting than assets that are found more commonly across the households. The wealth index is defined, for a household *I,* as:

Equation 1:
$$y_i = \alpha_1\left(\frac{x_1 - \overline{x_1}}{s_1}\right) + \alpha_2\left(\frac{x_2 - \overline{x_2}}{s_2}\right) + \cdots + \alpha_k\left(\frac{x_k - \overline{x_k}}{s_k}\right)$$

Where $\overline{x_k}$ and s_k are the mean and standard deviation of asset x_k , and α represents the weight for each variable x_k for the first principal component.

Weights for each asset were computed using the data combined from both villages together, given the number of cases required to undertake a PCA (Tabachnick and Fidell 2013). There is substantial debate in the literature regarding the number of cases required for a PCA (MacCallum *et al.* 1999), varying both on the total number of cases required as well as the case to variable ratio (i.e. number of households to number of assets). This varies from the minimum number of cases being 100 up to 1000, as well as the ratios

ranging from 2:1 (with a minimum of 100 cases) up to 20:1. Given that the sample size in Kigando was just above the minimum number of cases (108 households) and that both sub-counties have similar reported levels of poverty (44% Maliba and 49% Muhokya, KDLG 2012), the samples were combined to create the wealth index. The appropriateness of the PCA was assessed using the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy to assess the correlations and pattern between variables (Hair *et al.* 1998). KMO values above 0.50 are acceptable but those nearer 0.7 and above are more appropriate (Mooi and Sarstedt 2011). Table 3.8 summarises the results of the PCA for the combined dataset.

Table 3.8. Results from Principal Component Analysis to determine Factor scores for the asset-wealth index

Assets	Mean	Std. Dev.	Factor Score
Radio	68%	0.465	-0.106
Motorcycle	7%	0.256	0.129
Bicycle	22%	0.416	0.084
Mosquito Net	67%	0.471	0.010
Generator	2%	0.141	0.478
Solar Panel	1%	0.115	0.433
Mobile Phone	62%	0.485	-0.099
Television	2%	0.141	0.359
Lantern	42%	0.494	0.073
Torch	58%	0.494	-0.138
Largest Eigenvalue, λ	2.080		
Proportion of Variance Explained	20.802		
Kaiser-Meyer-Olkin	0.668		

Table 3.9 shows the number of households assigned to each wealth group. In order to assess the internal validity of the wealth index, quartiles of wealth were computed based on the index to assess the characteristics of households within each village respectively. Table 3.10 shows the percentage of asset ownership within each wealth group, as well as the average wealth across the quartiles. Clear increases are observed in ownership of a motorcycle, bicycle, generator, solar panel and lantern. Average wealth scores increase wealth group by wealth group.

Table 3.9. Asset group distribution (number of households and percentage)

Asset Classification	KIGANDO		KAHENDERO	
Extremely Poor	39	36.1%	104	54.7%
Poor	27	25.0%	32	16.8%
Moderate	23	21.3%	37	19.5%
Relatively Wealthy	19	17.6%	17	8.9%

Table 3.10. Internal validity of Wealth Index: Results based on the First Principal Component (all households combined, n=298)

Quartiles of wealth	*"Extremely Poor"*			*"Poor"*			*"Moderate"*			*"Relatively Wealthy"*		
	1			2			3			4		
Asset	Overall	KIG	KAH	Overall	KIG	KAH	Overall	KIG	KAH	Overall	KIG	KAH
Radio	90.9%	92.3%	90.4%	55.9%	70.4%	43.8%	30.0%	39.1%	24.3%	63.9%	57.9%	70.6%
Motorcycle	0.0%	0.0%	0.0%	1.7%	0.0%	3.1%	10.0%	4.3%	13.5%	38.9%	36.8%	41.2%
Bicycle	15.4%	17.9%	14.4%	22.0%	18.5%	25.0%	23.3%	34.8%	16.2%	47.2%	42.1%	52.9%
Mosquito Net	69.2%	74.4%	67.3%	67.8%	66.7%	68.8%	46.7%	65.2%	35.1%	91.7%	89.5%	94.1%
Generator	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	16.7%	15.8%	17.6%
Solar Panel	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	11.1%	5.3%	17.6%
Mobile Phone	82.5%	84.6%	81.7%	52.5%	48.1%	56.3%	28.3%	21.7%	32.4%	55.6%	36.8%	76.5%
Television	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	16.7%	0.0%	35.3%
Lantern	31.5%	20.5%	35.6%	37.3%	40.7%	34.4%	50.0%	34.8%	59.5%	77.8%	73.7%	82.4%
Torch	82.5%	71.8%	86.5%	50.8%	37.0%	62.5%	26.7%	13.0%	35.1%	27.8%	10.5%	47.1%
Average wealth (mean scores for First Principal Component)	-0.3942	-0.3817	-0.3990	-0.1343	-0.1304	-0.1377	0.1007	0.1076	0.0964	1.6184	1.0164	2.2913

3.3.2 Qualitative data analysis

All semi-structured and key informant interviews were audio-recorded, except for two district key-informants who requested not to be recorded, and for which notes were written up immediately after the interview. All data were then transcribed and transcripts imported into NVivo to enable thematic analysis. The researcher undertook all the transcription (given the interviews were translated *in-situ*, section 3.2.3), using the audio recordings to ensure no information had been missed which also enabled re-familiarisation with the data, and for the interview to be revisited during later analysis. Transcribing was undertaken predominantly in the field to enable reflection on key themes for follow up in subsequent interviews.

Creswell (2009) suggests that analysis of qualitative data contains three stages: 1) the preparation and organising of the data; 2) using coding to reduce the data into themes; and 3) presenting the data. In this research, material was coded for both descriptive and analytical codes (Hay 2010) in order to identify themes that were identified directly by the participants (descriptive) as well as underlying themes that reflected processes relevant to the role of institutions in adaptation (analytical). Initial themes and codes were generated based on specific observations (i.e. 're-plants after flooding' as one code, and 'digs trenches to divert water' as another code). As coding proceeded, codes were linked into hierarchical codes grouping together similar codes and enabling key themes to be identified in order to meet the research objectives.

Data were revisited separately for each research objective enabling new connections between different strands of the data to be generated. This was done to ensure that no relevant data was overlooked as a result of trying to undertake too broad an analysis on all objectives at once. At the household level, both villages were coded within the same file to allow for similarities and differences between contexts to be identified. Matrix coding queries were run on the coded data from household interviews in order to identify household and village trends in the data (outlined in more detail in Chapter 4).

3.4 Research reflections

3.4.1 Limitations

Inevitably there are limitations within this research. Key limitations of specific data collection and analysis methods have been identified in the earlier discussions of each method. An overarching limitation of this research is the resource constraint which led to the selection of only two case study villages. This has been discussed in section 3.1.

Whilst studies interested in natural resource governance and climate change have considered ethnicity and religion (Warren-Rhodes *et al.* 2011; Nielsen and Reenberg 2010; Onta and Resurreccion 2011), these were not focused upon in this research. Examining other variables, such as social assets, connections and livelihood activities were prioritised within the resources available to conduct the data collection, and the time required for analysis. Furthermore, during the interviews, ethnicity and religion were not identified as key issues by respondents. By not asking respondents about these issues, it could be argued that they would not be raised. However, the inductive approach taken by this research focused upon the issues that were raised by respondents, rather than imposing research topics on them. It should be noted that ethnicity and religion can be important factors within a sub-Saharan Africa context and should be considered in future work.

3.4.2 Positionality

Twyman *et al.* (1999) have stressed the importance of a researcher being aware of how their (and their research team's) positionality can influence the interaction between them and their respondents. I was not just an outsider to the case study villages involved in this study, but an outsider to the wider Uganda context. The power-relations and challenges cross-cultural research brings is increasingly recognised in the literature (Scheyvens and Leslie 2000; Howitt and Stevens 2005). To counteract the effects of this, I recruited and trained research assistants who came from Kasese district, and therefore had similar cultures, ethnicities and languages as the respondents. My research assistants, Baluku Gerald and Tembo Gerald were two male University graduates from Kasese District who had experience in social research. Whilst they helped address some of the power issues, inevitably even these researchers were seen as outsiders from the villages themselves.

I had gained contact with and entry into the two villages through a local NGO, FURA (the Foundation for Urban and Rural Advancement). This provided many advantages in that it enabled me to gain background context about the villages whilst also providing contacts to approach in the villages. In both villages, through the support of FURA, I was able to meet with the Village Chairperson to discuss the objectives of the research and to seek permission to undertake the surveys and interviews in their village. When presenting the research, I was introduced as a student from the University of Leeds, and even though we (the research team) had arrived in the village with FURA, it was stressed that the research was independent of the organisation. This was reiterated to all participants during the surveys and interviews. I was as explicit as I could be that the research was not conducted by FURA, but given how the NGO has been and remains active in the village, this is likely to have shaped village responses, as well as how I was perceived.

During the research, I was working with households who had previously interacted with 'whites': NGOs, tourist organisations and even some other researchers that have worked in the area, which had led to certain expectations from participants, such as money for their time (Scott *et al.* 2006). In order to provide consistency and fairness across the villages, and to not risk coercion into the research, no requests for money were met. Although challenging at times, no participants were paid or rewarded for their time, and all participants have been anonymised in the reporting of the research. This was fully explained before each survey and interview, and respondents voluntarily participated in the research. However, I developed good relations with several of the households and supported residents where possible, for example by providing lifts to/from trading centres at the end of each day in the village, which was perceived by many as a positive thing.

We (myself and research assistants) had planned to stay in each village for the duration of the fieldwork in order to develop a better relationship with households, generate a deeper understanding of the context of each village, and enable observations to support the main data collection. Both village chairpersons however were insistent that this was not possible given the lack of water supply and power. Although I would have been able to plan around this, village leaders were keen that instead I should travel in each day from the main town. Whilst this inevitably led to increasing perceptions of me as an outsider, having explained my preference to live within their community I had to respect village requests to not stay within the village. An unforeseen benefit of this was that it enabled access to electricity

each night so that data could be processed and early analysis undertaken in order to identify themes to pursue whilst in the field.

3.4.3 Ethical implications

This study has approval by the University of Leeds Ethics Review Committee (Reference number AREA 10-116) and therefore has considered the protection of participants and the processes that led to data generation, thus supporting the credibility of the research (Blaikie 2000). Further approval was given by the Uganda National Council for Science and Technology (UNCST) (Reference SS 2550). Copies of consent forms and information sheets used during the study are provided in Appendix 3.

Participation in the research was voluntary for all participants. For household questionnaires, an information sheet was read to participants, which included a summary of the research, assurance that any information they provided would only be used for the research, and that they would be anonymised in reporting, thus enabling households to freely decide if they wanted to participate (Guillemin and Gillam 2004). Informed consent was verbally obtained and space was provided on the questionnaire for research assistants to confirm this had been made. At the end of each survey, household respondents were asked if they had any specific questions and also whether they would consent to participate in a one-hour interview in the later stages of the research. Even where this permission had been given, consent was also taken again on the day of the interview, often on the electronic recording of the interview.

For key-informant interviews, information sheets and consent forms were provided to participants. The participant was able to keep the information sheet and the signed consent form was retained by the researcher.

Data (both hard and electronic versions) were only shared within the research team, and research assistants were fully trained about the need for participant confidentiality. Training of research assistants included a process of familiarising the assistants with the topic, and allowing them time to digest the information and 'interview' me about the research. This was helpful in them gaining more of an understanding about my interests specifically, rather than the broader area of climate change impacts and social survey that they had backgrounds in. A thorough process of training and familiarising the research

assistants with the surveys and interviews was undertaken, including translating the material into local languages.

3.5 Summary

This chapter has outlined the research design and methodology used in this research. It has described the overall case-study approach. Mixed-level, multi-method approaches are used within a case-study framework: qualitative and quantitative approaches together enable an enquiry into the institutions and networks that are involved in household coping and adaptation. The process and justification for the selection of Uganda, Kasese district, and the two villages of Kigando and Kahendero were outlined and discussed: situating the research in a real-life context enables context-specific issues to be explored in detail. The villages selected, and Kasese District as well as the national context of Uganda provides evidence from cases that resemble the wider sub-Saharan Africa context.

The various techniques that were used for both data collection and analysis have been discussed and specific detail on these methods is provided in the results chapters that used that method (Chapters 4, 5 and 6) in order to provide a greater discussion about the methods and current understanding of the use of these methods. The use of Social Network Analysis in this study required all households in both villages to be surveyed. There was a further time demand placed on households through the need to undertake household interviews to gain the necessary in-depth understanding.

My positionality as a researcher in this project and the ethical implications of the research has been considered. There are challenges and constraints of working as an 'outsider' in Uganda and efforts to alleviate this were managed through the recruitment and training of research assistants. By following the methods outlined in this chapter, data were collected that enabled the interrogation of the objectives outlined in chapter 1. The remainder of the thesis now presents and discusses the results that were obtained by following the approach outlined in this chapter. The next chapter addresses the first of the research questions, to identify past and present household coping strategies to floods and droughts in two communities in Uganda.

Chapter 4 Identifying drivers of household coping strategies to multiple climatic hazards in Western Uganda: implications for adapting to future climate change[5]

Summary

This chapter investigates what drives household coping strategies in rural Uganda under different climatic hazards. Rural households in sub-Saharan Africa draw on various coping strategies to reduce the impact of climatic hazards on their livelihoods, yet research to date provides only limited understanding of how the coping strategy portfolio of households changes depending on the climatic stress. Using empirical data from Uganda, this chapter contributes to this gap by 1) exploring how household coping strategy relates to household characteristics and livelihood activity; and 2) how these coping strategies vary depending on the hazard. Coping strategy is found to be hazard specific for households that lack market-orientated activities, whereas those with market-access rely on economic activities regardless of hazard. To maintain and improve the livelihoods and coping strategies of those most vulnerable to climatic variability and change, policies that advocate diversification away from a sole reliance on customary activities need to recognise the level and opportunity for market-based activities. Environmental, resource, income and diversification drivers shape different support mechanisms due to the different coping strategies they enable. Interventions must account for different sensitivities to different hazards as well as the homogeneity of the community in order to effectively support rural communities to cope with climate variability.

[5] This chapter is developed from the published article "Berman, R.J., Quinn, C.H., and Paavola, J. (2014) Identifying drivers of household coping strategies to multiple climatic hazards in Western Uganda: implications for adapting to future climate change, *Climate and Development*, DOI:10.1080/17565529.2014.902355

4.1 Introduction

Rural communities across the developing world use various coping strategies in response to poverty, food insecurity, conflict as well as environmental stresses; all challenges which are compounded by climate change and variability. The Intergovernmental Panel on Climate Change reports that parts of Africa may experience longer and more intense droughts, with other areas experiencing more erratic rainfall (IPCC 2012). As a result, communities may experience environmental stressors that are beyond their previous knowledge (Adger *et al.* 2003). Amongst the most vulnerable will be communities who depend on rain-fed agriculture and natural resource related activities. These communities will not only be impacted by changes in mean climate, but may experience greater impact from climate variability, including extreme events (Smit and Pilifosova 2001).

Early studies have examined slow-onset climatic hazards, such as droughts (Roncoli *et al.* 2001), as well as household responses to rapid-onset events such as floods (Motsholapheko *et al.* 2011), showing the importance of short-term labour switching, as well as longer term diversification. The majority of these studies focus on one stress, whilst a few have addressed strategies used to cope with multiple stresses (Osbahr *et al.* 2008; Quinn *et al.* 2011) with the latter remaining focused on the variety of strategies used. It is widely acknowledged that better understanding farmers' adaptation processes will enable more targeted and appropriate climate adaptation policies (Adger and Vincent 2005). This chapter therefore provides empirical evidence that helps attribute preferred strategies to specific stresses, with a focus on understanding the factors that shape this choice of strategy. In addressing objective 1 of this research, this chapter also provides evidence on the different coping strategies undertaken by households in the two case-studies. By providing this evidence, Chapters 5 and 6 are then able to explore the institutions that shape these strategies in more detail.

Different hazards cause different impacts. Therefore the association of household responses with hazards must be better understood to target policy and resource allocation. Where studies have previously tried to attribute strategies to stress, for example such as (Hisali *et al.* 2011) in Uganda, they have done so at a national level, thereby not accounting for the impact of local contexts. Place-based studies help us to understand the role of context specific factors (Eriksen *et al.* 2005b) which must be accounted for if associated policies are to benefit those they target. For this reason, this

chapter examines drivers of household coping strategies to floods and droughts in two communities in rural Uganda. The specific objectives of the chapter are:

1) to identify the coping strategies used by households in response to floods and droughts;
2) to examine the factors that influence choice of strategy;
3) to explore the potential implications this may have for adaptation policy in rural communities.

This chapter uses a mixed-methods approach with quantitative household surveys and qualitative interviews to identify factors that influence households' responses to climate variability and change. Both floods and droughts are related to extremes in precipitation (IPCC 2012), with drought commonly defined as "a period of abnormal dryness" (IPCC 2012, p558) and floods recognised as "the accumulation of water over areas not normally submerged" (IPCC 2012, p559). Households currently cope with floods and droughts as part of intra-seasonal weather variability. Climate projections for Uganda include both increased and decreased rainfall (McSweeney *et al.* 2010), and therefore this uncertainty makes it important to investigate both flood and drought events.

These results contribute towards understanding how adaptation and development policy can better support rural communities facing multiple climatic stresses. Adaptation research has focused on the marginal or most vulnerable, with targeted policy recommendations for coping strategies to (general or a single specific) stress. This chapter identifies that the levels of market access affect whether households vary coping strategy by hazard. Moreover, the ability to cope with one climatic hazard does not provide assurance that the same coping strategy will be successful with other hazards. Yet policy recommendations to diversify towards market-based activities do not guarantee the enhancement of current coping capacities. Interventions must recognise and account for different hazards, varying levels of homogeneity in community activities, and community specific contexts.

This chapter now discusses current understanding on how households in rural areas cope with climate induced hazards (section 4.2). Following this, section 4.3 provides a brief discussion on the methods that are specific to this chapter so to build on the overall methodology that was presented in Chapter 3 . Section 4.4 presents the results of the

analysis of household coping strategies, with the implications of these results further discussed in section 4.5.

4.2 Coping with climate induced hazards in rural households in Uganda

How rural households in natural resource dependent communities respond to and cope with livelihood shocks has been examined through the use of the Sustainable Livelihoods Framework (SLF) (Chambers 1987; Scoones 1998) as discussed in Chapter 2 . The SLF is now commonly used to help understand how rural livelihoods are diversified as part of a strategy to cope with shocks (Ellis 1998). For example, livelihood diversification includes diversification of income sources from farm to non-farm income (Paavola 2008), agricultural diversification including the use of better suited crop varieties (Deressa *et al.* 2009) and migration, often to provide remittances (Konseiga 2006). Whilst livelihood diversifications are considered as planned changes made in response to stress, coping strategies are widely understood as impromptu responses to sudden shocks (Ellis 1998). Therefore short-term adjustments to a households' livelihood portfolio or drawing on available capital assets to minimise the effects of sudden shocks are common place. For example, drawing on savings, consuming food stocks, or selling livestock are undertaken depending on the context of both the shock and household (Oyekale and Gedion 2012; Thornton *et al.* 2007; Chuku and Okoye 2009). Investigations into coping and adaptation are often differentiated between risk management approaches focused on hazard-coping strategies and adaptation considering the impacts of climate change (Agrawal 2008). For example, selling assets may be a strategy adopted by a household to cope with a drought, whereas they may adopt more drought tolerant crops as means to adapt to an increasing drought trend (Birkmann 2011). Therefore whilst the focus here is on coping, discussions on household coping strategies to floods and droughts are often relevant to discussions on household adaptation, and vice-versa.

Across the climate change literature, household coping strategies have been considered from both hazard vulnerability and political economy perspectives. Early studies considered hazard impact to be determined by the biophysical characteristics of an event (Liverman 1990; Lewis 1999). This perspective views differences between the impacts of floods and droughts to result from how rapid-onset events such as floods may occur with

limited warning, thus requiring an immediate response in order to reduce their impact (Blaikie *et al.* 1994) whilst slower-onset droughts often have long lead-up times, providing opportunity to prepare for the event. Recent studies however, have focused on the 'root causes' of hazard vulnerability and how the severity of the impact has, in part, socio-economic sources (Pelling 2003). That is, whilst two households may have the same asset base and livelihoods, in different locations they will be embedded within different social, political and economic systems: individual circumstances will determine whether a household can take advantage of the opportunity to prepare for a hazard, rather than the characteristics of the hazard itself. Typically, floods are relatively short term hazards compared to droughts, which may last many months. However, floods in sub-Saharan Africa have been known to last several months, such as the floods in Mozambique in 2000 (Hellmuth *et al.* 2007). Significant attention is now given to understanding how the wider processes, power relations and values of society shape both hazard vulnerability and the success of associated household coping strategies (Adger 2003; Brooks *et al.* 2005; Adger *et al.* 2009).

Where the wider adaptation literature has sought to better understand coping and adaptation responses, there is now a broadly recognised set of factors that are known to potentially influence the adoption of a particular coping strategy. For example, behavioural factors such as risk perception, as well as socio-economic characteristics such as education, wealth, age and gender are all argued to shape choice of coping strategy (Grothmann and Patt 2005; Deressa *et al.* 2009; Below *et al.* 2012; Hisali *et al.* 2011). Whilst these factors are known, and the range of coping strategies used by African farmers is broadly understood (see for example Below *et al.* 2010), there is still a need to better understand how these factors drive the adoption of particular strategies depending on the particular hazard experienced. The literature that has focused on coping with different hazards has made little separation between specific hazard events. For instance, Osbahr *et al.* (2008) found in Mozambique that diversification and collective land-use management were both used in response to climatic disturbances. However these responses were analysed in combination with responses to food security and poverty, without differentiating between shock-specific strategies. Kristjanson *et al.* (2012) explored the relationship between food security and adaptation: whilst food insecure households undertook fewer adaptive actions, the relationship is too complex to recommend any single solution. In Uganda, other studies have shown that selling livestock is widely used to

deal with covariate natural disasters, but individual climatic shocks remained unaccounted for (Helgeson *et al.* 2013). Therefore explicitly identifying how factors such as wealth, age and choice of livelihood affect coping strategies for particular hazards contributes towards further understanding the drivers of climate adaptation activities, especially considering the ways different farmers may perceive climatic variations (Osbahr *et al.* 2011).

Strategies to cope with multiple stressors are important. Adaptation (and coping) strategies do not automatically reduce household poverty, just like poverty reduction activities do not automatically improve capacity to respond to climatic stresses (Eriksen and O'Brien 2007). There are complex dynamics that exist in determining levels of poverty (see for example Okwi *et al.* 2007; Krishna *et al.* 2006). The literature provides valuable arguments concerning the need to consider both the direct impact of other stressors, and how coping with one stress can indirectly shape responses to others. This 'double exposure', as it is termed, has been examined to better understand how climate, environmental, economic and political shocks can compound each other (Silva *et al.* 2010; O'Brien and Leichenko 2000). Furthermore, similar tensions can be found as a result of the temporal difference between hazards. For example, as Tarhule (2005) found, households prone to drought may relocate closer to water sources to cope with reduced water availability, yet in doing so increase their exposure and vulnerability to unexpected short term shocks such as flooding. Comparably, coping strategies to short term shocks will differ from those used for long term trends, or between rapid onset and slow-onset events. Research into coping with multiple stresses has challenged perceptions about those most vulnerable to environmental stress, showing the need to consider those directly *and* indirectly affected (Hjerpe and Glaas 2011; Quinn *et al.* 2011). If analysing multiple stressors reveals new 'winners and losers' (O'Brien and Leichenko 2000), then likewise analysing multiple climatic hazards can substantially contribute towards current climate adaptation debates.

This review has shown how both context specific drivers and more generalised factors are important in understanding choice of coping strategy. Whilst different characteristics of floods and droughts may dictate particular responses, there still remains limited research into understanding other factors that differentiate choice of coping strategy for different hazards. The following analysis focuses on the socio-economic factors identified in this review as important for coping, such as livelihood activity and wealth, and how these

factors shape the response to different hazards, thereby contributing to the understanding of determinants of household coping strategies under multiple climatic hazards.

4.3 Methods

The two villages of Kigando and Kahendero provide evidence from locations with different customary and market-based opportunities, thereby enabling an exploration of the range of strategies used by different households, whilst remaining largely representative of villages in the wider Kasese district. Between January and June 2012, 108 households in Kigando (96%) and 190 in Kahendero (76%) were surveyed to capture information on household demographics, assets, and livelihood activities, the perceived impact of floods and droughts on activities, and market access (as set out in section 3.2.2). Post-survey, selected households were purposefully sampled to obtain a cross-section of respondents across different ages, genders, education levels, wealth, and livelihood activities (n=17 in Kigando and n=19 in Kahendero) for in-depth interviews. Interviews and surveys enabled triangulation of the data, supported by observation and informal conversations.

Semi-structured interviews were coded for household coping strategies during flood and drought events. These strategies were analysed through both qualitative interpretation and statistical association. Analyses of survey data were undertaken using descriptive and analytical statistical methods. Most variables such as gender, age and education level of the household head were obtained directly from the survey with the exception of both livelihood strategies and wealth, which were computed as part of an interim analysis, set out in the following section.

4.3.1 Characterisation of case studies and development of socio-economic indicators

The surrounding environs, and associated resource constraints, of both Kigando and Kahendero shape the different activity profiles of the two communities. Fisheries based livelihoods are afforded to residents in Kahendero by its lakeshore location, whereas crop farming and livestock keeping are restricted due to the proximity of Queen Elizabeth National Park (QENP) and therefore the presence of wildlife corridors and reduced

availability of land. Livestock keeping is more prevalent in Kigando, because of grazing land within the neighbouring forest reserve. However, in Kigando the distance to markets and limited trading within the village limits the engagement of households in market-based activities. Market access, indicated by the frequency to which households visit a market (to buy or sell goods) was greater in Kahendero: 70% of respondents directly accessed a market at least twice a week, compared to just under 40% in Kigando. Therefore whilst households in both villages had at least some degree of market access, this was more substantial in Kahendero. The livelihood strategies and associated activities were introduced in section 3.2.3, and are provided again in Table 4.1 alongside the proportion of households undertaking each activity per season.

Table 4.1. Livelihood strategies and proportion of households undertaking each strategy (both annually and per season)

Strategy	Activities[†]	Overall	Wet Season	Dry Season
Kigando				
Crop	Crop	28 (25%)	28 (25%)	36 (33%)
Diversified Crop	Crop and a natural-resource related activity or livestock keeping	69 (64%)	69 (64%)	62 (58%)
Service	Crop and a natural-resource related activity or livestock keeping, and a service-based activity.	11 (11%)	11 (11%)	10 (9%)
Kahendero				
Fish	Fishing	30 (16%)	44 (23%)	51 (27%)
Diversified Fish	Fishing and crop and/or a natural-resource related activity	82 (43%)	68 (36%)	59 (31%)
Crop	Crop and/or natural-resource related activity	24 (13%)	34 (18%)	35 (18%)
Service	Service based activities (maybe supported by crop, natural-resource of fishing activities	51 (27%)	41 (21%)	40 (21%)
No activity	No activity (rely on remittances or support).	3 (2%)	3 (2%)	5 (3%)

†In both villages, 25% of households surveyed engage in only one activity. Out of this 25%, in Kigando, this was all crop farming and in Kahendero, fishing = 57%, service-based = 18%, trading food stuffs = 12% and crop farming = 6%.

Whilst section 4.2 identified wealth as a key factor to be investigated it was not possible to directly record income during the survey due to the variation in dependence on subsistence activity across both villages. Instead, estimated wealth levels were computed using asset indicators to create a relative wealth index through a Principal Component

Analysis (as set out in section 3.3.1) (Filmer and Prtichett 2001; Córdova 2008). In summary, assets that vary most across households carry greater weight, thereby giving households that have these assets a higher wealth rank. Wealth groups were then computed for each village based on the wealth index score of each household: average wealth scores were greater in Kahendero than in Kigando (except the *moderately wealthy*) and the majority of households in both villages were '*very poor'* (Table 4.2).

Table 4.2. Distribution of wealth groups and average wealth rank in each village

Classification	KIGANDO			KAHENDERO		
	Households		Ave.	Households		Ave.
	(Number)	(Percent)	Wealth†	Number)	(Percent)	Wealth†
Very Poor	39	36.1%	-0.3817	104	54.7%	-0.3990
Poor	27	25.0%	-0.1304	32	16.8%	-0.1377
Moderate	23	21.3%	0.1076	37	19.5%	0.0964
Relatively Wealthy	19	17.6%	1.0164	17	8.9%	2.2913

†Mean scores for First Principal Component

4.3.2 Socio-economic drivers of livelihood strategy

The mixed-methods approach used in this study required a preliminary analysis of the quantitative survey data to provide context for the main analysis. The following analysis examines how socio-economic household characteristics vary by livelihood activity. This informs the interpretation of this chapter's main results, that is, what drives choice of coping strategy.

In Kahendero, there is a statistically significant relationship between livelihood strategy and education, gender and wealth[6] (Table 4.3). Service-related activities were undertaken by more educated households, whilst less educated households undertook a mix of fishing, arable farming or other natural resource based activities. Fishing, because of custom, is dominated by male-headed households. Furthermore, where younger members of a household would have been introduced to fishing through paternal activity, this was limited in female headed households. Relatively wealthy households did not exclusively

[6] Minimum expected cell counts were violated for these tests. At least 80% of cells should have expected frequencies of 5 or more. Yet, observations made during data collection provide evidence to support these relationships.

engage in fishing, with at least half of these households relying on service related activities. In fact, 70% of households who depended entirely on fishing were either 'very poor' or 'poor'. The lack of initial investment required to work as barias (crew) made fishing a popular activity amongst the poor and income from fishing often exceeded that from crop farming. Therefore the characterisation of fishing based households' results from both higher income levels and the traditional male-dominance of fishing[7]. In contrast, the household profile in Kigando was more homogenous in terms of wealth, education level and livelihood activity, and therefore households were not easily differentiated by socio-economic variables or livelihood activity, see Table 4.4.

[7] Chi-square test for association between wealth and gender in Kahendero $\chi^2(3, n=190) = 13.501$, $p<.01$.

Table 4.3. Relationship between livelihood activity and socio-economic household characteristics

Characteristic	Kigando			Kahendero		
	χ^2	*df*	*p*	χ^2	*df*	*p*
Age	12.116	6	0.059	18.481	12	0.102
Gender	1.572	2	0.456	20.274**†	4	<0.000
Education level	4.186	4	0.381	27.392**‡	8	0.001
Wealth group	6.550	6	0.364	26.219**†	12	0.010

* $p<0.05$, ** $p<0.01$

† 40% of cells have expected count less than 5, and test for independence is violated.

‡ 3 cells (20%) have expected count less than 5. Minimum expected count is 0.70

Table 4.4. Characteristics of case-study areas

Characteristic	**Kigando**	**Kahendero**
Population	~620	~930 (fluctuates seasonally)
Gender of household head	Male: 78% Female: 22%	Male: 84% Female: 16%
Average age of household head	47	40
Education	No formal education: 31% Primary: 56% Secondary: 13%	No formal education: 23% Primary: 51% Secondary: 26%
Market access	Bi-weekly market 3km away, no market in village. Less than 40% of households access market more than twice a week.	Formal market 3km away, trading stalls erected two/three times a week, and daily fish market at landing site. 70% of households access market at least twice a week.

The varying levels of customary and market-orientated livelihood activities across the two villages combined with household characteristics and the physical environs of each village shape the context within which the following analysis of coping strategies is interpreted (Table 4.5).

Table 4.5. Household and village characteristics of customary and market-based livelihoods

	Customary-based rural livelihoods	**Market-orientated rural livelihoods**
Household	Older household heads Less educated households Poorer households	Younger household heads More educated Wealthier households
Village	Low diversity of activities Lower overall community wealth Isolated communities disconnected from markets	Wider diversity of activities Greater overall community wealth Communities connected with market opportunities
Example	***Kigando***	***Kahendero***

4.4 Results

4.4.1 Household coping strategies

Household coping strategies vary depending on the hazard experienced (Figure 4.1). The most common flood coping strategies were *agricultural practises* (23%), *economic activities* (22%) and *social support* (20%), whereas during a drought these were *economic activities* (27%), drawing on *savings* (16%) and *social support* (14%). *Agricultural practices* included soil conservation during floods, and water conservation techniques during droughts, as well as climate sensitive practices such as delaying planting until the first rains, and multi-cropping. *Economic activities* included non-farm income generating activities such as market-trading, fishing and employment outside the village. Table 4.6 provides examples of the sorts of activities undertaken within each strategy.

Table 4.6 Example activities undertaken within the identified coping strategies

Strategy	Examples of activities within strategy
Agricultural practices	Agricultural management techniques such as soil and water conservation, waiting to plant until first rains etc.
Economic activities	Non-farm income generating activities such as market-trading, fishing and seeking employment outside the villages in centres of industry.
Selling assets	Selling livestock, surplus (or stored) crops and durable household assets that were previously invested in (i.e. bicycles).
Savings	Processes that enabled fiscal savings (rather than assets), typically through customary social gatherings rather than external micro-finance interventions.
Social support	Informal support networks facilitated the sharing of money, food, advice, information etc.
Labour exchange	Working on others' land in exchange for food, money or reciprocal labour at other times of the year
Sourcing food externally	Seeking food during times of low crop yield from markets beyond the village, as well as wild foraging of food from surrounding environs.

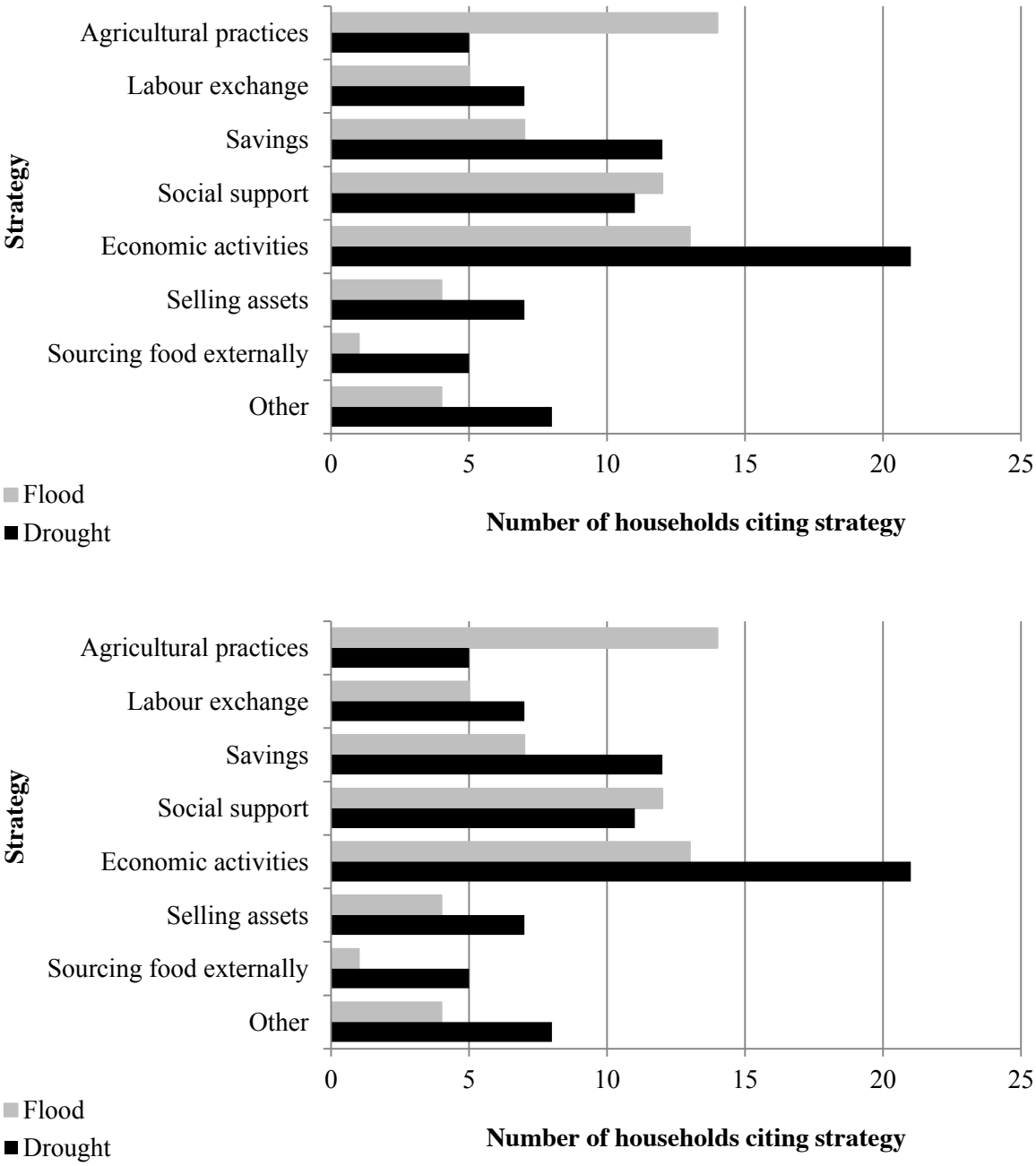

Figure 4.1. Flood and drought coping strategies identified during semi-structured interviews.

The inherent characteristics of floods and droughts lead some coping strategies to be more suited to one hazard or another. *Agricultural practices* such as digging trenches to divert flood water were most commonly used during floods rather than droughts. However, whilst respondents were aware of the benefits of mulching and water conservation techniques during periods of low rainfall, these were identified as ways to maximise crop

yields rather than as specific drought coping strategies. Likewise, *savings* and *selling assets* were more important during droughts than floods. Conserving assets during the wet season enabled households to sell them off during a drought, whereas reduced farming activity in a typical dry season made it harder to build up assets to prepare for flooding. However, differences between coping strategies adopted under different hazards still remain, as shown in Figure 4.1. Yet Figure 4.1 does not indicate whether any specific household uses the same coping strategy regardless of hazard. *Savings* (in Kahendero) and *social support* (in Kigando) were the only two strategies that were found to be used by the same households for both hazards[8], confirming that most households undertake different coping strategies during different hazards. To better understand the drivers of coping strategy it is necessary to investigate at both the household and village level.

4.4.2 Drivers of coping strategy

Socio-economic factors are important in choice of coping strategy, particularly those of age, education and wealth, as shown in Table 4.7. During floods, it was observed that older households were more likely to rely on social support than younger households. Whilst other studies argue that older farmers are most likely to reduce consumption (Hisali *et al.* 2011), this is likely to ultimately lead households to rely on *social support* to access basic levels of food and resources.

[8] Chi-squared result were for *savings* in Kahendero χ^2 (1, n=19) = 10.72 p<.01 and *social support* in Kigando χ^2 (1, n=17) = 4.38 p<.05).

Table 4.7. Household drivers of coping strategy

	Flood	Drought
Age	**Older** household heads favoured *agricultural practices*, then *economic activities* and *social support*. **Younger** household heads favoured *economic activities* and *savings*.	No differentiation with age.
Education	No differentiation with education.	**More educated** households drew on *savings* before *economic activities*. **Less educated** relied on *economic activities*.
Wealth	**Very poor** relied on *agricultural practises*. **Poor** relied on *social support*. **Wealthier** households relied on *economic activities*.	**Very poor** relied on *economic activities*. **Poor** relied on *social support* and *labour exchange*. **Wealthier** households relied on *economic activities.*

Education was also found to drive choice of coping strategy, whereby more educated households relied most on savings. This likely results from these households being more able to secure savings (cf. Kiiza and Pederson 2001) due to greater livelihood diversity. However, less educated households who undertook diverse livelihood strategies preferred relying on *social support* regardless of hazard. This may reflect the market activity of the communities: households from Kigando (where there was a lower level of education) who depend most on customary activities and the lower income returns associated with those activities, rely more on *social support* than *savings*.

Household livelihood strategy therefore has implications for coping strategy. Households engaged in customary farm-based livelihoods undertook *agricultural techniques* to cope with floods and *sourcing food externally* or *social support* during droughts. As livelihood diversity increased, coping strategy differed: where customary livelihoods were supplemented with livestock keeping, petty trading or service-based activities, households adopted *social support* and *economic activities* during floods and *labour exchange* and *social support* during droughts. However, those households with market-orientated livelihoods relied on the same (*economic*) activities regardless of hazard. The ability to engage in market-based activities determined whether households could draw on financial

capital during times of stress, but particularly whether they substituted financial capital based coping strategies with more human or social capital based ones.

The preliminary analysis showed the two villages differed in terms of market-opportunities and land access. Location factors also drive coping strategy, as shown in Figure 4.2. Whilst differences between responses may have been symptomatic of the risk variance of each hazard, some strategies were more common in one village than the other.

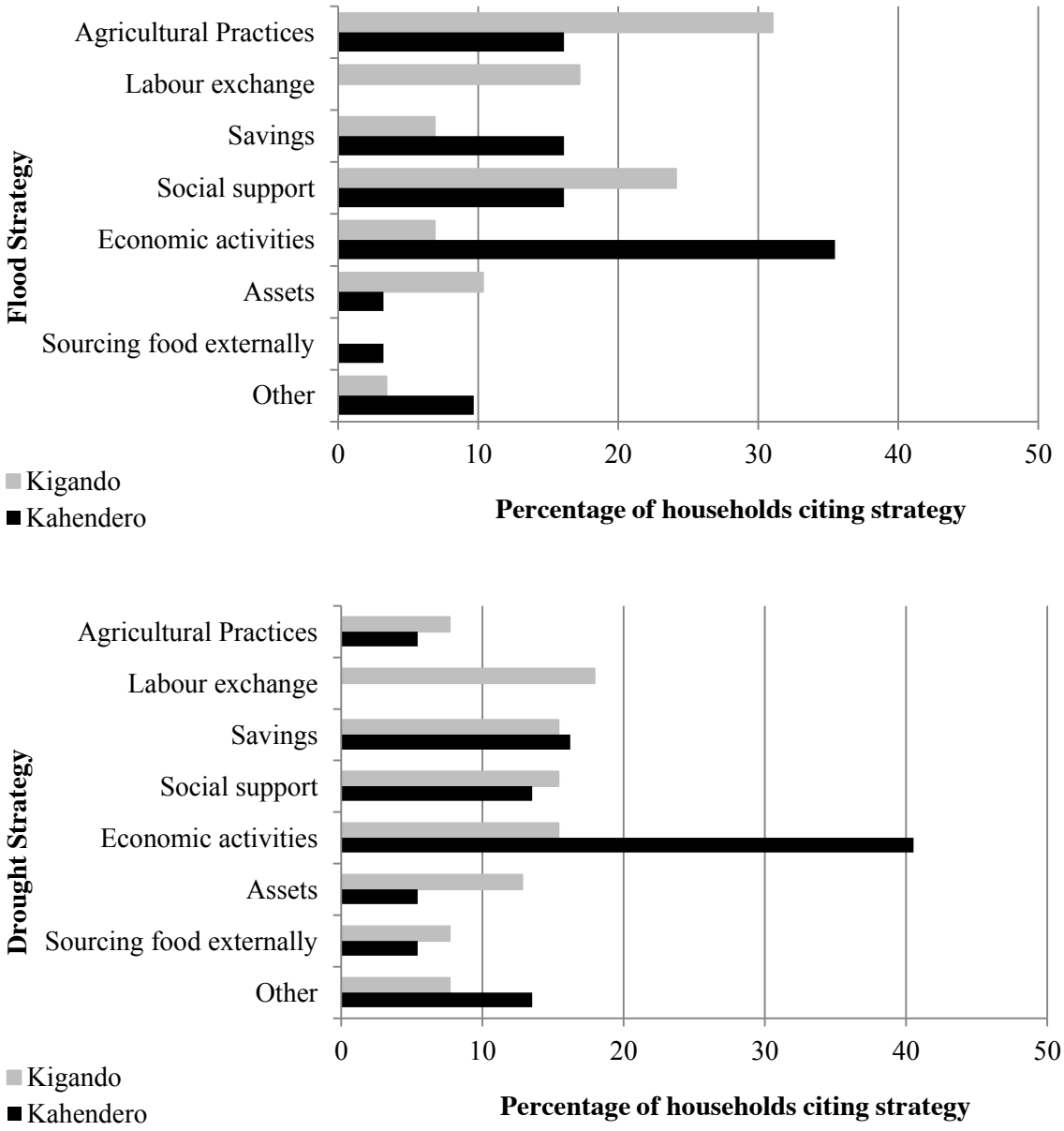

Figure 4.2. Flood (top) and drought (bottom) coping strategies, as undertaken within each village.

4.4.3 Village determinants of coping strategy

Selling assets, such as durables and livestock, was most common in Kigando. In Kahendero, the risk of heavy fines and imprisonment if their livestock were found within QENP, combined with lack of available grazing land, meant only 13% of households kept livestock. However the surrounding environs enabled 61% of households in Kigando to keep livestock and therefore draw on this resource as a coping strategy. These households openly discussed using the adjacent Mubuku Forest Reserve for grazing, despite its protected status. The surrounding physical environs and the customary and formal land tenure arrangements have determined how successful the use of *selling assets* is as a coping strategy. Access rights to land surrounding Kigando enabled households to keep livestock which can be sold in times of stress, whereas in Kahendero restricted access rights limited livestock selling options. However, new co-management regulations and policies that will impact on the Mubuku Forest Reserve adjacent to Kigando risk impacting on future livelihood and coping options:

> *I sometimes graze my cattle in the forest, which is from the Government and sometimes...if they find me here, they would fine me. But this is the only land that can accommodate my cattle.*
>
> (Kigando livestock keeper, 2012)

Beyond the impact of the surrounding environs, village context further influenced coping strategy: both *labour exchange* and *economic activities* were found to significantly vary by village (Table 4.8). Only households in Kigando cited *labour exchange* as a strategy (mostly working on others' land in off-farm agricultural practises). Despite households in Kahendero engaging in non-farm labour exchange such as fishing for others, this was only recognised as part of a wider livelihood strategy, rather than as a specific coping option. These households in Kahendero however, were significantly more likely to engage in *economic activities*, largely as a result of the developing service activity around the lake-shore landing site which provided greater opportunities for households to access markets than in Kigando.

Table 4.8. Chi-square tests for independence between coping strategies and village

	Flood		Drought	
	Labour Exchange	*Economic Activities*	*Labour Exchange*	*Economic Activities*
χ^2	4.236*†	6.397*	7.261**‡	7.023**
p	0.039	0.011	0.007	0.008
phi	-0.425	0.479	-0.519	0.498

* $p<0.05$, ** $p<0.01$

† 2 cells (50%) have expected count less than 5. Minimum expected count is 2.36

‡ 2 cells (50%) have expected count less than 5. Minimum expected count is 3.31

Further support for the role of the village in determining household coping strategies is provided by the earlier evidence whereby *savings* in Kahendero and *social support* in Kigando were the only two strategies identified to be undertaken by the same households during both floods and droughts. Not recognising *labour exchange* as a specific coping strategy, households in Kahendero instead relied on economic activities when fishing or farming failed (or during other financial challenges), both as an immediate response and to bolster their savings activities. In Kigando, *social support* networks provided access to off-farm and non-farm *labour exchange* opportunities as additional coping strategies. Supplementing these support networks were savings groups. Unlike in Kahendero these were relied upon more during everyday challenges and challenges indirectly linked to climatic hazards than as specific flood or drought coping strategies. These savings groups provided mechanisms through which everyday activities could be carried out:

> *I realise I can go and get a loan to help me buy these seeds then after I've planted and harvested I can then try and return this money.*
>
> (Kigando farmer, 2012)

In Kigando, the majority of savings resulted from the sale of crop yields, thus climatic events could indirectly affect households across the village:

> *My home is not affected by floods, but is affected by hunger and famine. It is not affected by floods, but it is affected by savings.*
>
> (Kigando savings group member, 2012)

Income sources in Kahendero were less sensitive to climatic hazards, enabling some residents to regularly deposit with these savings groups. This steady income for the savings group afforded households that were affected by floods or droughts better access to loans compared to those in Kigando.

4.5 Discussion: Livelihood activity and coping responses

Investigating socio-economic household drivers and village-level drivers of coping strategy highlights how livelihood activities and coping strategies vary depending on the levels of customary activities and market-based opportunities within the village. Natural resource availability and economic structures provide opportunities to diversify livelihoods. However, household factors further shape both livelihood and coping strategies by enabling or constraining households' abilities to take advantage of supposed opportunities. It is the interactions between these factors that determine household coping responses. These interactions can be categorised along axes characterising household livelihood and village activity, resulting in four key contextual drivers of coping (Figure 4.3): environmental, resource and income drivers, which also contribute to the fourth driver, diversification.

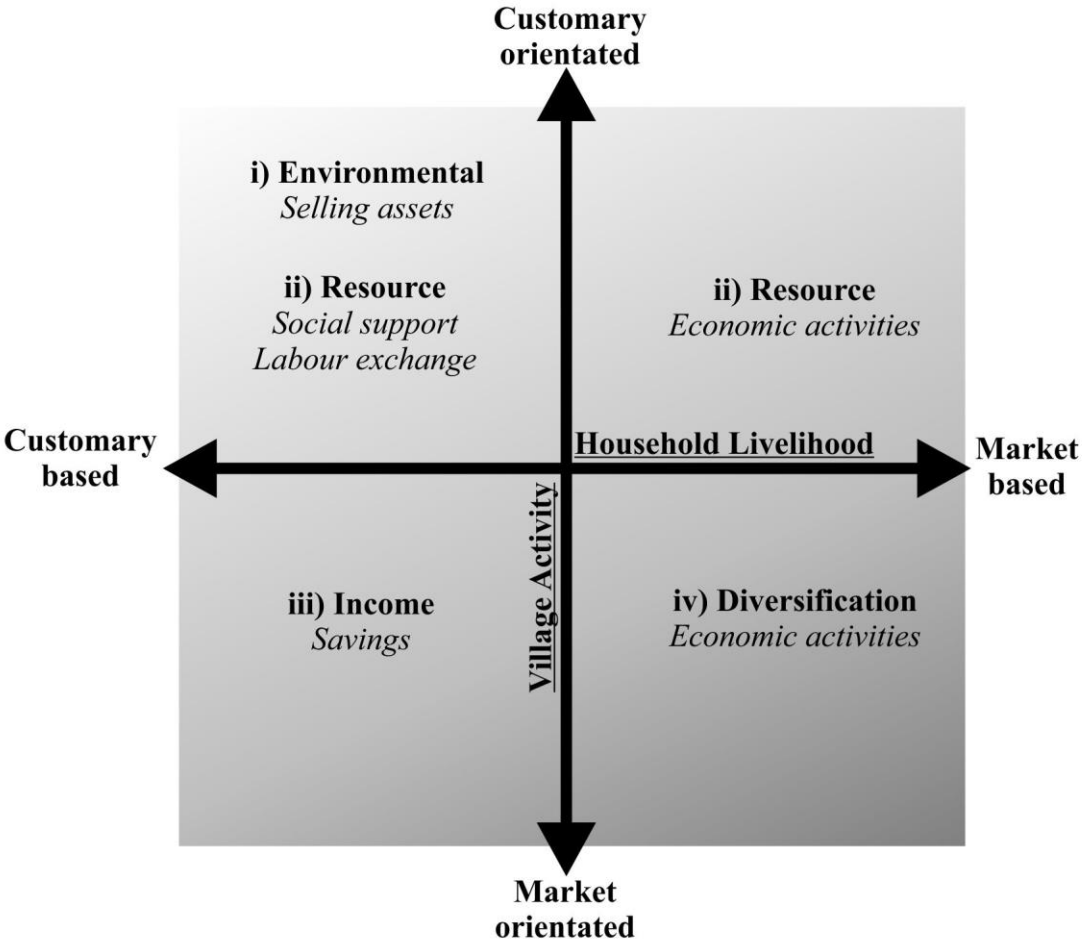

Figure 4.3. Coping strategy framework showing the interaction between village activity (vertical axis), household activity (horizontal axis) and the resulting drivers of household coping strategy: environmental, resource, income and diversification.

4.5.1 Environmental drivers

Whilst physical characteristics of a hazard play a role in determining its impact (Lewis 1999; Liverman 1990), the physical and environmental characteristics surrounding a household will affect their choice and ability to undertake a particular coping strategy. Access rights to surrounding environs can disadvantage some communities (Hisali *et al.* 2011), such as Kahendero, whilst these rights are increasingly important to others. Livestock is an important form of security (Mogues 2006), especially within more customary-orientated locations, such as Kigando. However, changing land tenure arrangements will impact future adaptation options, whereby policies and actions designed to conserve land can undermine the coping strategies that some households

utilise during times of climatic stress. Relying on coping strategies which can be readily affected by external processes can lead to increased vulnerability of these households.

4.5.2 Resources drivers

Across both villages, wealthier households engaged in *economic activities* during both hazards, whilst poorer households were found to adapt their strategies depending on the shock. However, non-farm income generating activities may not be reliable during droughts as the overall income and therefore spending within a community dependent on natural resources may decrease (Eriksen *et al.* 2005b). Nonetheless, some studies observed such activities increasing during drought (Cunguara *et al.* 2011) especially in market-orientated communities where there is more continuous trading activity. Thus economic activities may prove a more resilient coping option where there is strong market access but may leave households in more customary-orientated communities vulnerable to repeated drought events.

However, households in more market-orientated contexts may also be constrained in their choice of strategy. *Economic activities* and *savings* strategies may prove necessary in order to overcome reduced levels of social support, or as Bryan *et al.* (2009) argue, reduced levels of social capital. For example, Kahendero is both larger than Kigando, experiences high levels of in-migration due to the attraction of market opportunities, and has seasonal population fluctuations due to fishing activities. These factors negatively impact on social cohesion, limiting household coping abilities to environmental impacts (Pretty 2003). Therefore residents in communities such as Kahendero actively seek alternate coping options. In contrast, coping strategies in more customary based locations with greater social cohesion may be more dominated by *social support* based activities. The dependence on *labour exchange* as a strategy in Kigando reflects the opportunities afforded to households through available resources such as social networks, which are known to be important in diminishing risk (Osbahr *et al.* 2008; Adger 2003). Likewise, *labour exchange* was not cited by households in Kahendero, where there was also less utilisation of social support strategies. Therefore social support systems, and whether households have access to them, both have a role to play in enabling the adoption of particular coping strategies.

Yet can social support provide coping options regardless of hazard? Whilst the covariate nature of droughts can disrupt the social support network more than floods, the different impacts that different hazards present to households also dictates choice of strategy. For example, sudden disruptions from floods may require reliance on social support, whilst slower-onset events such as droughts enable households to prepare themselves.

4.5.3 Income drivers

Wider diversity in community activities results in increased viability of income generating activities during hazards, especially droughts. For example in Kahendero, this leads to the savings portfolio being more resilient to shocks. Therefore, savings are used more as a coping strategy here than by households in less diverse communities. Continual income from more varied sources that are less affected by climate variability afford regular savings to be made which increases the availability of drawing on savings as a coping strategy (Roncoli *et al.* 2001). Thus maintaining regular inputs into savings groups enables those that need loans to access them.

Meanwhile, less diverse communities who largely engage in natural resource based activities are likely to experience fluctuations in income in line with climatic shocks. In turn, this results in savings groups being unable to supply loans. Households therefore rely less on *savings* as a direct coping strategy for climatic hazards (Helgeson *et al.* 2013). Therefore providing community livelihoods are diverse, service-based activities buffer households in natural resource dependent communities from drought induced income reductions.

4.5.4 Diversification drivers

Environmental, resource and income drivers combine to shape the opportunity for livelihood diversification. Livelihood diversification and coping strategies are recognised as separate activities (Ellis 1998), yet diversification of livelihood activities can improve coping opportunities (McLeman and Smit 2006). Households with diverse long-term livelihood strategies are known to be better positioned to offset climate risk than those who rely on non-farm work as a short-term coping strategy (Cunguara *et al.* 2011). However, this success depends on existing customary livelihoods. For example, limited market opportunities restrict households in Kigando from alternate livelihood strategies, let alone coping strategies. Even where diversification is possible, it may not always

reduce risk (Silva *et al.* 2010). For example, income diversification risks eroding social cohesion that has built up around particular activities, thereby reducing alternate coping strategies. Or for instance in Kahendero, diversifying into fishing may increase income but it carries greater risk through fluctuating fish stocks and renewing expensive equipment if broken. Whilst declines in fish stocks were acknowledged by respondents, the associated risk of reduced market opportunities was not. Reduced market activity from a decreasing fishing market, and that continual increases in new businesses could over-saturate the local market, were both under recognised.

Diversification arguments are also not devoid of gender considerations. Socio-economic factors clearly drive choice of coping activity. Indeed these findings resonate for example, with those of Eriksen *et al.* (2005b) who found gender to be important in household decisions to specialise in an activity. However, this chapter shows it is not so much choice that leads to specialisation, but restriction such as the traditional absence of women's participation in fishing. Thus, the lower income-return activities that female headed households are restricted to also subsequently limit their available coping strategies through both livelihood dependent strategies and additional strategies, such as *savings*. Consequently it is not only community culture that is important (Nielsen and Reenberg 2010; Motsholapheko *et al.* 2011), but also the culture of the activity itself.

Diversification away from customary activity also leads to shifts towards more market-based coping strategies. Diversifying away from farm-based opportunities may support drought coping capacities (see also Antwi-Agyei *et al.* 2012; Paavola 2008) but may lead to tensions between coping with different hazards (Tarhule 2005). For example, flood strategies may be restricted by reducing off-farm *labour exchange* opportunities as a result of reduced on farm activity. Diversification may therefore erode current coping capacities without providing sustainable alternatives. Whilst some households' can, and do, transition away from traditional resource dependent livelihoods to more market-based activities, it may remain difficult for a whole community to follow. In Kahendero fishing, and to a lesser extent crop farming, enables market trading to exist, thus if households transition away from these activities, the local market may collapse.

4.5.5 Implications for coping and adaptation policy

By investigating household and village drivers of household coping strategy, these findings highlight the importance of considering how interacting drivers shape the available coping strategy of a household. More specifically, environmental, resource, income and diversification drivers shape different support mechanisms due to the different coping strategies they enable.

The literature calls for adaptation policies that target the marginal in society, such as women, children, the elderly, or the poor (Cunguara *et al.* 2011; Tanner and Mitchell 2008), arguing that these groups will remain most vulnerable. Yet these groups do not respond to climatic hazards homogeneously: the poor, or the elderly, or the less educated adapt their coping strategy depending on the hazard experienced. Adaptive strategies also depend on the homogeneity of the community as well as wider factors including access and provision of markets and security of credit schemes. Policy must support households to diversify income activities to continue to cope in times of drought, whilst ensuring that they support and foster strategies relied on during floods. For instance, the poorest households vary strategy by hazard and need support to participate in savings groups, especially where market-based opportunities are limited. Enhancing a supportive social foundation provides the groundwork from which members of such groups can collectively diversify their activities, especially where social resources are more readily available than financial resources. Indeed participation in such groups is an important mechanism through which households receive formal support, for example, through NAADS (National Agricultural and Advisory Development Service) (see further discussion in Bahiigwa *et al.* 2005; Osbahr *et al.* 2011 and in Chapter 6).

Market access is widely identified as important in determining levels of diversification (see for example Motsholapheko *et al.* 2011; Cunguara *et al.* 2011; Paavola 2008) yet caveats remain. The level of customary activities and market opportunities must be considered for livelihood diversification policies to be successful. For example, cultural activities, land tenure and access limit livelihood activities, in turn restricting available coping options. The coping strategies that remain inevitably shape the availability of future adaptation options, through for example, reducing the asset portfolio of a household. Both physical and institutional restrictions surrounding access to non-farm activities make diversification

unsuitable for all rural communities. Further research is necessary to understand the contexts in which these restrictions exist.

4.6 Conclusion

This chapter has mapped the household coping responses of two communities in Uganda, and has shown how household livelihood strategies are ultimately shaped by socio-economic household characteristics as well as the surrounding cultural, economic and environmental contexts. By considering coping strategies along interacting axes of household and village activities, the contexts that determine how household coping strategies arise from different levels of customary activities and market access are discussed. It is important to consider socio-economic household characteristics in order to provide a targeted approach to specific groups, and further research is needed to specifically address the types of strategies each group may require. By examining the two different community contexts of Kigando and Kahendero this chapter has shown how these factors shape the available coping strategies of different households: *labour exchange* and *social support* were common coping strategies within Kigando, whilst *economic activities* and *savings* were preferred in Kahendero. Analysing drivers of coping strategy from the perspective of two different climatic hazards has also shown that household coping mechanisms differ under different manifestations of climatic variability.

Whilst these findings are context-specific, they reveal characteristics of communities that should be considered in wider coping and adaptation debates. For example, the level of customary-based activities and opportunities for market-orientated activities must be considered within coping and adaptation, especially in order to consider obstacles concerning diversification. Unforeseen trade-offs between structures associated with different market and customary activities will determine the success of different coping strategies.

These findings provide an important starting point to direct future research into unpacking household coping strategies. Further work is needed in order to understand how these coping strategies may lead to particular adaptation responses. The proposed coping strategy framework can be taken forward and used to explore what households with particular livelihoods in particular villages may undertake in regards to longer term

adaptation strategies, and to identify whether there is a relationship between coping response and adaptation response. The methodological approach used to analyse coping strategies has provided rich empirical data that has enabled the coping responses in the two villages to be mapped. This approach does have its limitations. For example, it has not been possible to identify the overall combination of strategies a household might take: do particular strategies get preference over others, and if so, what determines this order?

The theoretical approach undertaken in this chapter was to focus on coping responses to past and present climatic hazards. Therefore based on these findings, speculation can be made about how current coping strategies will affect future adaptation options. This will depend on the interaction between socio-economic household characteristics and the wider village context, and will manifest differently depending on the hazard experienced. Improving understanding of how different institutional structures, both formal and informal, shape these access rights and coping strategies in different communities will support the development of targeted adaptation strategies. From this perspective, this thesis now moves on to explore the social support networks that exist in Kigando and Kahendero during floods and droughts to understand how informal support networks in different contexts might shape coping options.

Chapter 5 The impact of climatic hazards on social network structure: insights from community support networks in Western Uganda[9]

Summary

Social support networks are considered important coping mechanisms in the literature, however not all households experience the same levels of inclusion in these networks. Understanding how support networks vary across communities in realation to climatic shocks is necessary to ensure that adaptation and development policies do not erode access to networks, yet few studies have investigated this phenomenon. This chapter contributes to this gap by exploring social networks in Kigando and Kahendero during floods, droughts and non-climatic stresses. This extends from the analysis in Chapter 4 , which showed networks are important for social support, savings and labour exchange, and provides complementary evidence to the institutional analysis presented in Chapter 6. Social network analysis (SNA) is used to examine the structures of different support networks, and the ties that exist between households. The analysis shows (1) support networks differ depending on the stress experienced; (2) networks are characterised by bridging social ties with little evidence of bonding social ties and (3) core households that provide support within the networks typically hold formal positions in village institutions, mediating access to both formal and informal support structures. Using SNA to study social support networks under climatic hazards suggests social ties are not as dependent on bonding ties as existing literature suggests. The findings from this chapter have important implications for adaptation and development policies and programmes that seek to maintain and develop community support structures, particularly those dominated by informal ties.

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[9] This chapter is developed from the working paper "Berman, R.J., Quinn, C.H., and Paavola, J. (2014) The impact of climatic hazards on social network structure: insights from community support networks in Western Uganda, *Centre for Climate Change, Economics and Policy Working Paper No. 179 and Sustainability Research Institute Working Paper No. 65*, Leeds, University of Leeds

5.1 Introduction

Chapter 4 showed there are a variety of coping strategies that households use in response to floods and droughts. This contributes towards the existing evidence in the literature on coping strategies across sub-Saharan Africa (Chuku and Okoye 2009; Thornton *et al.* 2007; Adger *et al.* 2003), by explicitly differentiating between different climatic hazards. Fundamental to these strategies are relations of trust, reciprocity and exchange, more commonly known as social capital (Adger 2003; Woolcock 2001; Lyon 2000), which enable and enhance the coping capacity of rural livelihoods. However, there is still limited understanding of how the social ties that provide access to social capital are shaped. This chapter provides evidence on the different structures surrounding these social ties in both communities. Whilst this directly enhances our understanding of how support structures differ under different hazards, this chapter also provides complementary evidence to support the institutional analysis in Chapter 6. By focusing on social networks, aspects of social capital in both communities can be compared, and contribute towards the challenge of examining local, informal institutions (as argued in Chapter 2).

Social capital has interested scholars in organisational management (Lee 2009); social anthropology (Putnam 1995), natural resource management (Brondizio *et al.* 2009), and its importance is increasingly recognised in climate change adaptation research (Adger 2003; Pelling 1998). Recently, a developing body of literature has sought to increase understanding of adaptation through analysing the pattern of relations, or social networks, which result from people's interactions. This has provided insight into community leadership (Bodin and Crona 2008), adaptive co-management (Sandström and Rova 2010), resilience (Cassidy and Barnes 2012) and stakeholder selection (Prell *et al.* 2008). This chapter contributes to this literature by examining community social network structures under different climatic hazards. Social network analysis (SNA) is used (following Barnes-Mauthe *et al.* 2013; Ramirez-Sanchez and Pinkerton 2009), to examine the effect of climatic hazards on community networks and inter-household ties in Kigando and Kahendero. Network structure is not only important for coping, but also for shaping local natural resource governance systems (Bodin and Prell 2011). However, such structures vary across contexts: network density, cohesion, relations, and

structural patterns shape whether networks can support or constrain the activities of different individuals (Bodin and Crona 2009).

Community social networks can facilitate adaptation, particularly to unforeseen environmental changes (Tompkins and Adger 2004). Two distinct types of network relations are identified within the social capital literature: bonding ties tightly connect actors and often result in dense networks amongst family, friends and neighbours (Newman and Dale 2005), whilst bridging ties are found between weakly connected groups (Bebbington 2009; Putnam 2000). Bonding ties have been highlighted as important for coping with weather extremes (Adger 2003; Pelling 1998), yet it is also argued that the balance between bonding and bridging is important (Dale and Onyx 2005; Newman and Dale 2005). Therefore, understanding the bonding and bridging ties within rural social networks is important for gaining insight that helps support rural household coping and adaptation.

This chapter examines the networks under different climatic hazards in Kigando and Kahendero, thereby examining the different contexts that lead to particular network structures. Specifically, this chapter aims to:

1) assess the characteristics of networks under different climatic hazards compared to everyday networks;
2) examine the bonding and bridging social ties of these network structures; and
3) identify and examine the characteristics of core households within each network.

By examining the structures of bonding and bridging ties under different climatic hazards alongside characterising key households' involvement in the network, this chapter reflects on how different shocks impact the network and what this means for resilience and adaptation under different environmental conditions. Informal networks – the internal social support network developed through community relations – is distinguished from formal networks – the network established through externally initiated support programmes. This chapter also contributes to the growing empirical base that adopts social network analysis (SNA) to develop insights into rural livelihoods. The evidence collected here enables a better understanding on the local, informal institutional arrangements and thereby directly supports the institutional analysis undertaken in Chapter 6.

5.2 Bonding and bridging network structures for coping and adaptation

Individuals, households and communities respond to shocks depending on their vulnerability, resilience and resources (i.e. Engle 2011; Gallopín 2006). In developing country rural communities, such responses are shaped by inter-household relationships, assets, and livelihood activities (Adger 2003). For example, in addition to money lending, selling off assets, temporary relocation and savings, households may rely on extended family and friends for mutual support during droughts (Mogues 2006). Indeed households with greater social connectivity can be more adaptable (Cassidy and Barnes 2012). Therefore, community networks can have significant implications for how a household copes and adapts to different climatic events.

Alongside environmental, economic and political factors, social norms and community structures impact household activities by regulating access to natural, financial, human, physical and social capitals (Scoones 1998; Carney 1998; Ellis 2000). Moreover, social capital is acknowledged to shape households' access to other forms of capital (Adger 2003). Social capital has been extensively researched and a rich literature debating the associated social theories exists (see Bourdieu 1984; Coleman 1990; Putnam 2000; Lin 2001; Woolcock and Narayan 2000). Measuring intangible resources such as social capital is challenging (Brondizio *et al.* 2009; Bhandari and Yasunobu 2009) and therefore it can be more insightful to investigate specific aspects of social capital, such as the networks and ties of social relationships.

SNA has been used to examine ties between different actors and their implications within different contexts (Burt 1992; Granovetter 1983; Wasserman and Faust 1994). This includes natural resource management scholars who have investigated the information and knowledge sharing mechanisms within different governance regimes or community networks (for example Sandström and Rova 2010; Cassidy and Barnes 2012; Barnes-Mauthe *et al.* 2013). Despite this, few studies have investigated how floods and droughts impact social networks and the implications this has for future adaptation.

SNA studies of social-ecological systems draw upon various analytical techniques to unpack the complexity of networked relationships. For example, in their study of coastal fisheries management, Bodin and Crona (2008) measure the connectivity of individual actors using two

measures: “degree” (the number of direct ties an individual has) and “betweenness” (the number of times an individual connects two other actors) (Wasserman and Faust 1994). This is useful to explore how individuals may influence a network, thereby offering insights into levels of trust and social learning across a community (Cassidy and Barnes 2012).

Whilst trust and influence amongst individuals in a network is important, the ability of individuals to access new information from outside of a dense network is also important for social learning and coping (Newman and Dale 2005). Burt (2001) distinguishes between SNA measures such as density (the number of ties in a network), which reinforces trust and sharing with bridging or weak ties - and what he refers to as structural holes – which are important for the diffusion of innovative ideas and information. Burt proposed the concept of brokerage to refer to key individuals who connect across structural holes and enable the distribution of novel ideas (Burt 2005). This resonates with Granovetter’s (1973) arguments about the strength of weak ties, the theory that the most novel information in a network is attained by weak ties (i.e. ties that loosely connect two actors, for example, where there is little contact). Connections that are not frequently relied upon are best placed to diffuse new ideas, information and techniques into a network. Other studies have since identified the potential of brokers to contribute towards rural adaptability (Rotberg 2013) although the evidence base remains limited.

Bonding, or common values and shared responsibilities, often occur within homogenous socioeconomic groups that are tightly connected, whilst bridging ties ‘weakly’ connect different groups. Newman and Dale (2005) argue that bonding ties risk hindering network innovation by imposing social norms that restrict novelty, whereas bridging ties facilitate access to more diverse information and resources. It is therefore argued that both capitals are needed: bridging to provide novel techniques to help overcome challenges, and bonding to provide a level of resilience that is capable of absorbing the benefits from bridging ties (Dale and Onyx 2005; Newman and Dale 2005).

Operationalising bonding and bridging ties has helped explore social capital structures, yet the definitions remain broad (Putnam 2000). Bonding ties are commonly described as ‘internal’, ‘homogenous’ or ‘localised’. Whilst they need not share all these characteristics, they often result in closed, tightly connected networks. Likewise bridging ties suggest more distant connections, although as Woolcock (2001) argues this is essentially between individuals with

similar demographics rather than between individuals with substantially different characteristics. Crowe (2007) attempted to overcome these challenges by analysing bonding and bridging ties along a spectrum from complete networks through to factional, coalitional and bridging configurations, thus providing more specific interpretations of the different social relations. A third social relation, linking, is often identified in the literature alongside bonding and bridging. Linking ties have been used to define bridging relations between different communities (Crowe 2007) as well as between members of a community and external actors (Sanginga *et al.* 2007). Linking capital is known to be important in community engagement with formal institutions (Szreter and Woolcock 2004). Indeed individual 'brokers' link actors in a community network to more formal institutions (Lyon 2000). Such 'scale-crossing brokers' are important for linking actors across scales (Ernstson *et al.* 2010), especially in rural developing communities.

The extent to which different social ties substitute for each other is of increasing interest to researchers. Different forms and combinations of social ties become important to different groups at different times (Adger 2003; Woolcock and Narayan 2000). Empirical studies within the climate-vulnerability literature have largely focused on marine and fisheries resource systems (for example Barnes-Mauthe *et al.* 2013; Bodin and Crona 2008; Ramirez-Sanchez and Pinkerton 2009). Studies that research broader rural livelihoods have largely focused on a particular climatic shock or stress. For example, Cassidy and Barnes (2012) studied resilience to drought induced stress in rural Botswana, and Rotberg (2010) explored social networks and coping with floods in rural Bangladesh. These studies have contributed to our understanding of the role of networks in adaptation, yet how such structures vary under different manifestations of climate variability remains uncertain.

Social capital has been subject to critique in the literature. This has largely focused around the breadth of the concept and its growing amalgamation of numerous factors to counter any critique (Fine 2002). Thompson (2011) suggests that there is no such thing as social capital, but there is a social capital framework. She goes on to argue that a framework seeks to examine factors such as networks of relationships between individuals and groups. Whilst these factors or networks do exist, the term 'social capital' Thompson argues adds no further value (Thompson 2011).

Consequently, there remains debate about how best to quantify and measure social capital, and researchers have attempted to measure its presence or absence using different indices (Woolcock and Narayan 2000). The World Bank have also developed a tool to measure social capital at a household level, which focuses on different dimensions of social capital, including trust and solidarity, information and communication and social cohesion and inclusion (Grootaert *et al.* 2004). Given the numerous factors that pertain to social capital, focusing on just one element can prove more informative than attempting to analyse the growing number of facets of social capital. Recognising the different dimensions of social capital is important (Woolcock 2001), and therefore there is a need to understanding these elements, such as different network structures, in detail.

The following analysis seeks to address this gap by comparing the network structures that exist during different climatic events. Drawing on evidence from both Kigando and Kahendero helps consider the influence of different livelihood activities and external drivers. This not only provides insights into the structure of rural networks, and the importance of bonding and bridging ties for household coping, but also the impact on future adaptation and resilience. This chapter goes beyond studies that have previously explored social capital and adaptation (Rubin and Rossing 2012; Kithiia 2010; Pelling and High 2005) by applying SNA to identify the bonding and bridging structures that exist under different climatic stresses, and how key actors in each community are integrated into these structures. Whilst this chapter is therefore able to explore the types of network structures that are important for different climatic stresses (bonding, bridging etc), these are identified through a quantitative analytical framework, as opposed to fully examining the strength of the relationships between individuals (Granovetter 1973; Woolcock and Narayan 2000). The analysis can thereby contribute to our understanding of structures that may enable particular elements of social capital to be enhanced, but does not analyse a level of social capital per se.

5.3 Methods

This chapter focuses on Kigando and Kahendero to explore the networks in locations with different customary and market-based opportunities. The range of activities undertaken by

the households in each village was discussed in Chapter 4 (see Table 4.1). The household survey (discussed in 3.2.2) captured social network data under situations of drought, flood and non-climatic daily stress, thereby providing data on household relations alongside household attribute data. Three questions were asked: apart from members of your household, who provides you with resources or information to enable you to cope when you have a problem that affects your household or livelihood in (a) daily situations, (b) during a flood, and (c) during a drought? For each question respondents were asked to name the person, and report on the type of information or resource provided and where the person lives. A support network was developed from the data generated by each question: in each village support networks were analysed for a) daily situations; b) times of flood; and c) times of drought. The network measures analysed are detailed in the next section.

The household is the recognised unit where individuals' activities combine to create different livelihood strategies (Sallu *et al.* 2010; Thomas *et al.* 2007). Therefore this analysis focuses on inter- rather than intra-household interactions. Names of all household members were recorded to enable the social network relations to be matched between households. Absent households and members names were obtained from neighbours. Whilst these were included in the development of the network, in practice many of these households were isolated and were not relied upon by others. This analysis adopts a whole-network approach to capture the pattern of relations across the two villages by interviewing all households (cf. Cassidy and Barnes 2012): response rates were 96% in Kigando (108/112 households) and 76% in Kahendero (190/250).

Social network data were collected using the free recall method (Wasserman and Faust 1994) whereby respondents nominated people they were connected to without selecting from a pre-determined list. Whilst this approach generates fewer relations given respondents may forget to recall everyone they gain support from, the reported ties are likely to be amongst the strongest (Prell 2012). Moreover, no complete roster of names was available in the villages for respondents to select from.

Informal comments made by respondents during the survey were recorded and used to provide further insight to the analysis. Semi-structured interviews were conducted post-survey to elicit further qualitative information. Interview respondents were purposefully sampled to

obtain a cross-section of households based on age, gender, education level, wealth, and livelihood activity (n=17 in Kigando and n=19 in Kahendero), as set out in section 3.2.3.

5.3.1 Data analysis

Data were analysed with the UCINET Social Network Analysis Version 6 (Borgatti *et al.* 2002). Whilst some respondents reported ties with actors outside of the village, the analysis of network properties was only conducted on data regarding within community ties. Direct comparisons between the two villages could not be undertaken due to variations in network size, although comparative interpretation was possible.

To address the first research question on network characteristics, total number of actors, mean and total number of ties, and degrees of centrality were analysed. Households that provide support (i.e. directed networks) were identified by using indegree centrality measures. Network homophily, the idea that actors prefer having ties with those similar to themselves (McPherson *et al.* 2001), was analysed using ANOVA density model of variable homophily. This tests the probability that within-group tie density differs from between-group tie density (Hanneman and Riddle 2005). Homophily was examined based on attributes of livelihood, gender, age, wealth and education. In addition, a QAP correlation was undertaken to statistically test network variation under different hazards. Similar to standard statistical tests of association (such as Pearson's r), QAP correlation corrects for how correlating network matrices would otherwise violate the assumptions of standard statistical tests (Borgatti *et al.* 2013).

Network structure was analysed following Crowe (2007) who characterises bonding and bridging structures as a continuum, rather than as discrete groups. Network structures can suggest more bonding relationships (complete and factional) and more bridging relationships (coalitional and bridging). Crowe's framework has previously been used to study bonding and bridging aspects of networks at the community level (Ramirez-Sanchez and Pinkerton 2009; Barnes-Mauthe *et al.* 2013) and provides a suitable framework for this analysis. *K*-cores and cut-points were examined in order to categorize each network as complete, factional, coalitional, or bridging (Figure 5.1). *K*-core analysis assesses the level of cohesion within a network: a k-core is a sub-group whereby each household is directly connected to at least *k*

other households (Seidman 1983), therefore the higher a networks' largest *k*-core the more cohesive the network is. The lowest value of *k* shared by all networks in a community is reported in order to allow comparisons between networks (Crowe 2007). Relatedly, the cut-points within a network, that is households within the social networks that if absent would cause the network to fragment into two or more blocks (parts of a network), were also analysed in order to infer structural holes within the network (Hanneman and Riddle 2005). Whilst linking capital can be evaluated alongside bonding and bridging, this chapter does not examine linking social capital per se. However, the proportion of ties that link to nodes external to the village are considered, as well as the identification of the households that broker these links.

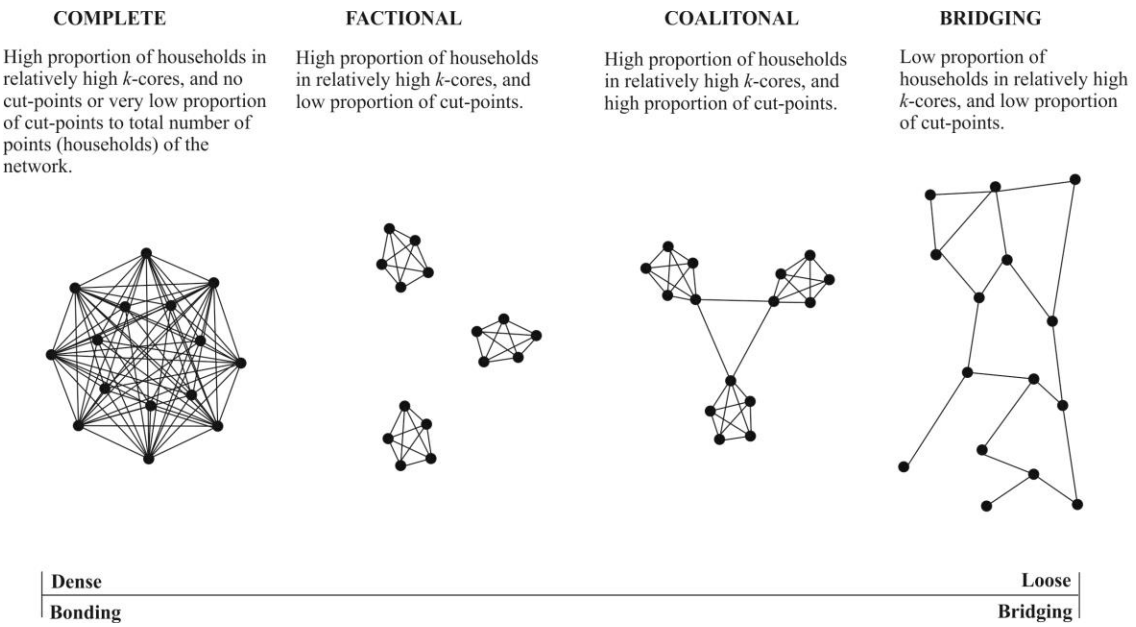

Figure 5.1 Network structure characterisation as defined through k-cores and cut-points. Adapted from Crowe (2007) and Ramirez-Sanchez and Pinkerton (2009)

Finally, core households were identified and analysed using structural network measures of in-degree and betweenness centrality, based on the assumption that such measures offer a robust way of identifying influential households in a community (Bodin and Crona 2008). Following such studies, households that were ranked as the top ten central households in each network were identified and defined as 'core' households. Identifying core households

through analysing their network position provides a means through which to infer potentially influential households (Wasserman and Faust 1994) but in a manner conducted through community input rather than relying on potentially subjective key informants (Davis and Wagner 2003). Households' in-degree and betweenness centrality scores were ranked and households were scored on:

1) how often the household scored in the top 10 households of all networks (daily, flood and drought);
2) the number of times they score highest in any network; and
3) the total value of their in-degree and betweenness scores;

Qualitative data were used to support the characterisation of core households.

5.4 Results

Network structures under daily, flood and drought conditions are shown for both Kigando and Kahendero in Figure 5.2. For visualisation, isolated households have been removed from the diagrams although they are still included in the network analysis.

Support networks in Kigando are characterised by the inclusion of various livelihoods, wealth classes and a mix of male and female household heads. The daily network is dominated by a single large component (i.e. all households are connected by at least one tie) with two isolated pairs of households. During floods and droughts, networks are more fragmented. Kahendero's networks also varied by livelihood, wealth and gender - consisting of several smaller components rather than one large component. Similar to Kigando, the flood and drought networks show greater fragmentation. These visual patterns of fragmentation can be quantified through SNA techniques to more robustly analyse social network structures.

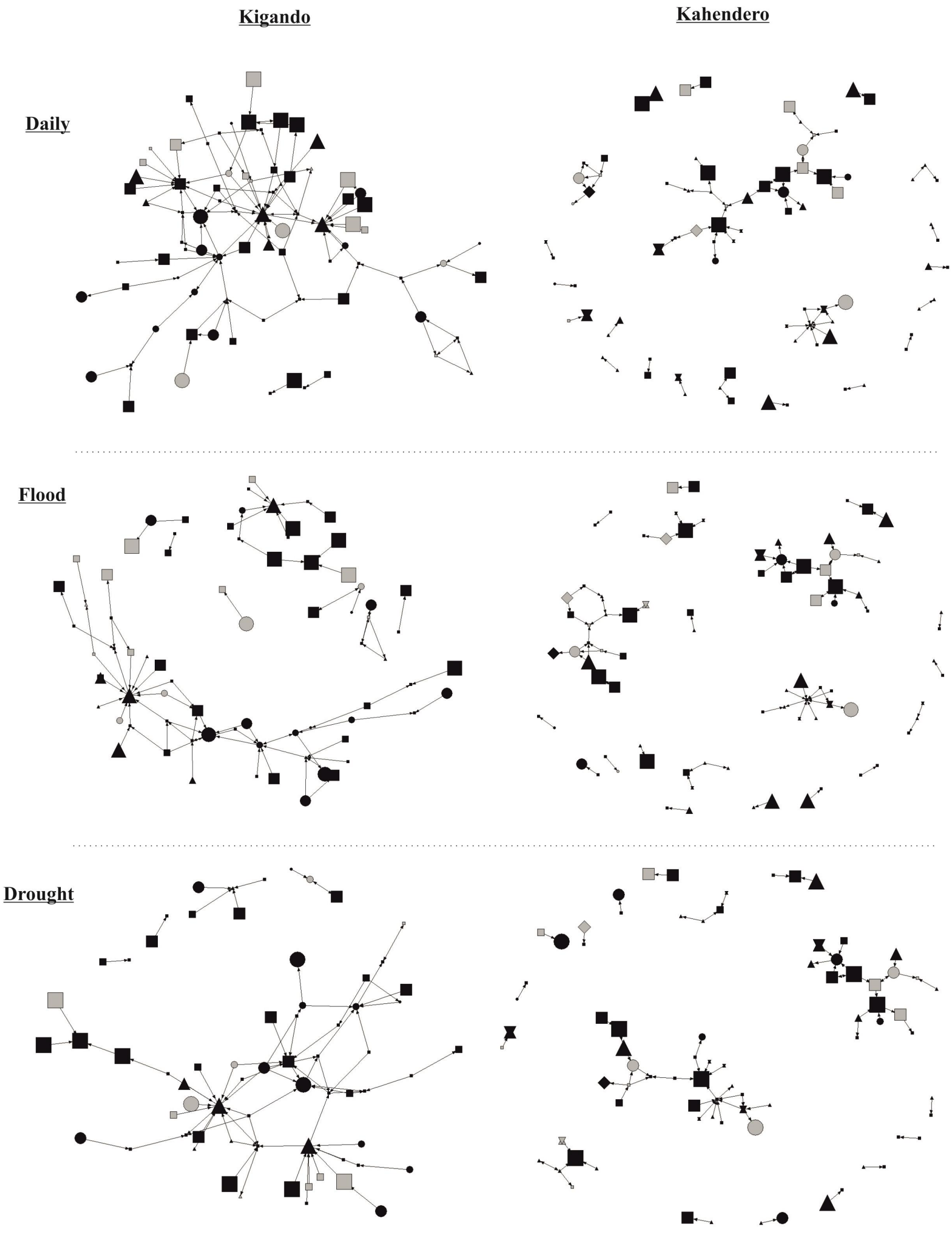

Figure 5.2. Network visualisation of all daily, flood and drought networks in Kigando and Kahendero.

5.4.1 Network characteristics

Basic network characteristics are shown in Table 5.1. Despite a smaller network (n=108), Kigando has more ties across the community than Kahendero, fewer components, and a much higher number of households per component: networks in Kigando are less fragmented. Relatedly, a greater number of households remain isolated in Kahendero's networks. In both villages, similar patterns of network characteristics emerge during hazards. Drought networks contain fewer components than the corresponding flood networks (excluding isolates), and therefore can be said to be more connected (i.e. fewer groups enables a more cohesive network). However, if isolated households are considered, drought networks contain more components (more unconnected households). This suggests fewer households rely on support networks during drought, and there is greater community connectivity during floods (for households involved in the network). The covariance of hazard risk is therefore greater during droughts. Whilst impacts will vary between households during a drought, the stress is uniform across the village and households may be less able to depend on others in the village. However during floods, the network fragments further as households seek support from those not directly affected, or those nearest to them.

Table 5.1. Summary of network characteristics

	KIGANDO (n=108)			KAHENDERO (n=190)		
	Daily	Flood	Drought	Daily	Flood	Drought
Network Data						
Total number of ties	109	80	79	68	75	67
No. of components	30	41	47	129	126	129
No. of components (excl. isolates)	3	9	5	21	20	17
No. of households in largest component	77	45	54	29	16‡	24
Isolated actors†	27 (25%)	32 (30%)	42 (39%)	108 (57%)	106 (56%)	112 (59%)

†Isolated households did not rely on, or provide internal support, and were not considered to determine the bonding/bridging characteristics of each community.
‡ Two components both contained 16 households.

Table 5.2 provides results of the QAP correlation between different networks. In both villages, there is a moderate positive correlation between all networks: networks show

elements of similarity across different stresses. However, elements of each network do differ: there is no perfect correlation. Greater similarity is observed between flood and drought networks in Kahendero (0.693) than Kigando (0.597). This correlation can result from households in Kigando only requiring support during one hazard, relying on other coping strategies during other stressors (although QAP correlation does not suggest which hazard is which), whereas in Kahendero, if a household requires support during a flood, they are more likely to also require support during a drought. In addition, the similarity in Kahendero also suggests the same households are approached to provide support during different hazards, whereas in Kigando a larger number of different households are approached during different hazards.

Table 5.2. QAP Correlation measures between different networks.

	KIGANDO			KAHENDERO		
	Daily	Drought	Flood	Daily	Drought	Flood
Daily	1*	0.59*	0.699*	1*	0.599*	0.626*
Drought	-	1*	0.597*	-	1*	0.693*
Flood	-	-	1*	-	-	1*

*significant at $p<0.001$.

Results of the homophily analysis are shown in Table 5.3 (full between and within-group densities shown in Appendix 4). No attribute shows complete homophily across all networks within a village. In Kigando, homophily is present within the service livelihood and between male headed households across all support networks. For the daily and drought networks, homophily is also suggested among relatively wealthy households. In Kahendero, homophily is suggested among households that have no education. However, no attribute showed homophily across all categories in either village. Therefore households do not necessarily seek support from their 'own kind'. This may be a conscious decision to seek support from someone who is different to them (i.e. different livelihood) and will therefore have experienced a different (lesser) impact, or that the factors that characterise those households who are seeking support inherently means the same type of household is unable to offer support. This is revisited later in the analysis of core households (section 5.4.3).

Table 5.3. Density of ties by attribute for all households (within group densities presented as percentages).

Category (n) †	KIGANDO			KAHENDERO		
	Daily	**Flood**	**Drought**	**Daily**	**Flood**	**Drought**
Livelihood						
Crop (28/24)	4%	4%	3%	0%	0%	0%
Diversified Crop (69/0)	3%	2%	2%	-	-	-
Service (11/51)	12%**	9%**	8%*	1%	1%	o%
Fish (0/30)	-	-	-	0%	0%	0%
Diversified fish (0/82)	-	-	-	1%	1%	1%*
No activity (0/3)	-	-	-	0%	0%	0%
Gender						
Male (84/159)	4%*	3%**	3%**	1%	1%	1%
Female (24/31)	1%	2%	2%	2%	2%	2%
Age						
<27 (13/35)	2%	5%	0%	1%	1%	0%
28-42 (36/88)	6%*	3%	4%	1%	1%	1%
43-59 (30/42)	5%	3%	2%	1%	1%	1%
60+ (29/25)	1%	1%	1%	1%	2%	1%
Wealth						
Extremely Poor (39/104)	4%	2%	3%	1%	1%	1%
Poor (27/32)	2%	1%	1%	0%	0%	0%
Moderate (23/37)	2%	1%	1%	2%	2%	2%
Relatively Wealthy (19/17)	10%**	4%	7%**	2%	3%	2%
Education						
No education (33/44)	1%	1%	0%	2%**	2%**	2%**
Primary education (61/96)	4%	3%	3%	1%	1%	1%
Secondary education (14/48)	9%*	4%	4%	0%	0%	0%

†Numbers in parentheses represent the number of households in each category (Kigando/Kahendero).
* $p<0.10$, ** $p<0.05$

5.4.2 Network structure

Results of the *K*-core analysis for network cohesion and cut-point analysis for structural holes are presented in Table 5.4. Across all support networks in both villages, the highest value of *k* is 2: no household gains support from more than two other households in the village. A much greater proportion of households are within a 2-core in Kigando than in Kahendero. Despite this difference between villages, all networks are classified as bridging network structures given the high number of blocks, low proportion of cut-points to total

points, and low *k*-cores (as framed in Figure 5.1). This also suggests a coalitional structure of Kigando's daily network given the higher proportion of households in the 2-core. No network shows evidence of substantial bonding structures. Bridging network structures suggest there is a much looser connection within the village than would be found in tightly bonded structures. This is not to suggest tight bonds are not found within the communities, but that such bonds do not characterise the overall network structure during hazards.

Table 5.4 Summary of network cohesion measures

	KIGANDO (n=108)			KAHENDERO (n=190)		
	Daily	**Flood**	**Drought**	**Daily**	**Flood**	**Drought**
Indicators of network cohesion						
Average indegree	13.2%	10.6%	11.6%	3.5%	3.5%	3%
Largest k-core	2	2	2	2	2	2
No. of households that are part of 2-core (largest k-core)	46	18	21	4	10	8
Proportion in 2-core	0.43	0.17	0.19	0.02	0.05	0.04
Indicators of structural holes						
No. of cut-points	1	1	1	1	1	1
No. of blocks	40	52	42	56	56	58
Proportion of cut-points to total points	0.01	0.01	0.01	0.01	0.01	0.01
Estimated network configuration	Coalitional/ Bridging	Bridging	Bridging	Bridging	Bridging	Bridging

Linking social capital is analysed indirectly: informal conversations during the survey suggested low levels of linking capital in both communities with few households reporting direct access to hierarchical support. Examining the internal/external tie relations in the village provides some indication about the support households seek from outside the village. In Kigando, the proportion of households that relied on external support was 19% in the daily network and 18% during floods and droughts. In Kahendero, 28% of households relied on external ties in the daily network, 24% during floods and 25% during droughts. A greater proportion of support is provided from external relations in Kahendero than Kigando (in line with the earlier findings in Table 5.1, showing fewer internal relations

in Kahendero than Kigando) although this does not indicate whether households in Kahendero are unable to access internal support or whether they choose not to. A large proportion of these external ties were to family relations through remittances. In relation to linking capital, external institutional support was largely accessed through key individuals and households within the community that had links to external hierarchal support: village committees reporting to higher levels of government; community based trainers who link to NGOs; and government outreach programmes such as NAADS (National Agricultural Advisory Service). In Kahendero further links exist with private sector outreach and the Beach Management Unit (BMU), which is a government initiated community organisation based at landing sites.

5.4.3 Core households

Ten core households (i.e. those who are most influential in the network) were identified in each village across all three networks (daily, flood and drought). However, when investigating the top 10 households of each hazard, 36 different households in Kigando and 22 in Kahendero can be identified: core households varied across hazards more in Kigando than Kahendero. Less variation in Kahendero suggests core households are approached for support regardless of stress, whereas households in Kigando are targeted depending on the stress experienced. This confirms the earlier speculation from the QAP correlation (section 5.4.1): fewer households in Kahendero provide support and therefore there is less variation between networks. Nonetheless, core households in both villages vary depending on the hazard: only ten households in both villages appear in the top ten across all three networks.

In Kigando, core households largely reflect the village demography, yet differ in terms of wealth: wealthier households are most likely to hold core positions in social support networks. However in Kahendero, households across the wealth index hold core positions in social support networks. Greater livelihood diversity in Kahendero means that households are not necessarily approached for financial support, but for activity-specific support whilst more homogenous, customary livelihoods in Kigando leads to a greater dependency on households who have more disposable income. Core households typically have more diversified livelihoods or are less dependent on natural resources. These livelihoods better enable a household to provide support as typically, not all activities will be affected at once.

Core households often hold broker positions between otherwise disconnected areas of the network, and are therefore crucial in supporting community cohesion. Some also hold positions within formally recognised institutions such as village management committees and savings groups, therefore brokering between the village and wider scales. This can inadvertently reinforce the control some individuals have over support networks. Households that struggle to access informal support (such as village networks) may also struggle to access formal support (structured support offered by external actors) where the same households mediate access to both these networks. This was noted by respondents in both villages:

> *"So when I took that issue to them, they [village committee] didn't seem to get bothered or take me seriously because they were friends with the one causing me problems"*
>
> (Kahendero resident, 2012)

> *"NAADS has come in, but it has been a little bit segregated. Those people who are responsible for allocating resources to us here, they will always want their relatives to be the beneficiaries"*
>
> (Kigando resident, 2012)

In summary, results from both communities show that support networks vary under different manifestations of climate variability. In both villages, these networks are characterised by bridging social ties and low levels of homophily. Core households within the support networks are typically wealthier and/or have more diverse livelihood activities than others in the villages.

5.5 Discussion: support networks and climatic variability

SNA of community support networks for different climatic hazards shows support networks do vary under different manifestations of climate variability (Figure 5.2, Table 5.1 and Table 5.2), and that these differ compared to support networks that exist for non-

climatic stress. This suggests covariance of hazard risk has an impact on network structures. Not only will households approach different households depending on the type of support they require, but also because some households may only be affected by one hazard and therefore able to offer support during another.

These results resonate with previous studies suggesting that households will activate different social ties depending on the stress experienced (Cassidy and Barnes 2012): under all three stresses (daily, flood and drought) the networks differed in both villages. This is most apparent during floods when networks show greatest fragmentation. Floods cause more immediate and sudden impacts, thus households directly approach those they are certain will assist them. However, drought affects a larger number of households within an area, thereby having a broader impact on the network: more households will be affected by the hazard, thus reducing a household's ability to provide support. As explained:

> *"In most cases, when those people are also affected it becomes hard for me to approach them... because I know they have the same problem as I do"*
>
> (Kahendero resident, 2012)

Therefore, whilst flood coping strategies may include greater reliance on social support, the network remains more fragmented as specific households must be targeted. In summary, support networks differ under different hazards both due to the impact of the hazard, and the support required.

Network structure also differed by village: Kahendero's networks were less cohesive than Kigando. Whilst this may result from the variation in network size, other factors also contribute towards this difference. Seasonal population changes in Kahendero due to the fluctuating fish stocks negatively impacts on the creation and maintenance of social ties as not everyone will be contributing towards sustaining such ties (Wilson and Chiveralls 2004). Furthermore, greater fragmentation may also limit opportunities to develop social ties (Putnam 2000) as found in Kahendero and within other rural communities (Bodin and Crona 2008). Therefore regular disruption to the networks in Kahendero limits the development of social ties, in turn limiting the use of internal support networks during times of stress. Whilst some isolated households did not depend on the internal network, for example by relying on social ties outside the village, they also were not relied upon by other households in the village (i.e. no incoming ties).

Bridging social capital has been found to be less common in social-ecological systems (Goulden *et al.* 2013). In contrast, the analysis shown here suggests that support networks in Kigando and Kahendero are characterised by bridging ties with little evidence of bonding. Burt (2001) has argued that density and network closure (bonding) maintain and reinforce ideas of trust and reciprocity whilst structural gaps in the network (bridging) are important to access and obtain additional resources, both important aspects for coping. In this argument, households in Kigando and Kahendero show evidence of being able to access additional resources such as new information or physical resources such as replacement crops, but show limited indication that social ties are being maintained in relation to trust and sharing.

Whilst there will inevitably be bonding ties across the community, these are not being significantly drawn upon in the case of climatic hazards. Further evidence for bridging comes from the analysis of homophily (Table 5.3), in which little evidence was found that suggests households relied on their 'own kind' for support. Relying on homophilous ties has been known to expose a household to greater risk. For example, high levels of homophily amongst natural resource dependent livelihoods will increase a household's vulnerability should such livelihoods cease to function during a particular covariate shock or stress (Osbahr 2007). Therefore, cross-community tie structures go some way to reducing household vulnerability to climatic hazards.

Networks that are composed of bridging ties have been said to strengthen a community's ability to adapt to change (Newman and Dale 2005) by increasing access to a diverse range of resources. Likewise, networks that only contain bonding ties may reduce resilience through hindering innovation. According to Szreter and Woolcock (2004), both bridging and bonding ties (and linking) are needed to support the effective use of community social capital. Bonding ties have been found to be important for enabling collective action in rural communities, especially through the establishment of common goals and shared norms (Barnes-Mauthe *et al.* 2013). In Kigando and Kahendero, whilst bridging ties may currently be supporting household coping, a lack of bonding ties across the network is limiting community capacity to proactively increase the overall resilience of their livelihoods to future changes. For example, a lack of collective action in Kahendero is resulting in increased pressure on the fisheries resource, with little action being taken to move towards a more sustainable resource system:

"These days it is changed and those that go into fishing, fish for free. They don't consult anybody. We use to consult our elders, but these days, even a child of 14 years starts and he goes…there are no rules to really protect the fishing project."

(Kahendero resident, 2012)

Therefore, the findings in this chapter suggest there are cases whereby households can be seen to be 'successfully' coping without the presence of strong bonding ties. Although networks are known to be context specific, especially in relation to a system's resilience (Janssen *et al.* 2006b), these results reinforce the need to not fully focus on bonding capital in enabling households and communities to cope with climatic extremes. Whilst the evidence suggests a lack of bonding capital across support networks, however this is not to say such social capital is not present or does not exist between individual households, but only that it does not characterise support networks in general.

5.5.1 Core households and the role of brokers

Core households in both villages were generally wealthier with more diverse livelihood activities, although there was no statistical difference between them and the village demographic which is in contrast to other studies (Bodin and Crona 2008). The core households that were identified were relied upon not only due to their ability to provide resources in times of need, but because of their ability to (intentionally and unintentionally) influence others, be that through controlling information, or shaping the support others are provided with. Core actors have been found to support community resilience, for example, through disseminating information to others in the network (Isaac *et al.* 2007), or through helping to represent stakeholders in a network (Prell *et al.* 2008). Therefore core households are important to consider for coping and adaptation planning: other households are dependent (and vulnerable) to the activities of these core households. Given that demographics did not shape whether households in the two villages held core positions, other household attributes are likely to be responsible.

Core households often held formal roles in village or management committees, or as community-based trainers, thereby acting as important scale-crossing brokers to external formal institutional support mechanisms (Ernstson *et al.* 2010). These authoritative positions impact on both the informal support networks, but also shape other households'

access to formal support (Osbahr *et al.* 2010). Given these positions of responsibility, households core to both formal and informal networks are not independent of each other. If a household cannot access formal support, they may depend on informal networks, such as social support networks. However, if they are isolated from the informal network but still require support, they may be unable to access formal networks given substantially fewer households have links to the formal network. Therefore households excluded from informal social support networks face compounded levels of vulnerability from both the occurring climatic hazard, and because of an inability to access support networks.

Where informal support networks are weak, dependence on formal networks (often with clearly defined access criteria such as village savings groups) increases. This echoes arguments by Titeca and Vervisch (2008) whereby linking capital, such as that to formal networks, can disrupt community activities especially where bonding and bridging capital are limited. Core households may therefore readily affect the activities of other households given limited bonding ties in both communities. These core-households can have a negative impact on community activities, thereby limiting some households' capacities to cope with climatic variability. Whilst Rotberg (2013) argues such brokers provide opportunities to strengthen support networks, the evidence shown here raises concerns that such brokers restrict households from accessing support by shaping who accesses and benefits from formal support. These households may act as brokers due to their resource availability: wealthier households will most likely be relied upon more often because they should have more resource to be able to cope whilst supporting others. Despite this, some households do benefit from such ties, and linking capital can also complement the activities of these households.

5.5.2 Climate adaptation, social resilience and development policy

This analysis has provided insight into how rural support networks function, and why different hazards might lead to different network structures. This chapter explored the social networks that exist during recent climatic hazard events. Households must make long–term investments in networks to support both short term coping and long-term reduction in livelihood risks (Osbahr 2007), yet this research finds no evidence to suggest households are proactively investing in their networks to build resilience to future changes. Different social ties will become important to different groups at different times (Adger 2003; Woolcock and Narayan 2000). Therefore, the dominance of bridging

structures over bonding does not automatically lead to low levels of social capital within the communities in general, but that the dominance of bridging may be preventing the development of trust relations that are required for long-term investments. Again, this does not mean the community is devoid of strong social bonds: strong social relations may exist under other stresses, or were overlooked by the respondents as they do not view the relation as a support mechanism. Studies have suggested that social norms surrounding trust are high within rural communities (Barnes-Mauthe *et al.* 2013; Bodin and Crona 2009), yet there is limited evidence for this in the networks studied here.

Access to support networks and the social capital they afford is increasingly recognised as a form of resilience in natural resource dependent communities (Goulden *et al.* 2013), and informal networks enable households to cope with short-term climatic shocks. Encouraging inter-household engagement across a village can enhance local adaptive capacity (Osbahr *et al.* 2010), yet this is not guaranteed. If informal support networks are to contribute towards increased household resilience, investments in building long-term relationships are needed. Whilst bridging ties are being invested in to maintain and enhance access to resources for coping, there is little evidence to suggest investments are being made in networks to build increased resilience to future changes. For example, there was limited evidence that investments in trust and reciprocity during times of climatic hazards in the villages were being made. Adaptation and development policy initiatives may easily influence community structures where there is low bonding, but such initiatives must carefully consider the future implications that any policy or programme will have on community social structures, and whether they risk undermining the functioning of such structures.

This limited investment in future networks may result in part from the culture of consensus building and respect for social hierarchies that are ingrained within local forms of participation in Uganda (Roncoli *et al.* 2011). Therefore unless village leaders are seen to invest in trust and practises of reciprocity, few other households will. Khayesi and George (2011) have also suggested that reciprocal norms can have negative effects on a network. If a household is to invest in the network, there needs to be high confidence that their investment would be reciprocated in the future. As Inkpen and Tsang (2005) argue, this can lead to an unwillingness of actors to experiment with the network. This challenge is exacerbated through the respect for social hierarchies within such cultures. Whilst households invest to enable short-term coping, the deeper investments needed for future

adaptation are not apparent. Identifying and supporting processes that enhance trust building can help develop longer-term network structures that aid household resilience.

Both formal and informal networks have implications for future household vulnerability. Some households invest in only one of these networks, therefore remaining vulnerable if that network collapses (Osbahr 2007). However, other households invest in both, although membership to one can determine access to the other. For example, for those unable to access formal and/or external networks, complete reliance on internal support leaves households vulnerable when a covariate shock affects the whole community and disrupts network functioning. Similarly, if formal external support fails and a household has not invested in the informal village networks, they risk being left unable to engage in such networks. Therefore both informal and formal networks need investment to provide households with options during times of stress. If households remain unable to access multiple networks, inequalities may become exacerbated and restrict households from building resilience to future change.

5.6 Conclusion

This chapter has used SNA to empirically investigate the impact of climatic hazards on the structure of community support networks. The analysis has shown (1) support structures are hazard specific; (2) bonding social ties are not always relied upon during times of coping; and (3) core households are largely representative of the wider village demographic, often acting as brokers to other ecological scales and formal institutions.

There is a small yet developing literature that examines network structures within social-ecological systems. So far such studies have largely focused on governance systems for collective action and natural resource management rather than on coping or adapting to system shocks. This chapter has provided insight into the characteristics of network structures that are relied upon during times of coping with evidence from two differing rural contexts. Whilst both communities use support networks to cope during times of floods and droughts, neither showed evidence of using the networks to support longer term adapting. In particular, whilst bonding ties have been extensively argued as important for coping with climatic hazards, both communities exhibited greater bridging ties compared to bonding ties. This can have significant implications for the ability of

communities to proactively build resilience towards future changes. Bridging ties may be enabling households to access resources to cope with changing situations, but there is little suggestion that households are investing in bonding ties and relations of shared norms and collective action, that may help overcome unexpected changes.

SNA studies for adaptation are still in their infancy. This study has drawn upon frameworks and methods used in similar studies to enable results to be comparable with existing work. Of significance from this analysis is that rural networks with few bonding ties can still be used to cope with climatic hazards, and also core households (acting as brokers) can negatively impact on other households' coping capacities. Despite this, other studies have shown the importance and positive function core households can play in adaptation, as well as the importance of bonding ties. Extending the analysis presented here to examine support in other communities would help to explore whether such findings are more commonplace than has previously been reported, and if so, what the implications or reasons may be. This would have substantial implications for adaptation and development policies and programmes that seek to maintain and develop community support structures, particularly those dominated by informal ties.

This research has highlighted the variation in village support networks under different climatic hazards. This has particular implications for our understanding of community responses, and suggests responses to climatic hazards differ from those collective action responses, such as may be needed for adaptation. Social network analysis is only one method that could be used to examine these structures. An ethnographic study, for example, would help elicit more qualitative information about the types of relationships that occur within the networks. Alternative methods may reveal alternative evidence that would provide further detail about the network structures. However, the SNA methodology utilised in this study enabled a quantitative exploration of the variation in structures under different climatic hazards. This not only enabled a visual representation of the network to be identified, but also examine the characteristics of the network structures through known network measures. This has provided important methodological insight into the use of SNA within the climate change adaptation literature.

Alongside social support structures, there is a range of additional institutional structures that impact on household coping activities. These range from local community through to national institutions, and can be formal and informal. Chapter 6 now specifically focuses on these different patterns of institutional arrangements, and how they affect household

coping capacities. The evidence presented here specifically complements this analysis through supporting the examination of the local, informal institutional relationships, as portrayed through the social networks.

Chapter 6 The role of institutions in coping with climate variability and adapting to change in two Ugandan communities

Summary

Household strategies for coping with climatic variability vary both within and between communities in developing countries as seen in the previous chapters in Kigando and Kahendero in Uganda. Whilst the importance of institutions for adaptation is widely acknowledged, the role they play in facilitating coping and adaptation in rural communities remains largely unknown. This chapter sheds light on how institutions ranging from the local through to the national enable and constrain coping strategies for households in Kigando and Kahendero. Formal (officially recognised rules and bodies) and informal (socially recognised rules) institutions are identified and explored as considered through each coping strategy (identified in Chapter 4). The P-AIL (Adaptation, Institutions and Livelihoods through a Polycentric lens) framework is developed and then used to demonstrate how local institutions are crucial in shaping household coping strategies. Formal institutions play a dominant role in livelihood-specific coping strategies whilst informal institutions underpin more general coping strategies. Informal institutions for social support determine whether households respect or disregard local formal by-laws and regulations. Acknowledging the presence and function of local customary institutions provides access points for externally planned adaptation activities. Focusing on developing and strengthening political frameworks to enable planned adaptation activities to support autonomous activities will contribute towards empowering rural households and building their capacity to cope.

6.1 Introduction

The previous chapter examined the role of informal community support networks in shaping household coping and adaptation. Whilst providing evidence of informal institutional arrangements, this only partially explores the influence institutions play in shaping household capacities. The integral role of institutions in natural-resource dependent livelihoods is widely acknowledged (Leach *et al.* 1999; Nunan 2006). Increasingly, so too is their role in coping strategies (Agrawal and Perrin 2010; Lebel *et al.* 2010; Young 2010): research recognises the importance institutions play in building adaptive capacity (Jones *et al.* 2011), as well as the adaptive capacity of institutions themselves (Anderies *et al.* 2004). Nonetheless, how institutions influence household coping strategies and longer-term household adaptations remains under-investigated. Specifically, how do informal and formal institutions facilitate and constrain coping strategies?

Following the literature on institutions within environmental governance and natural resource management (i.e. Næss *et al.* 2005; Paavola and Adger 2005; Quinn *et al.* 2007; Poteete and Ostrom 2008; Duit *et al.* 2010; Young 2010; Djalante *et al.* 2012), institutions are defined here as the rules, procedures and norms that guide social practices and define rights and responsibilities of individuals and organisations (Young 2002; Ostrom 1990). Institutions interact across scales: creating successful policies demands cross-scale considerations especially in the context of complex problems such as climate change adaptation (Ostrom 2010b). For example, customary land rights combine with nationally recognised formal laws to shape rural communities' access to land, therefore influencing an individual's livelihood and coping strategies.

Many livelihood activities occur in developing countries with limited state input and can thus be considered autonomous (Jones 2009; Smit *et al.* 2000): they are undertaken by individuals without planned input from external actors. Yet these livelihood activities occur within varied social, political, cultural and market institutions. Extending these activities to include those relating to coping and adapting, and it can be argued that no single livelihood, coping or adaptation strategy is wholly autonomous and there is ongoing debate around the level of official intervention in autonomous adaptation (Forsyth and

Evans 2013). Planned adaptations can complement or substitute for autonomous adaptations (Fankhauser *et al.* 1999). The extent to which coping strategies are planned or autonomous partly depends on whether they are proactive adaptations, or short-term coping responses.

Agrawal (2008) developed the "Adaptation, Institutions and Livelihood's" (AIL) framework and argues that adaptation in rural communities is inherently local. Others have since used this framework to investigate the role of institutions in adaptation (i.e. Washington-Ottombre *et al.* 2010; Brown *et al.* 2010a; Upton 2012). Whilst the public-private-civic characterisation in the AIL framework is suitable for examining formal institutions, it risks overlooking informal institutions such as social norms and cultural traditions. The role informal institutions play in coping and adapting alongside formal institutions is yet to be fully explored despite efforts of the AIL framework.

Agrawal (2008) suggests that both institutional access and articulation are critical for adaptation: individuals, households and communities access different institutions within a wider environment of institutional articulation. Cross-scale articulation which can affect local strategies has been examined in the literature using the concept of interplay (Young 2002). This recognises that multiple institutions can govern any one activity or problem (Grilo 2011), both across (vertical) and within (horizontal) scales. The literature has largely focused on international rather than national or sub-national interplay (Gehring and Oberthür 2009), yet the notion of interplay is thought to be applicable at other levels (Berkes 2006; Cash *et al.* 2006). Institutional interactions can positively or negatively affect an institution's aims, thereby supporting or constraining household coping responses. How and to what extent the notion of interplay could be applied to the interaction of informal and formal institutions remains to be examined.

Djalante *et al.* (2013) suggest that collective action for natural resource management can be enhanced by polycentric institutions that facilitate participation and enable learning and self-organisation. This does not require new institutions, just reconstruction of existing formal and informal institutions (Cleaver 2007; Merry and Cook 2012). Cleaver (2002) refers to this process as 'institutional bricolage', or the interaction of formal rules and laws and local norms of practice. The resulting institutions are hybrids of the formal and informal (Cleaver *et al.* 2013). Polycentric viewpoints consider hybridity, specifically in

natural resource management where both customary informal and contemporary formal decision-making structures overlap and interact (Lankford and Hepworth 2010).

Understanding polycentric systems has developed from early studies within metropolitan areas (Ostrom *et al.* 1961), and has since been used to understand issues of fisheries (Berkes 2006), forestry (Bixler 2014) and climate change (Ostrom 2010b). These studies, amongst others, have contributed towards a developing research agenda on polycentrism in complex systems, including issues relevant to this thesis such as the management of agricultural land (Marshall 2009). Largely this literature has investigated polycentric governance systems, with relatively few studies drawing on polycentrism as a framework for analysis (Gruby and Basurto 2013; Andersson and Ostrom 2008).

This chapter adopts a polycentric lens in order to explore the informal institutions alongside the formal public, private and civic institutions highlighted by the AIL framework (Agrawal 2008). Therefore, viewing AIL through a new polycentric lens positions the household at the centre of the analysis, with a focus on both informal and formal institutions, whilst also considering the impact of institutions across scales, levels and nodes of decision-making. Two overarching principles pertain to a polycentric approach: first, the presence of multiple centres; and second the coordination by an overarching system of rules. In other words, decisions are not made at one single level (Pahl-Wostl 2009). In order to better understand how institutions affect household coping strategies, this chapter aims to:

1) identify the institutions that enable and constrain household coping strategies;
2) examine the interplay between these different institutions; and
3) explore the opportunities the P-AIL framework provides for understanding household coping and adaptation.

By applying the AIL framework through a polycentric lens (hereon referred to as P-AIL), this chapter explores the role of institutions in shaping household coping strategies in Kigando and Kahendero, and identifies potential implications for future coping and adaptation strategies both in the case studies and more widely. In doing so, this chapter also tests the ability of the P-AIL framework to shed light on both formal and informal institutions and their interaction.

6.2 Research design and methods

The P-AIL framework is applied and tested in the villages of Kigando and Kahendero. Nunan (2006) has argued that it is impossible to fully understand the implication of every institution within a natural-resource livelihood system. Recognising this, this analysis specifically examines those institutions that affect coping strategies and does not attempt a full analysis of all institutions pertinent to the case studies. The analysis focuses on the coping strategies undertaken by households in the two villages as identified in Chapter 4 (summarised in Table 6.1).

Together, the two villages offer different customary and market-based opportunities to their residents, thus enabling an exploration of a range of institutions. Semi-structured interviews were conducted in the two villages, as well as key-informant interviews with respondents at the local, district and national levels (see section 3.2). Specifically, the interviews explored the opportunities and challenges for different livelihood and coping strategies, and how the district and national levels organise and implement adaptation related activities.

Table 6.1. Summary of coping strategies drawn upon within case-studies (as identified in Chapter 4).

Strategy	Examples of activities within strategy
Agricultural practices	Agricultural management techniques such as soil and water conservation, waiting to plant until first rains etc.
Economic activities	Non-farm income generating activities such as market-trading, fishing and seeking employment outside the villages in centres of industry.
Selling assets	Selling livestock, surplus (or stored) crops and durable household assets that were previously invested in (i.e. bicycles).
Savings	Processes that enabled fiscal savings (rather than assets), typically through customary social gatherings rather than external micro-finance interventions.
Social support	Informal support networks facilitated the sharing of money, food, advice, information etc.
Labour exchange	Working on others' land in exchange for food, money or reciprocal labour at other times of the year
Sourcing food externally	Seeking food during times of low crop yield from markets beyond the village, as well as wild foraging of food from surrounding environs.

To undertake the analysis, each coping strategy was considered individually, and the different institutions that are involved in shaping the coping strategy identified. The interplays between different institutions were identified by locating and examining the relationships as mapped out (for example) in Figure 6.1. Once all coping strategies had been examined, 'categories' of institutions were identified (as reported in Table 6.2). Following the analysis of individual coping strategies, the institutional overlaps between different coping strategies were considered to identify and understand different interplays.

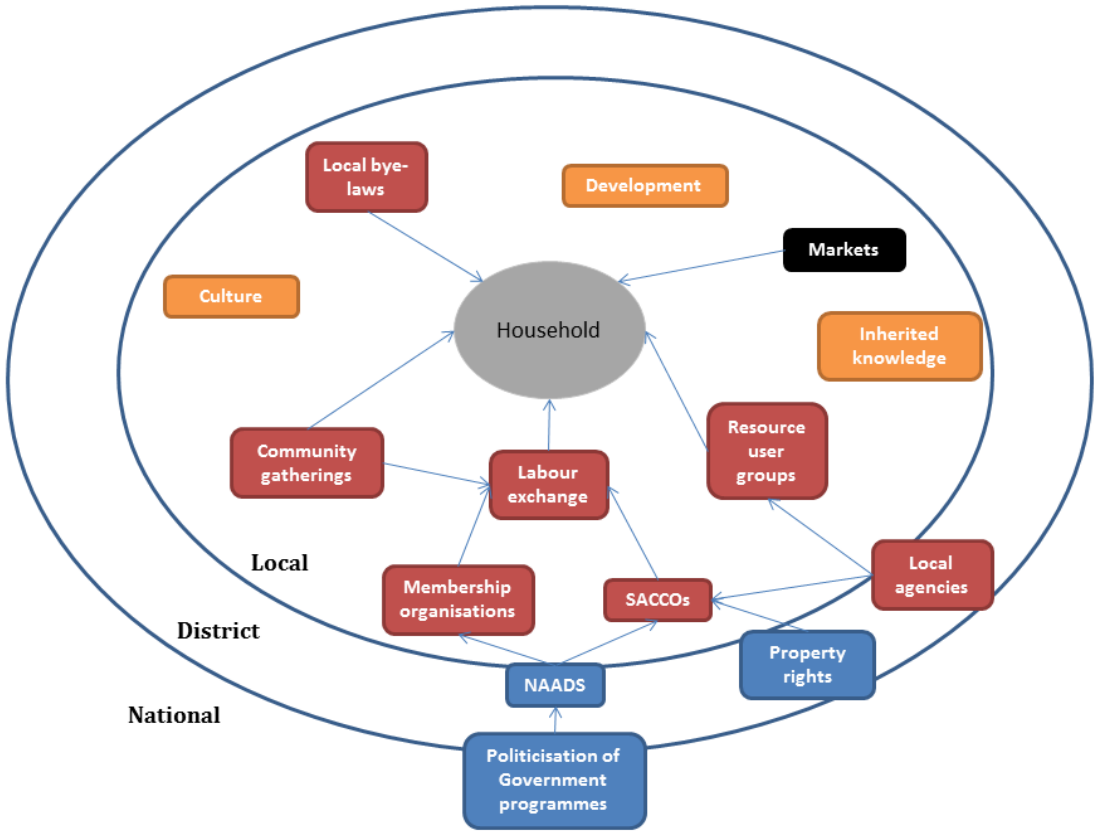

Figure 6.1. Example of the coping strategy institutional mapping (agricultural practices in Kigando), used to develop the analysis reported in section 6.3. Colours used to denote type of institutions (blue for state, red for civic, black for private/market and yellow for informal institutions outside this characterisation).

Institutional analysis allows a multi-scale exploration of households' access to different coping mechanisms, whilst also exploring different institutional articulations. Previous institutional analyses of adaptation strategies (see Gupta *et al.* 2010; Anderies *et al.* 2004), largely focused on more formalised governance structures or more planned adaptation

strategies, typically adopting a top-down approach starting from an established policy or institution and investigating how it affects local strategies. Whilst the AIL framework draws on the widely accepted differentiation between informal and formal institutions, it still restricts consideration of local informal institutions such as socially accepted norms and cultural traditions. To address this, the P-AIL framework is used to give consideration to the full range of formal and informal institutions that contribute to household decisions over coping strategies. Figure 6.2 shows the proposed modification to the AIL framework: institutions are considered through various nodes of decision-making.

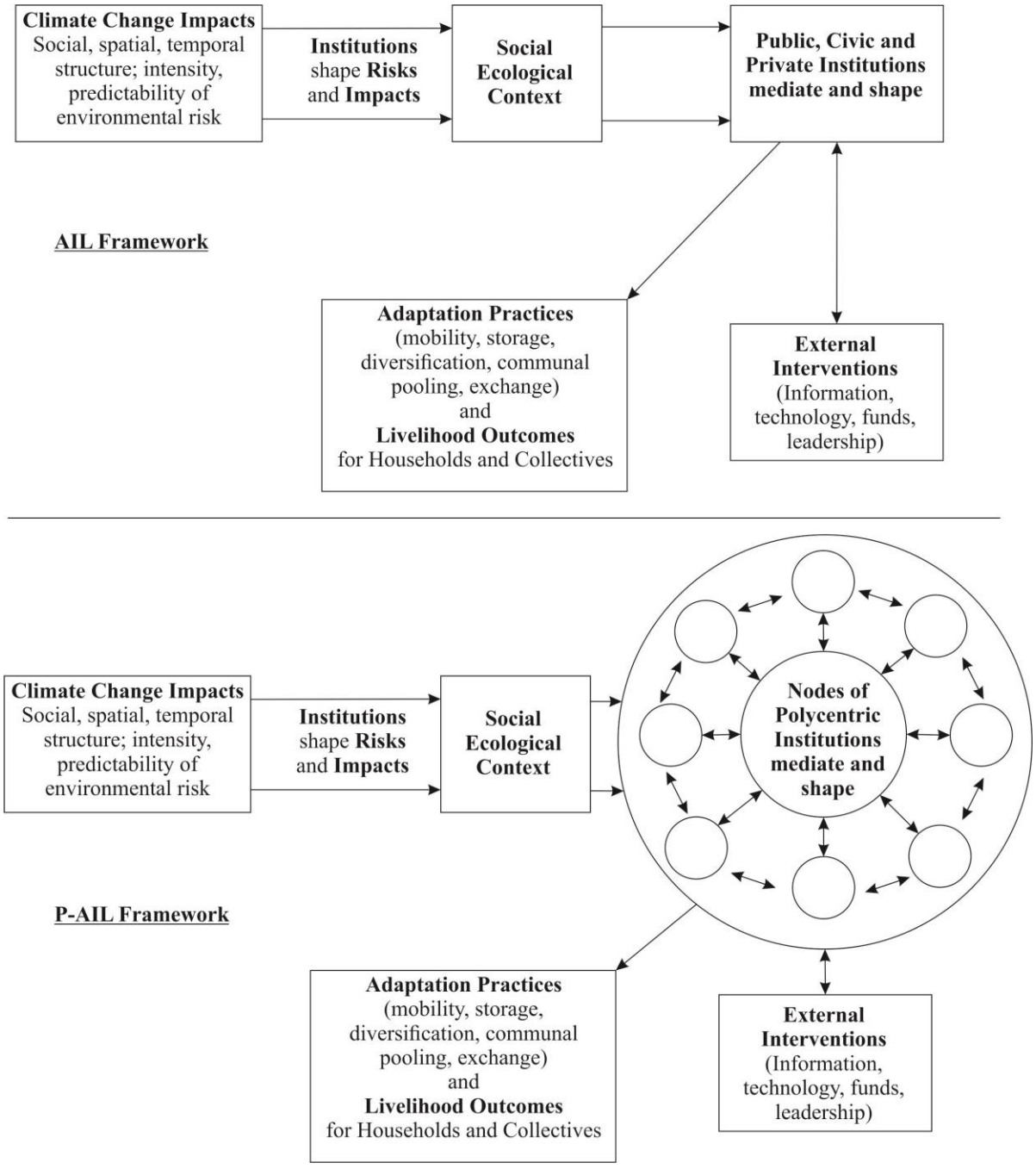

Figure 6.2. The P-AIL framework (bottom) as adapted from Agrawal's (2008) Adaptation, Institutions and Livelihoods (AIL) framework (top) through a polycentric lens.

6.3 Results

The following section describes the institutions exclusively relevant to households' livelihoods, coping and adaptation. Firstly, local level institutions are identified and discussed in order to understand the immediate context in which households' decision

making processes occur, with each coping strategy considered individually. Following this, institutions beyond the local level are investigated, exploring how institutions across the public-private-civic characterisation affect coping strategies.

After providing this descriptive account of the different institutions within the case-studies, the interplay and polycentric characteristics of the institutional environment that shape household coping and adaptive capacities is analysed (6.4). Multi-scale articulation between institutions is explored through the idea of interplay, and the value of a polycentric perspective to examining institutions is considered. Institutional articulation is well established in the AIL framework and resembles the concept of interplay (Oberthür and Gehring 2006). The term 'institutional gulf' is used to refer to cases where institutions operate in relative isolation from other institutions, or where institutions at a particular level are dysfunctional or absent. A thorough description of the different institutions is necessary in order to sufficiently unpack how they interact with each other.

6.3.1 The institutional context of household coping strategies

Various institutions shape household coping strategies in Kigando and Kahendero and enable coping strategies in numerous ways. These are summarised in Table 6.2 in relation to the household coping strategies identified in Chapter 4 , and discussed in detail below.

Table 6.2. Summary of key institutions that influence household coping strategies.

	Kigando	Kahendero
Agricultural practices	**Inherited practices** – techniques inherited from prior generations. **Government support** (NAADS) – only provided to households in membership organisations **Community gatherings** – shape household interactions (how and with whom) **Cultural activities** – cultural techniques dictate increased need for coping strategies. **Local bye-law** enforcement to manage crops in best practice manner.	**Inherited practices** – techniques inherited from prior generations. **Government support** (NAADS) – only provided to households in membership organisations **Bush burning** – cultural acceptance and confusion over who burns.
Economic – fishing	-	**Gender relations** – traditionally a male activity; females unable to engage directly in fishing activity. **Inherited activity** – family always fished.
Economic – market/ petty trade	**SACCOs** – opportunity to take loans to continue trading goods.	**SACCOs** – opportunity to take loans to continue trading goods. **Lakeside market activity** - facilitates household trading (rather than traveling elsewhere).
Savings	'**Official' savings organisations (VSLAs/SACCOs)** - mechanism for regular savings/ loans to rural households. Well-defined procedures. **Groups organised around common principle** - i.e. elderly group, women's group etc. **Empowerment** - groups recognised to promote time-keeping, and providing a voice (i.e. in women's groups). **Trust in savings activities** – Different SACCOs operate differently (depending on founding NGO) – confidence in one scheme can be affected by another's operations and savings goals.	'**Official' savings organisations (VSLAs/SACCOs)** - mechanism for regular savings/ loans to rural households. Well-defined procedures. **Groups organised around common principle** - i.e. elderly group, women's group etc. **Grassroots activity** - formal microfinance schemes operate but dominant activity is through grassroots savings schemes. **Trust in savings activities** - Loans from banks and external agencies confused with SACCOs/VSLAs
Selling assets	**Gender relations** – traditionally a male activity; female headed households restricted from keeping	**Gender relations** – traditionally a male activity; female headed households restricted from

	Kigando	Kahendero
	livestock as a form of liquid asset.	keeping livestock as a form of liquid asset. **SACCOs** – utilise loans to buy and increase assets to prepare to sell (only works against idiosyncratic shocks).
Social support	**Reciprocity** – traditional institution remains functional **SACCOs and membership organisations** - encourage community engagement (often with recognised rules. **Neighbour support** - low (no) cost support mechanism. "**Elites**" – known to provide help **Access to support** - determined by gender/ethnicity etc. **Religious groups** - foster community activity	Increased migration and seasonal activity – reduced support opportunities. "**Elites**" - low confidence in support from village committee. **Family – r**eliance on external ties greater than internal village support. **Reciprocity** – traditional institution remains functional (typical rural Uganda institution), but practice is less apparent than in Kigando.
Labour Exchange	**Land tenure** - determines whether a household can offer 'labour' opportunities. **Reciprocity** – informal partnerships for daily labour exchange.	-
Sourcing food externally	**Access to distant locations** – elderly/family responsibilities limits option.	-

Agricultural households in both villages use land management techniques promoted by outreach programmes to reduce the impact of climatic extremes. These programmes include both state-run (i.e. NAADS) and NGO-led projects. The techniques are disseminated through 'model farmers' based on the idea of farmers learning from each other. Whilst NAADS may enable particular coping strategies in one location or household, they can also constrain options elsewhere. For example, NAADS facilitate the adoption of practices that improve coping abilities such as distributing drought-tolerant seed varieties, yet their implementation mechanisms constrain some households because they must be a member of a sub-county registered community group to receive NAADS support. Those unable to join a group are therefore prevented from receiving support. In some instances,

NAADS provides goats to community leaders who then select the households they feel will successfully rear the goats, thus providing additional goats to the community in future years. This informal enabling institutional mechanism overrides households' inabilities to register with sub-county groups. However, in practice, this only benefits households who are favoured by the village committee.

Formal savings groups commonly referred to as VSLAs (Village Savings and Loans Associations) or SACCOs (Savings And Credit Co-Operatives) are another example of enabling institutions. These groups are named after the NGO that originally set up the group: residents self-identified as a member of FURA if their group had been trained by the local NGO, FURA. The savings groups provide a mechanism through which to save, which is particularly important for households lacking access to formal financial institutions. The savings groups have well-defined but varying rules: some stipulate a uniform saving target for all members regardless of income, others encourage members to save whatever they can. This leads to issues of trust. Some members are perceived to be 'favoured' if they take a higher loan, whereas they may have just saved more. The groups are embedded in formal institutional structures such as elected committees and rules dictating fines for rule violations and grounds for exclusion from the group.

Traditional institutions supporting reciprocity remain important. For example, whilst community engagement within SACCOs often revolves around formal rules, they facilitate wider social support by providing space for collective action. SACCOs provide a forum through which residents regularly meet and engage with each other, and often draw upon traditional institutions to guide there operation. Religious groups also foster community activity and a culture of support. Beyond 'traditional' groups, certain households feel obliged to support their own:

> *"When there is too much flood and people's houses are washed away, if that person is a fisherman, the fellow fishermen come to help. They sometimes solicit some money for their fellow guy and they're able to solve that problem..."*
>
> HH172, Diversified fishing household, Kahendero

These informal institutions are important in enabling labour exchange as a coping strategy in Kigando[10], practiced by agricultural households whose crops are affected by floods or drought. Members of these households would work on another household's land in exchange for food or money. Whilst formal land tenure arrangements determine whether a household owns land and therefore can offer labour opportunities to others, it is the informal reciprocal tradition that shapes the practice of labour exchange.

Other institutions constrain coping options. In both villages, family institutions influence agricultural practices: households' farming practices pass through generations, and can be resistant to new techniques. Informal cultural norms further constrain agricultural coping activities. Bakonjo culture restricts 'winnowing', the process of sorting and removing bad seeds prior to planting, thus increasing the risk of poor yields under climatic extremes. These informal institutions thus constrain households from adopting farming practices that could increase their ability to cope with climatic variation, as was stressed when discussing households inherited practices:

> *"People have no education. People don't want to change. You tell them what is right and they will say no, we can't do it…They say 'my grandfather's took from this river and they lived for many years'"*
>
> Government, Sub-County Informant

Local by-laws are often designed to enforce best practice crop management techniques. By improving agricultural practices that strengthen everyday livelihood strategies, these can also support coping activities. For example, by-laws that stipulate regular pruning of coffee trees within a village seek to ensure the trees remain healthy and produce a high yield. In practice, these are weakly enforced: poor institutional functioning largely results from the wider withdrawal of state influence in everyday activities. Farmers see no benefit from investing additional time in crop management for no immediate return as opposed to investing in other income-generating activities, and there are no repercussions for not doing so.

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[10] Labour exchange was not cited by residents in Kahendero as a coping strategy (see section 4.4, Figure 4.2).

Institutions for social support can constrain households' strategies. In Kahendero, some households could not access social support as they were not 'one of them': increased in and out migration in the village (compared to Kigando) reinforced social support based on ethnicity. In Kahendero, family institutions remain strong, with increased reliance on external family ties for support rather than social networks within the village. Yet internal ties can constrain particular coping strategies. Households in a position of community representation could influence the functioning of different community groups. For example, collectives designed with the interests of women could still be influenced by male community members:

> *"There is a CBO [community-based organisation] that helps me… It is a women's CBO, but they just allowed me because I know how to write and read."*
>
> Male group member, Kahendero

In both villages, there is low confidence in village representation mechanisms. Traditionally, formal village representation through village committees was an important support mechanism for residents. Households could report any problems to their village representatives, whom would then report to higher government levels if necessary. These structures have theoretically strengthened since decentralisation processes in 1993, yet they no longer function sufficiently. Whilst some residents always seek support from community elites (Village and SACCO committees), others reported dissatisfaction with these structures:

> *"The authorities must not go through the channels of the Local Chairpersons' because they are corrupt and only benefit their relatives."*
>
> *"The Local Chairpersons, they don't even call any meetings for people to discuss issues…they are never serious about it."*
>
> Local residents, Kahendero

6.3.2 Beyond the local: interactions across the institutional environment

So far the application of the P-AIL framework has only explicitly examined local institutions. The following section applies the P-AIL framework to institutions (characterised within the public-private-civic framing) at the district and national levels, as summarised in Table 6.3.

Table 6.3. Institutions beyond the local-scale.

	District	National
Public (State)	**District disaster management committee** – tasked with response to disaster events. **Statutory enforcement** – local by-laws, taskforces and legal sanctions over resource access – structured to enable and incentivise local residents. **Beach Management Committees** (BMUs) – designed to enable all stakeholders of the fisheries resource access to decision making (and not just boat owners).	**Government capacity** – key departments are under resourced (resources and finances). **Government service** – poor confidence with forecasting and integration of indigenous knowledge. **Politicisation** of support programmes. **Ethnicity** – representation of dominant groups on council/parliamentary positions.
Private (Markets)	**Industry partnerships –** local industry activities support community activities.	**Enabling legal frameworks** – legislation to provide opportunity for resource valuation.
Civil Society (NGOs, Donors etc)	**Framework to facilitate sharing project outcomes** – donor project outcomes are currently restricted to the direct location of the project. **Develop integrated resource user groups** – i.e. water user groups (rather than extraction focus).	

6.3.2.1 Public institutions

Government capacity and service delivery are important for household coping strategies. The Climate Change Unit (CCU) – a subsidiary body of the Ministry of Water and Environment - is tasked with implementing the National Adaptation Programme of Action (NAPA), the main policy response to climate change. Yet under-resourcing affects the

delivery of NAPA projects: only four pilot projects have been trialled since the NAPA was launched in 2008. Whilst key national public institutions are present, they significantly underperform and are under-resourced in their activities.

Uganda's decentralised government system aimed to establish a system of local government with greater authority. However, resource constraints hamper activities at the district level. In Kasese District, the District Disaster Management Committee provides general disaster response without recognising individual household needs. For example:

> *"I was involved as a Disaster Committee member and when the floods come and they pass on the crops… as the response group we go and distributed blankets and plastic jerry cans. So I say that the two are not related... This now makes people think that if they lose their crops they will get an extra blanket in their home. So when we say don't plant there and he feels that if he plants there and loses then you know… So some interventions may not be quite directed."*

Government, District Informant

Household coping strategies are further impacted by a combination of poor confidence in the national forecasting system, and limited integration of indigenous knowledge into planning activities. Previous inaccurate forecasts led households to sell off assets in preparation for a drought that did not materialise. Forecasts are now treated with caution, which risks households being ill-prepared for a drought. Similarly, insufficient consideration of indigenous knowledge can lead to limited adoption of planned strategies by households. For example:

> *"The indigenous knowledge tells them that if you do terracing in Mount Elgon you have landslides, but the other side [Kabale], if you do it you have stability. So if you go there [Mt Elgon] to promote terracing, you will not succeed. It is not something that came from out, or is written somewhere, but it is there. The problem of course is that people have not been able to go to the community and extract that knowledge and share it widely."*

National Informant, Civil Society

Attempts to strengthen the utilisation of local knowledge and autonomy can be seen in the Beach Management Units (BMUs). These have replaced former Landing Site Committees as the local fisheries management institutions - they were designed to increase participation in decision-making processes. Previously, marginalised groups such as women and *barias* (boat crew) were not represented in the committees: boat owners were the dominant stakeholder in fisheries management. BMUs now enable the representation of women and *barias*. Therefore, although associated more with livelihoods than coping strategies, improved stakeholder representation in BMUs means certain households are more involved in decisions that affect the activities they rely upon during times of hazards, for example, by inputting into discussions about lake management during droughts.

District by-laws, taskforces and legal sanctions aim at empowering local communities to take ownership over their environment and activities. In Kahendero, BMUs enforce fisheries by-laws, whilst in Kigando taskforces under the Department of Agriculture seek to enable farmers to self-govern their community to ensure that best agricultural techniques are used. However, households often explicitly disregard them, or they are considered to be defunct. In addition, national government programmes designed to support household activities have become highly politicised. Village committees may not support the nationally elected government (NRM) and perceive this as the reason for not receiving government support.

6.3.2.2 Private institutions

Private sector involvement in household coping strategies is minimal. A local mining company Kasese Cobalt Company Ltd (KCCL) is known in Kigando and Kahendero. KCCL's CSR programme runs Aids/HIV outreach activities in Kahendero, and their hydro-power canal runs through Kigando, although residents are not permitted to access the water. These access restrictions are largely in place for safety, given the canal's irregular flow. KCCL installed pumps along the canal for residents in Kigando to access the water. However these were frequently vandalised for their metal:

"When they [the taps] were put up, they were handed over to the local leaders' responsibility. Then in four months the pipes were

gone and the pumps were no more. Actually the company replaced them three times and then after that the general manager just said enough is enough, we can't continue doing this."

KCCL Interviewee

Civil society is pushing for greater private sector involvement in supporting development activities in the district, which in turn will support household coping strategies:

"In the district, we are setting up a framework for public-private partnerships (PPP). It brings private service providers, civic society organisations and government to work together so that we create synergies, and then the overall output is big."

District Informant, Civil Society

Ad-hoc household tree planting and large-scale NGO and state-led tree planting schemes were widely reported. Whilst these present opportunities for carbon-trading schemes, there is no framework that exists to support the economic valuation of these resources. The private sector has the opportunity to help develop financial markets for such activities, but there is no current incentive for them to do so:

"Until someone economically values the forestry resource, a community has no incentive to maintain the forest in favour of extracting resources from it. Those questions have to be answered. The economic evaluation of all these resources has to be done"

National Informant, Civil Society

6.3.2.3 Civil Society institutions

Donor and NGO-led projects can support coping strategies. Yet no institutional framework exists to facilitate the sharing and dissemination of project outcomes, therefore benefits often occur within the confines of the project itself. This limits opportunities to share project evaluations: lessons from one project are not integrated into the planning of others. For coping, this could mean not identifying processes that limit the success of household strategies.

Civil society also leads on numerous tree-planting projects. Whilst these are designed to combat deforestation, they do not currently address drivers of deforestation. Projects are typically reactive, ad-hoc and dependent on donor project funding. A more coordinated response would not only support household coping by increasing natural water retention during times of heavy rainfall, but could help support longer term adaptation if integrated into payment for ecosystem service (PES) schemes, for example.

6.3.2.4 Institutional gulfs

A number of institutional gulfs exist which currently limit household coping strategies. Firstly, whilst there is limited private sector activity that shapes household coping strategies in both Kigando and Kahendero, there is scope for it to play a much bigger role. However, current market institutions provide limited incentives or benefits for private companies to do so.

Secondly, an absence of legal frameworks restricts the development of markets that value the environment. Whilst economic valuation of the environment does not necessarily enhance coping strategies, creating such a framework could contribute towards improved ecosystem management. For example, frameworks that support access to carbon markets may act as incentives for investment in forests through private-sector led PES schemes. This would indirectly support household coping strategies through supporting alternative income sources and through afforestation programmes reducing run-off induced crop losses.

A final gulf exists in relation to the lack of capacity across formal state institutions and the role of civil society institutions. Limited resources, be that financial, technical or knowledge capacity, significantly constrain both district and national government activities. At times, civil-society contributes to these service delivery gaps. For example, a Belgium Technical Cooperation (BTC) project in Kasese District aims to build capacity of the Local Government. Similar articulation exists at the national level, whereby the CCU receives funding support from BTC as well as Danida, the Danish Development Agency, amongst others. However, such articulations are typically sporadic and there is no framework to facilitate best practice or maximum gains from the funding.

6.4 Interplay and articulation: how do institutions affect each other?

Following the previous description of the different institutions, this section is now able to explore the articulations between the different institutions discussed above and how they shape household coping strategies. These are summarised in Table 6.4. Institutions that shape household coping strategies vary in terms of formality, scale and driver (i.e. being state, private sector or civil society led). Even the same type of institution (formal, state-led, sub-national institution, i.e. NAADS) can function differently in different contexts. Given the complexities that exist within social-ecological systems, it is important to recognise these interactions to understand how changes in one part of a (governance) system will impact elsewhere.

Table 6.4. Inter- and intra-scale institutional articulations

	Positive Interplay	**Negative Interplay**
Cross-scale	Informal institutions of social support create enabling environment for the dissemination of new techniques and information (Local-district) Civil society institutions fill gaps left by limited state functioning (but currently sporadic approach).	Customary land rights and formal management legislation conflict to limit access to natural resources (Local-national). Informal social institutions conflict with formal legislation around resource access (i.e. BMUs) (Local-district)
Local-local	Social-cultural institutions around community gatherings (and rules) facilitate savings groups (NGO and grass-roots).	Dependence and resistance to government programmes.
District-district		Different policy goals across different government programs (i.e. UWA/NAADS policies).
National-national		Silo approaches of different government departments (but also at district scale).

Formal and informal institutions influence all coping strategies but their relative importance and role varies. Livelihood specific coping strategies such as farming, market

trading and fishing, are underpinned by formal institutions. This is not to say that informal institutions have no impact; informal power relations concerning nepotism and gender clearly have an effect, for example:

> *Another issue is employment through family links and relationships rather than the skills needed. It is a problem of nepotism.*
>
> District Informant, Civil Society

However formal legislation concerning resource access has greater influence on these strategies. Informal institutions are important for coping strategies that are less specific to particular livelihoods. Institutions of reciprocity and social networks shape savings, social support, labour exchange and asset-based coping strategies.

Formal institutions provide access points for planned interventions to interact with autonomous coping strategies. Yet planned interventions also utilise informal institutions, such as through the operation of NAADS programmes. Hybrid institutions that overlap both customary norms and bureaucratic and political government functioning can provide a mechanism for delivering interventions that 'work with the grain' of current practices, particularly in rural African communities (Cleaver *et al.* 2013). It is important to explore whether hybrid institutions present such opportunities. Individual institutions may enable or constrain household strategies, yet these do not operate in isolation from the wider institutional environment:

> *They have those structures [village associations, savings associations and associations for mutual support]. Most of them are informal others are formal and have been registered at the district level. The coordination is through those which have formalised their operations. When they are formal, then we can for example, identify one of such groups and support them. When these associations are formalised then it becomes easy for us to support them. But when they remain informal then the coordination and support sometimes is not possible.*
>
> District Informant, Government

Articulation, as Agrawal (2008) argues, is critical to adaptation and therefore coping. From a polycentric perspective, institutions across different scales of decision making will affect local strategies and therefore the notion of hybridity may offer opportunities for household coping strategies.

Positive interplays are important for the implementation of activities that support household coping strategies. Social-cultural institutions surrounding community gatherings and the associated norms and behaviours facilitate the development and functioning of savings groups. These have built upon civil-society support and training, but also savings practices related to traditional community gatherings. Groups are structured around member-characteristics (such as burial groups, livelihood groups, women's groups etc.), for example *bakade kwyamba* ('helping the elderly') is a group for village elders. The groups are increasingly adopting saving practices into their activities, and extending and developing group activities themselves:

> *FURA is a very good organisation and it is the only organisation that came up with an issue to help others and teach us about loaning and saving. ..at least now 300 people know why and how to save. As we have gone on we have some practices that even FURA did not initiate. And if they came back here, because they have been finalised for some time now, they would find that there are other tactics that we have tried to use to try to help ourselves.*
>
> HH192, Service based household, Kahendero

These traditional groups build capacity of members by providing opportunities for under-represented groups to become involved in decision-making forums and group purchasing, as well as by promoting time-keeping of members: late-attendance or absence from meetings results in a member being fined. Informal institutions of social support also provide a mechanism through which state-led extension services could operate. These structures provide opportunities for inter-household learning thereby contributing to building the coping capacity of households through the sharing of different strategies.

Whilst positive interplays are evident, so too are negative ones relating to government programmes and policies. Uganda Wildlife Authority (UWA) regulations forbid households

within designated protected areas from keeping livestock. As a designated fishing enclave, Kahendero is outside UWA jurisdiction, yet livestock keeping is still challenged due to the proximity of QENP. Simultaneously, NAADS programmes are selected by the community residents: households in Kahendero request goats through NAADS, yet once they have received them, owner's often experience problems accessing pasture (see Box 6.1). This limits the opportunity of households to rear livestock as part of their coping strategy. This may be one reason for the increased reliance on the lake during time of stress.

Additional negative interplays within government also exist. The pressure on lake resources demands long-term sustainable management practices. BMUs fall under the responsibility of the District Fisheries Office. However, Fisheries sit within the Production Department and any training BMUs receive is focused on market-related issues, such as record keeping and licensing procedures, rather than consideration of wider ecosystem management. Environmental issues fall under the Environment Office, within the Natural Resources Department, and have no direct mandate to train BMUs:

> *The BMUs are trained in areas such as planning, areas of budgeting, on the laws concerning illegal fishing, and in their roles and responsibilities. So what we're doing is capacity building to strengthen these BMU so that they stand out to be firm organisations that should be able to handle the affairs of fisheries within their communities….The training is normally skewed to fisheries issues. Issues of environment and natural resource management have not been so emphasised to the BMU's. So the gap is between fisheries and environment.*
>
> District Informant, Government

BMUs receive no training on methods of sustainable fisheries management: environmentally sensitive techniques are not disseminated through to households involved in fishing. The result is unintentional degradation of fisheries resources thus reducing the quality of the environment on which households depend upon during times of coping.

Box 6.1 UWA regulations and NAADS negatively interact in Kahendero

Households are challenged through wanting to keep livestock in proximity of QENP:

"They [UWA] put heavy restrictions on those people who have livestock around…it really scared us and it has prevented us from having livestock" (**HH234, Kahendero**)

"We would love to do a different activity than this we are doing now. The only challenge here is the fact that we are basically bordering a park. So you can't think of buying goats or cows… if we have a cow, it would need pasture from the park yet those people don't want us in the Park, and there is no other way to graze them. So this is a big constraint to us." (**HH317, Kahendero**)

The Uganda Wildlife Authority recognises this conflict but stresses the legislation that is in place:

"Kahendero is a fishing village, which is an enclave in the National Park so it has been gazetted a wildlife sanctuary...Basically, these villages [like Kahendero] were created purely for fishing. Livestock is not supposed to be kept there and no cultivation is supposed to take place but when you go there you find animals and livestock. The wildlife sanctuary is gazetted under statutory instruments and livestock keeping is not one of the permitted activities in a wildlife sanctuary. Also, it is supposed to be the responsibility of the District to ensure that the wildlife sanctuary is managed in place of the provisions of the statutory agreement. So they are supposed to have a management plan to say what kind of developments can take place, bylaws or some guidelines on things that take place there…This is partly attributed to politics: politicians do what people want. If people have seen service delivery elsewhere provide goats, they too want goats. But when the goat is eaten there is no compensation for the loss of livestock." (**UWA Official**).

One outcome of such pressures has been increased demand on the lake resources. Households feel they face limitations in the availability of alternate livelihoods. This is exacerbated by lack of alternatives:

"The problem we have always had is that in the whole of the sub County, there is no (educational) institution, such as tailoring, carpentry, these ones for school dropouts. So if the government came in and could maybe look at it in this perspective, then the fishing activity would definitely change and most of the people would vacate this place and go out to other businesses and few would be left here which would actually be a better way for the fishing activity to be improved." (**HH226, Kahendero**)

"All these households cannot survive on one boat, so they have to find a way of survival, which is making illegal boats. When they go into illegal fishing, they further deteriorate the fisheries resources more...The most important item to address in such a type of management plan is to have such alternate income generating issues." (**District Government**)

This 'silo' approach affects the mainstreaming of activities at the local level. Lockwood (2013) noted this is particularly problematic in Uganda where the ministerial cabinet has over 70 members compared to 30 in Tanzania and 42 in Kenya: each ministry approaches their own activities whilst simultaneously competing for resources and policy control. Mainstreaming climate adaptation into existing policies will be problematic with numerous ministries[11] and is exacerbated at the District level due to funding constraints. Locally, negative interplay exists between household dependence from and resistance to government programmes and policies. For example, the Disaster Management Committee's general relief approach is creating a dependence on government support:

> *"I'm beginning to advocate that communities should not receive things for free. It is like we are supporting them but in the final analysis it is making them disabled. When they don't feel the cost of something they just take things for granted."*
>
> Government, District Informant

At other times, households resist government support. An agricultural project designed to improve and support coffee cultivation was initiated by a local Minister. However, politicisation resulted in some communities refusing to participate in projects associated with the NRM Government, despite potential benefits. It is not so much the refusal to participate in the project that is important, but the reason behind the refusal. A level of dissatisfaction with government programmes is seen by resident's perspectives on NAADS projects:

> *"So there is that problem of facilitation. The government created NAADS. It has been operating for the last 10 years, they are trying to re-structure now, but I can tell you for the 10 years, it was a flop."*
>
> Government, National Informant

[11] Guidelines to support the mainstreaming of adaptation into existing policy in Uganda were in development at the time of data collection in 2012, but were yet to be enforced.

The problem with NAADS is that it is so much politicised. It is more of a political programme than a technical programme.

Government, District Informant

Further negative interplays exist between formal legislation for access to resources, informal social institutions and customary land rights. In Kahendero, the demarcation of the QENP boundary is contested: residents claim they are entitled to more land than they are granted. Whilst the issue has been raised in the community's favour with the Country Parliamentary representative, the dispute continues. Related issues surround the legal processes that exist in relation to livestock keeping. The UWA has authority to confiscate any livestock found within the Park, retaining it for cash, or to fine or imprison the owner if they're identified. However, no comparable legal mechanism exists for residents to seek compensation should wildlife damage their crops.

In Kigando, new joint forest management procedures, known locally as collaborative forest management (CFM), are changing communities' access to the neighbouring forest reserve (see Box 6.2). Previously, residents were 'custodians' of the forest, and were allowed to cultivate crops and keep livestock. However, disregard for guidelines by some residents has led the National Forestry Authority to change access rights: at the time of fieldwork, a CFM agreement was being debated between stakeholders with authority shared between public administration and community SACCOs. Some households had already sold-off livestock due to reduced pasture, thereby constraining current coping options.

Formal regulations have negative interplays with informal social institutions. BMU regulations are of increased importance during times of stress, whereby fishing activities increase as part of households' coping strategies. However, internal power-relations determine the success of households relying on fisheries based coping strategies. Households with close relations to BMU members are often overlooked when using illegal methods in order to maximise the return they get from an over-used resource. Therefore despite the BMUs responsibility to enforce regulations, there is an acknowledged ill-regard for the system in favour of social ties and connections:

Some people, because we are born here, some are our relatives, and some are our fathers. So we told them that they should fish with the recommended fishing gears but some refused because

they know us, and they are the ones that elect us. So sometimes we will bend the law. For example these ones here [points to nearby boat] these are illegal fishing nets. They are too small. But this is my brother and I refuse to arrest him.

BMU Committee Member, Kahendero

Therefore, the ability of households to rely on fishing as a coping strategy largely depends on their social position and relationship to others in the community. In order to overcome legal restrictions concerning lake access and to maximise their gains using illegal fishing nets, households must have favourable social relations.

Box 6.2. Forest land access in Kigando

Recent changes in usage permissions of the Mubuku Central Forest Reserve are affecting household activities:

> *"I faced challenges with the forest. I sometimes graze my cattle from the forest, which is from the government and sometimes the government officials restrict me from grazing from this land. If they find me here, they would fine me. But this is the only land that can accommodate my cattle. [Mubuku central forest reserve]"* (**HH39, Kigando**)

> *"That is not enough carrying these out and now we do agriculture. We have some nearby forest reserve. Those people in charge of the reserve, they no longer allow people to cultivate plants in the forest. We don't do agriculture on large-scale, so we carry out some little agriculture on the land we have. Last season we grow some crops in the forest reserve, but from now, we have heard that there is no more carrying out agriculture in the forest."* (**HH56, Kigando**)

> *"We are using forests to graze, but now they (the government) have stopped us from grazing. So there is no land where I can do this."* (**HH68, Kigando**)

The *Forest act of 2003* specifies what activities can be carried out in the forest reserve and those which are prohibited, except with some special arrangement. The National Forestry Authority (NFA) allowed for tree planting, and after the tress are established, the following season some specific crops can be planted (i.e. beans, soya beans, groundnut etc that will not overshadow the tree seedlings).

> *"The forest guys invited us. They told us to be planting the beans and g-nuts, and also plant trees and these trees will be yours. So in other words, they allowed us to cultivate in the forest. You couldn't plant any crops with tough roots."* (**Village committee, Kigando**)

Since, this agreement has been violated.

> *"If you go to the forest, there are very few trees. So the responsible bodies are saying you are not serious, you did not respect the gentleman's agreement, so let's ban crop farming." (***Civil Society, District)**

In regards to the development of the new CFM procedures, MIFA (the Mubuku Integrated Farmers Association, a CBO formed in 2009) are negotiating access rights with the NFA. A point of contention is issues of grazing and agriculture:

> *"NFA is not going to allow such activities [grazing and agriculture) to be a part of the agreement. So now the communities are also resisting saying if you are not allowing us to graze then we're not getting anything. So this is where the challenge is because communities want to graze yet this is a forest reserve and according to the Act there is no grazing or agricultural activities are allowed in a forestry reserve." (***District Government)**

6.5 Discussion: What does a polycentric perspective mean for coping and adaptation?

The P-AIL framework facilitated the identification of institutions that shape household coping capacities, thus shaping their coping strategies. This considered the institutional articulation and interplay which the analysis here shows is important for understanding coping and adapting. Communities' reluctance to adopt external interventions, the perceived political goals of government projects, and under-appreciation of informal social institutions are all observed to determine whether planned adaptation strategies are able to support household coping options. Positive articulations represent opportunities to support existing coping capacities, whilst negative interplays highlight institutions that restrict strategies. Coping can therefore be supported either by addressing negative interplays and institutional gulfs and/or by strengthening positive institutional interplays. Polycentricism has previously been used in climate change research, but largely in relation to the design of institutions related to efforts to mitigate climate change (Ostrom 2010b; Nagendra and Ostrom 2012). Ostrom (2010c) has stressed that polycentric approaches facilitate achieving benefits at multiple scales and levels. Therefore, polycentric perspectives provide an approach that guides the consideration of the variety of drivers of coping capacities.

The AIL framework provided an "important conceptual bases for thinking about adaptation in relation to the livelihoods of the rural poor… and the specific effects of rural institutions on adaptation practices" (Agrawal 2008: 51). The P-AIL framework provides distinct advantages over the AIL framework in unpacking the complexity surrounding adaptation of rural livelihoods, specifically how household coping capacities are shaped. A polycentric perspective explicitly acknowledges the importance of informal institutions alongside formal institutions, and provides theoretical advantages in seeking to understand institutional interplays and institutional gulfs.

Households operate within a relatively flexible institutional environment, and therefore it is important to understand the interplay between different institutions. Some institutions theoretically constrain available households coping strategies although they are disregarded depending on a households' access to social structures. Recent studies have suggested that people seek to bypass formal rules in order to retain traditional practise

(i.e. Naess 2013). This chapter has confirmed this, especially where customary norms may conflict with formal government policy. Attempts to formalise customary institutions have been found to undermine the flexibility of the institution (Cinner and Aswani 2007). Therefore the extent to which informal arrangements, such as self-enforcement, are successful depends on the social structures within a community and differing levels of nepotism, and it is not sufficient to assume these can be strengthen through government intervention.

The P-AIL approach has shown that the interplay between formal and informal institutions may provide important opportunities to strengthen future adaptation. Coulthard (2011) argues that customary institutions play a crucial role in local governance despite risks that current community power inequalities may be maintained. Communities across sub-Saharan Africa are increasingly observed to oppose state-led top-down approaches (here, and also Baudoin 2013), whilst participatory grassroots activities such as savings groups are increasing in popularity. Furthermore, government led co-management policies can weaken traditional institutions (Gelcich *et al.* 2006), thus impacting on the functioning of community activities that are shaped by informal customary institutions. Increasing understanding of these interplays between different local institutions and those at wider scales helps unpack the complex relationships that exist in shaping the environments within which households cope and adapt.

Polycentric approaches encourage opportunities to identify processes that may be considered 'successful' in one context and enable these to be compared or adopted elsewhere (Ostrom 2010c). The results here show that polycentric approaches offer these opportunities for adaptation to climate change, given how applying such a framing has identified important institutional interactions which were not apparent by considering a monocentric perspective. Yet institutional frameworks to facilitate the process involved in this are lacking. Enhancing capacity at district and national levels enables cross-country learning and knowledge exchange as well as improving resource efficiency. This highlights that polycentric institutions are important in regulating the vertical interplay between different levels of governance (Young 2002). By focusing on the institutional interplays, the P-AIL framework supported the identification of institutional gulfs, which provides a focus for further research to understand what may cause these gulfs, and how to overcome them. Recent debates in the literature have called for greater understanding into the dynamics of institutions within adaptation (as outlined in Chapter 2). The P-AIL framework

has provided an approach that offers greater opportunity to unpack the dynamics across the institutional environment compared to the AIL framework.

Whilst the P-AIL framework helps the theoretical development of understanding institutional interplays and gulfs, there are also important social-political implications pertaining to household coping and adaptation. Firstly, as discussed above, formal restrictions are more frequently and readily overcome due to disconnects between the state and the daily functioning of rural communities. Understanding how the local interacts with wider formal policies is critical to formulating activities that enable successful coping strategies: decision makers must recognise how informal institutions overcome seemingly inflexible restrictions.

Secondly, addressing the institutional gulfs discussed earlier, including the lack of enabling and political frameworks, will contribute towards developing cross-scale capacity that supports household coping and adaptation. Enhancing household capacity for autonomous coping releases resources at the district and national level to support wider adaptation and development activities. However, knowledge-sharing frameworks do not yet exist despite their recognised value (see for example Bodin. *et al.* 2006; Cohen *et al.* 2012): they need to be developed to support the dissemination of project outputs. Current institutional isolation limits the impact of activities and funding: civil-society led projects are sporadic and uncoordinated and remain isolated from each other. Whilst frameworks must facilitate disseminating information, institutions must also be flexible enough to consider utilising the information. Providing the enabling framework is one challenge, but supporting institutions to utilise the resulting information is another (Pahl-Wostl 2009).

Finally, the success of policies designed to manage climate vulnerability depends on the institutional integration of micro-scale adaptation practices (Rodima-Taylor 2012). Specifically, recognising how customary institutions shape current coping strategies can provide a framework through which to target support. This should focus on empowering communities in enhancing and developing institutions to build their capacity. For example, civil-society led projects enable the VSLA/SACCO models to be embedded within rural societies, thus enabling some community members to develop their own savings groups, or widening the portfolio of activities undertaken by existing groups. Participatory processes maximise the benefits from existing customary institutions whilst reducing any associated constraints. Women-only savings groups are one example of targeting these

activities: women have the opportunity to engage in activities that they otherwise might have been prevented from joining.

6.6 Conclusions

This chapter developed the P-AIL framework to explore the value of a polycentric lens for understanding household coping strategies and tested the framework by analysing the local institutions that affect household coping strategies in Kigando and Kahendero. Formal law and governance structures play an important role in shaping the availability of particular resources. Alongside this, various informal, local institutions also shape decisions. Projects and policies that focus on coping would benefit from acknowledging the polycentric arrangements that shape local decisions.

Analysing institutions through the P-AIL framework illustrates the important role that local informal institutions play within a wider institutional environment. Informal and formal institutions enable and constrain household coping strategies to climatic extremes directly, and through various positive and negative cross-scale interactions. Formal institutions play a significant role in livelihood specific coping strategies, whilst informal social institutions are important in enabling households to draw upon strategies regardless of livelihood. Moreover, informal institutions provide formal institutions access to engage with the local. That does not necessarily require 'new' hybrid institutions to form, but to recognise the value in acknowledging the interplay between formal and informal institutions. There is a need to support and enhance people's capacity thereby empowering households to undertake autonomous coping strategies rather than relying on externally planned options that currently rely heavily on formal institutional process.

Recent studies have adopted the AIL framework to try to focus on local institutions (i.e.Washington-Ottombre *et al.* 2010), but informal customary institutions remain relatively under-investigated. These studies have argued for the role local rural organisations play in strengthening adaptive capacities in rural African societies. Whilst this has provided much needed focus at the local level, there must be recognition of how these organisations are operating, and therefore for understanding the institutions that shape coping activities at the local level. Yet further questions remain unanswered. Informal institutions clearly provide a mechanism through which households can learn from each other at various scales. However, whether these mechanisms facilitate learning

on timescales that is necessary for adaptation remains unknown. These institutions may be more resistant to change and remain relatively static compared to those required for successful coping and adaptation. The presented P-AIL framework helps emphasise the plurality of decision-making processes, not only in shaping household coping strategies, but also in the articulation of formal institutions with more local level informal institutions.

The use of the P-AIL framework does have its limitations. The P-AIL framework provides a starting point towards institutional analysis approaches that prioritise a focus on the interplay between formal and informal institutions. As such it can be considered quite 'general'. For example, the framework currently does not unpack the issues of scale, or specifically the formalisation of different institutions. Nor does the framework suggest approaches or methods that can be used to address the different interdependencies that are identified through the analysis. However, the framework does help provide important new insight, adding value to the current research on institutions and coping responses. For example, the framework extends current approaches which have focused on the more formal characterisation of institutions, and makes explicit the need to examine informal institutions alongside existing analyses. In addition, the polycentric approach specifically focuses on the interaction between different institutions, rather than looking at individual institutions.

Developing and adopting the P-AIL framework has highlighted the importance of undertaking an institutional analysis through a polycentric approach. Despite the growing literature on institutional perspectives within the wider climate change adaptation literature, a substantial gap remains where studies have insufficiently considered local level institutions that remain outside the formal or 'traditional' policy sphere. The modification of the AIL framework has identified the need to give more consideration to the polycentric nature of the institutional environment concerning household coping strategies. Polycentric institutions have very high implications for resilience (Djalante *et al.* 2012), and therefore considering their role within household coping and adaption strategies is imperative to support rural African societies to become resilient to both climatic extremes and climate change. The development of the P-AIL framework is one contribution towards developing institutional analysis approaches that enhance understanding of the complex relationships that shape coping and adaptive capacities.

Chapter 7 Discussion

7.1 Introduction

Communities across Africa have been coping with climate variability and climate change for generations with varying levels of success (IPCC 2014b). In addition, these communities are also affected by multiple non-climatic stresses. As a result, adaptation to climate variability and change is now becoming embedded in the goals of development policies and programmes across Africa. It is therefore increasingly important to understand the processes that lead to strategies for coping and adapting at the local level so that policy can support and enhance them to build resilience. The research presented in this thesis helps to advance our knowledge on the institutional dynamics that shape household coping capacities.

This thesis has shed light on these processes by considering the coping strategies households undertake (Chapter 4), the local networks that are integral to these strategies (Chapter 5) and the wider institutional environment that shapes them (Chapter 6). The findings and arguments presented in the previous three chapters as well as the literature reviewed in Chapter 2 are brought together in this chapter. Whilst the data analysed in this thesis is specific to the cases of Kigando and Kahendero, the evidence can contribute towards broader debates on coping and adapting to climate variability and change. This chapter summarises the earlier findings and examines how this enhances current understanding regarding how coping capacity can develop into adaptive capacity.

The underlying argument throughout this thesis is that we need to understand current coping strategies in order to help develop adaptive strategies. Having examined household coping strategies, it is now possible to identify the potential implications that this has for adaptation, and adaptive capacity, that is, what are we now able to understand about adaptive capacity? The findings presented in this thesis corroborate other literature that has suggested that 'successful' future adaptation strategies will need to recognise current strategies (Vincent *et al.* 2013; Eriksen *et al.* 2005a; Orindi and Eriksen 2005), and that both coping capacity and adaptive capacity are needed (Béné *et al.* 2014). Within this literature, understanding how these capacities are shaped and how they can strengthen

future strategies rather than weaken them is still under-developed. This thesis has sought to understand the institutional dynamics that shape household coping capacities in more detail. In particular, this thesis has argued that investigating how institutions shape coping capacities can not only increase our understanding of coping capacity itself, but that it provides insight into adaptive capacities. Moreover, through gaining such insight it may be possible to start to address how best to simultaneously support current coping capacities whilst strengthening adaptive capacities. The development of coping capacity into adaptive capacity remains unresolved, but these issues surrounding building capacity at different levels are becoming more apparent in the literature (i.e. Hill and Engle 2013; Birkmann *et al.* 2013), and require further research.

The following section reviews each of the research objectives set at the start of this thesis. Objectives 1-3 are revisited in respect of the main results, the contribution this has made to the literature, and how these findings have advanced knowledge in this area. Synthesising the results from these three objectives enables objective 4 to be introduced and discussed in section 7.3. Specifically, themes of resource use, local institutional capacity and polycentric frameworks are discussed in relation to coping and adaptive capacity. From the evidence found in this thesis, it is argued that autonomous and planned adaptation is a more operational perspective through which adaptive capacities can be supported. Section 7.4 finally outlines some of the social-political implications that are raised from this work.

7.2 Revisiting the research objectives

7.2.1 Revisiting objective one: to identify household coping strategies to climatic hazards such as floods and droughts in two communities in Uganda.

Chapter 4 investigated the types of strategies that households use to cope with climatic hazards such as floods and droughts. Predicted increases in rainfall variability across parts of Africa could result in both longer and more intense droughts and more erratic rainfall episodes (IPCC 2012). Many communities across sub-Saharan Africa remain vulnerable to not only mean climate change, and increased climate variability but also numerous non-

climatic stressors, especially those communities who depend on rain-fed agriculture and natural-resource activities. The literature provides numerous empirical cases whereby communities are successfully coping with climate variability (for example Antwi-Agyei *et al.* 2012; Bryan *et al.* 2009; Traerup and Mertz 2011), yet understanding how these coping strategies vary depending on the hazards experienced remains limited. Therefore, the objective of Chapter 4 was to investigate the different strategies households use to cope with different climate stresses, and to characterise what drives this choice of strategy. Quantitative and qualitative analysis of household survey's and interviews were undertaken to identify the different strategies household's use and what drives the choice of strategy.

The analysis in Chapter 4 showed that if livelihoods are not market-orientated, coping strategy is hazard specific, particularly for the poorest households. If livelihoods are market-orientated, households typically draw upon these livelihood activities to cope regardless of the hazard. The results empirically contribute to the literature by showing the hazard-specific variation of coping strategies to climatic variability. Out of the seven coping strategies identified, only two were found to be used by the same households during both floods and droughts: savings in Kahendero and social support in Kigando. This analysis has shown that the most vulnerable households rely on different strategies for different hazards, and therefore adaptation support needs to account for this variability.

Chapter 4 discussed the opportunities for diversification as an adaptation strategy. The analysis identified that a wider diversity in community activities results in increased viability of income generating activities during hazards. This enabled village savings groups to maintain a steady input to savings, enabling those impacted by hazards to draw upon these savings. Therefore in communities with diverse livelihoods, service-based activities were able to safeguard natural-resource dependent households from hazard-induced income reductions. However, diversification can erode current coping capacities: it can replace previously sustainable activities with those that have negative environmental impacts (Niang *et al.* 2014). This can lead to the need for further coping strategies to respond to 'new' environmental impacts (Adger *et al.* 2011), such as the burning of bush to clear land for agricultural productivity. There are also non-environmental impacts that risk the success of diversification. Diversification at a household level shapes the level of diversity in community activities. Kahendero has a more diverse activity profile than Kigando. However several households expressed a desire to undertake more market-based

activities in efforts to increase their resilience to climatic variability, yet increasing market-activity in Kahendero risks over-saturating the market. Therefore the discussion in Chapter 4 identifies that although diversification is an important adaptation strategy and often advocated as a way to reduce vulnerability and build household resilience, we need to unpack the different ways diversification may actually increase vulnerabilities.

This thesis contributes towards understanding the factors that differentiate choice of coping strategy: coping strategies are shaped by multiple interactions of different household and village contexts, as well as characteristics of the hazard itself. The evidence supports the need for a more nuanced view of diversification, one that considers the level of customary-based and market-orientated activities at household and village level. How choice of coping strategy will impact future adaptive capacity and subsequent adaptive strategies remains unresolved. Potential implications for the progression of coping capacity into adaptive capacity are raised in section 7.3.

7.2.2 Revisiting objective two: to examine the network structures that exist in two communities during floods and droughts.

Objective 2 was addressed in Chapter 5 where SNA was used to examine the structures of different community support networks under different climatic hazards, and the ties that exist between households. Whilst the value of SNA within ecosystem management is growing in recognition (Sandström and Rova 2010; Cassidy and Barnes 2012; Barnes-Mauthe *et al.* 2013), there has been limited consideration of its use in understanding the influence networks have on coping and adaptive capacities. The analysis within the chapter built on the results in Chapter 4 , and showed that support networks differ depending on the stress experienced.

Chapter 5 also identified that social support ties are not as dependent on bonding ties (dense ties between homogenous groups) as the existing literature suggests (Barnes-Mauthe *et al.* 2013). Bridging ties have enabled households to access resources to cope with changing situations (as stressed by households that have used these networks to cope in the past), but limited investment in bonding ties and relations of shared norms limit the capacity of households to respond to unexpected shocks and stresses. The literature has argued bonding ties are necessary for households to cope with climatic hazards (Adger

2003; Pelling 1998), however Chapter 5 provides empirical evidence that networks characterised by bridging ties can also be used to cope with climatic hazards.

A further empirical contribution to understanding rural support networks is made by the finding that core households act as important scale crossing brokers between local formal and informal support, as well as external formal support. These core households affect how other households access both formal and informal support by determining who can access different options: for some households this enables them to benefit from such ties, for others it restricts their coping options.

The discussion in Chapter 5 considered the relationship between how networks are used to cope with hazards in the short-term, and how they can support the development of future adaptive capacity. Limited evidence suggests investments are being made in the networks to build resilience to future changes. This is linked to social-cultural institutions within the village, and the respect for social hierarchies combined with the lack of bonding ties evident within the hazard response networks.

Empirical and theoretical contributions are made from the analysis presented in this chapter. Chapter 5 provides empirical evidence of how networks in rural communities differ under different climatic hazards. This advances knowledge from networks that have been considered from the perspective of a single stress, which is important given future climate uncertainty (cf. Cassidy and Barnes 2012), and also provides evidence from rural farming and inland fisheries systems where the literature has been dominated by network analysis in coastal and marine fisheries (Barnes-Mauthe *et al.* 2013; Bodin and Crona 2008). Theoretically, the results challenge the literature that advocates brokers in a network provide opportunities to strengthen the support networks (Rotberg 2010). The evidence found here shows such brokers can restrict some households from accessing support. At a policy level, it is important to consider the role of these core households: both informal and formal networks needs investment, but policy must account for the social injustice that can arise through from the position of these brokers if informal networks are to support household coping capacities.

The analysis in Chapter 5 provides evidence on the social assets and relational ties during times of coping. The network analysis also provides complementary evidence that supports the institutional analysis of coping strategies undertaken in Chapter 6. The analysis has not been able to show how networks support the development of coping into

adaptive capacities. It has shown the network structure and household position in the network can potentially impact the vulnerability or resilience of households. However, these issues still require further investigation. Methodologies such as SNA provide opportunities to explore the coping-adaptation development. As section 7.3 shows, considering the role of networks from a coping capacity perspective provides opportunity to hypothesis about the implications of adaptive capacity, and a guide for further research.

7.2.3 Revisiting objective three: to identify the formal and informal institutions that shape coping strategies and the interplay between them

Chapter 6 addressed objective 3 and investigated the effect institutions have on household coping. In doing so, the P-AIL framework was developed which drew upon the established AIL framework (Agrawal 2008) but specifically considered the polycentric dimension (different institutions, at different levels and scales) thereby giving more attention to informal institutions. A polycentric perspective overcomes previous limitations of the AIL framework, whilst considering issues relevant to agency, a facet that is increasingly argued for in resilience work (Béné *et al.* 2014).

The analysis provided novel empirical evidence regarding the effect institutions have on the nexus between livelihood strategies and coping with climate shocks: formal institutions play an important role in livelihood specific coping strategies whilst informal institutions are important in enabling households to draw upon strategies regardless of livelihood. Further, the interactions between different institutions were investigated and different positive and negative interplays were identified. By adopting a polycentric approach that focused on multi-directed, multi-scalar institutions, the analysis was able to examine the vertical and horizontal coordination between different institutions.

Whilst positive interplays were evident, for example, how the articulation between social-cultural informal institutions and civil society institutions enabled the development and functioning of village savings groups, there were several negative interplays that currently impact household coping capacities. These include households' simultaneous dependence and resistance to government programmes and support; the interplay between formal legislation and customary land rights; and the way informal social institutions can

circumvent formal regulations. The P-AIL framework also assisted in the identification of institutional gulfs. Such gulfs exist where there are no frameworks to facilitate best practice, or maximise resource use. For example, there is scope for the private sector to help develop carbon markets, yet there is no framework to value the physical resource. This includes an absence of legal frameworks that support access to carbon markets. Additional gulfs exist in frameworks which ensure institutional substitution. Currently civil society institutions can support gaps in service delivery of state-led adaptations, but these are often sporadic and uncoordinated. Frameworks that streamline these articulations will help facilitate best practice and maximise resource efficiency.

These results contribute to the wider literature on the role of institutions in adaptation. Brown *et al.* (2010a) have argued that facilitating institutional linkages across government, private sector and civil society can enhance adaptive capacity. Others stress the value of considering the formal mechanisms and institutions that shape societies adaptive capacity (Vasquez-Leon 2009). By adopting a polycentric perspective through the P-AIL framework, Chapter 6 provides empirical evidence on cross-scale and formal-informal interplay, and shows that in addition to the above, informal mechanisms are also key to providing access points for formal institutions to engage with the local. This shows the need for decision-makers to identify and consider the formal-informal interplays that occur within rural communities, in addition to considering how national policy plays out at a local level. Whilst the P-AIL framework was applied directly to understand coping strategies, it can highlight areas where focus needs to be given to also support adaptive strategies. For example, where formal-informal institutional interplays shape coping capacity, they may well have implications for adaptive capacity and these need to be further studied.

This evidence shows that coping capacities can be supported by addressing the negative interplays and gulfs, as well as identifying positive interplays and seeking to strengthen them. Da Silveira and Richards (2013) talk of 'functional polycentrism' in regard to the interplays between different institutions, arguing this is important to enable critical system functions to continue during times of change. The evidence in Chapter 6 shows rural households operate in relatively flexible institutional environments: informal institutions are not only able to by-pass restrictions that formal institutions otherwise present, but culture, and social rules and values can support building coping capacity where such institutions shape existing culturally ingrained activities. However, at times these institutions may hinder longer term adaptation in some circumstances whereby some

institutions can restrict particular households' activities. For example, some households do not have access to the informal institutions that enable them to overcome formal restrictions, as seen in the ability of some households in Kahendero to overcome BMU regulations. Formal institutions can shape planned adaptive actions that are directed from levels beyond the local community but must recognise the informal institutions within a local context and how the variety of activities undertaken as both planned and autonomous adaptations are currently shaped.

7.3 Reflecting on what the institutional dynamics of coping means for adaptation and adaptive capacity: addressing objective four

7.3.1 Introducing objective four

Objective 4 of this research draws upon the evidence gained from the previous three objectives to reflect on what insights the institutional dynamics of coping provide for understanding adaptation and adaptive capacity. This section synthesises the findings of this thesis (Chapters 4-6 and summarised above in section 7.2), in order to meet objective four and therefore move towards increasing understanding of the role of institutions in shaping adaptive capacity. This thesis has explored the institutional dynamics that shape household coping strategies. From this evidence, it is possible to consider the potential role institutions have in not only shaping coping capacity, but how this can support the development of adaptive capacity, or in other words moving '*coping actors*' to '*adaptive managers*' (Fabricius *et al.* 2007)(Figure 2.3). The majority of households involved in this research showed limited awareness of the potential impacts of future climate change. That is to say, regardless of whether the phenomenon of climate change was understood, households' prioritised short-term responses over long-term planning, demonstrating how immediate challenges restrict households from making decisions that would improve their adaptive capacity. Therefore, improving short term livelihood security is important to enable adaptive capacity to be strengthened. Once households are (more) secure in the present, options can be explored that look to strengthen adaptive capacity for the future.

This thesis has identified the different coping strategies households in Kigando and Kahendero use during times of floods and droughts (Chapter 4). It is evident that social

structures are important in many of these strategies, and investigating these further in Chapter 5 showed that there are specific households within the communities that are influential in shaping household coping responses. These households provide access points for other households to engage with both formal and informal support mechanisms, as well as providing key bridging points for institutions at other levels and scales to engage with the community. Chapter 6 then used the P-AIL framework to show the importance of different interplays between formal and informal institutions. Specifically, the evidence shows formal institutions play a significant role in livelihood specific coping strategies, whilst informal institutions are important regardless of livelihood.

The knowledge gained through this thesis is only directly applicable to coping capacity and coping strategies. However indirectly, it is possible to draw out the potential implications this can have for household adaptive capacity and adaptation. Coping and adapting aspects of resilience are essentially "different perspectives of the same reality" (Béné *et al.* 2014: 5). Therefore household coping capacities can be strengthened, but in certain situations, they may need to decrease to allow adaptive capacities to develop. The trade-offs and synergies between enhancing both capacities are essentially mediated by institutions. As a vulnerability perspective argues, the ability of households to make decisions regarding the coping responses they take is informed through differing levels of agency and power (Djoudi and Brockhaus 2011; Roncoli *et al.* 2011). Integrating these issues pertaining to agency and power is gaining urgency within resilience perspectives so as to recognise the multi-directed, multi-scalar environment these households are situated within (Béné *et al.* 2014; Gelcich *et al.* 2006; Galaz and Duit 2008). Moreover, the household focused perspective adopted within this study contributes to understanding what enables or constrains particular households to adopt certain strategies.

Numerous studies highlight the reactive and autonomous nature of adaptation (Smit *et al.* 2000; Vermuelen *et al.* 2008; Ziervogel *et al.* 2008). Whilst no single coping strategy will be wholly autonomous given the variety of factors that shape coping and adaptation, the autonomous element must be recognised. Planned adaptation can support autonomous adaptations, providing the process and institutions that shape such autonomous activities are considered. Households' coping and adaptive capacities shape their coping and adaptation strategies. Planned adaptations can strengthen these capacities, but there is a risk they can also reduce them: there will be particular leverage points at which coping strategies either contribute towards building future adaptive capacity, or inadvertently

restrict the development pathway so as to limit adaptation options and weaken adaptive capacity.

In practice, coping and adaptive capacity may be operationalised through planned and autonomous adaptation (Figure 7.1). Whilst autonomous and planned adaptation are not synonymous with coping and adaptive capacity (i.e. coping is not always autonomous), they provide a tangible means for decision makers to target policy interventions whilst considering the different capacity needs of households. For example, identifying how coping capacity is currently shaped, and then considering and implementing policy that seeks to support longer term adaptation whilst avoiding any negative effects on coping may support the development of adaptive capacity. Thus considering how planned and autonomous adaptation is related, through an institutional perspective, enables policy to target activities and strategies that contribute towards strengthening either coping and/or adaptive capacity. The interplay between planned and autonomous adaptation shapes the different coping strategies available to households.

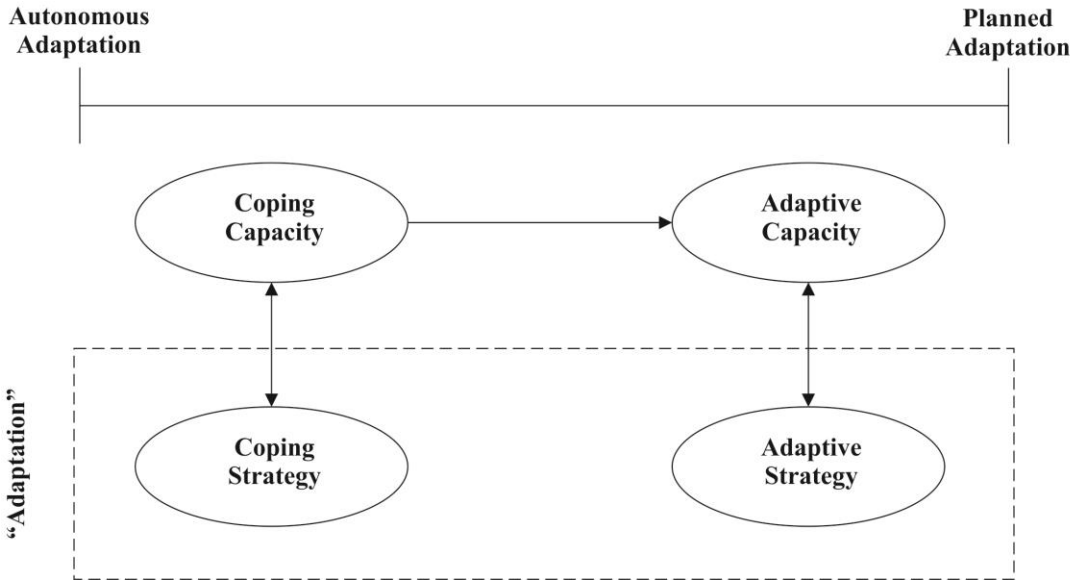

Figure 7.1. The relationship between coping and adaptive capacities as viewed on a planned/autonomous adaptation continuum

Autonomous adaptations refers to responses undertaken without explicit planning or focus on addressing climate related effects, and has sometimes been referred to as spontaneous adaptation (IPCC 2014a). At the other end of the continuum, planned

adaptation results from deliberate policy action or decisions which recognises future changes (IPCC 2007). Therefore coping capacity and associated coping strategies become aligned (although not synonymous) with autonomous adaptation through the notion of an immediate response. Similarly, adaptive capacity draws parallels with planned adaptation in the need to prepare in advance and respond to future impacts. Collectively, as shown in Figure 7.1, the coping strategies and adaptive strategies that given levels of coping and adaptive capacity result in, are collectively referred to as 'adaptations', recognising that autonomous and planned adaptations can contribute towards both coping and adaptive capacity. As McGray *et al.* (2007) suggest, planned adaptation can include planning for adaptation decision-making processes, rather than planning for specific outcomes. This is increasingly important given uncertainty in future climate projections.

The different ways planned and autonomous adaptations lead to different coping and adaptive capacities depends on the way institutions are situated along the planned-autonomous continuum (Figure 7.1). The evidence examined in this thesis has argued that it is important to recognise the how coping capacities of households are shaped, to then be able to consider how to support the development of adaptive capacity. How different institutions and the interplay between them will shape differing levels of coping capacity, will shape households strategies, and therefore have potential implications for adaptive capacity. The institutional dynamics of coping capacity can provide important insight into the institutional dynamics that shape adaptive capacity. This therefore raises the question about how coping capacity can develop into adaptive capacity. In Chapter 2, three challenges were outlined in relation to understanding the role of institutions in the development of coping and adaptive capacity: the concealed nature of adaptive capacity; temporal trade-offs; and the limited focus and lack of evidence in rural communities. Whilst these issues remain unresolved, understanding how institutions shape coping capacity has potential implications for better understanding adaptive capacity.

The evidence in this thesis has contributed towards an understanding of the institutional dynamics in shaping household coping capacities. From these findings it is possible to suggest ways in which institutions may shape household adaptive capacities. In other words, there are potential implications for understanding adaptation and adaptive capacity that can be gained from reflecting on the role of institutions in shaping coping capacity, and specifically by considering this from a planned/autonomous framing. The findings suggest that an autonomous/planned framing enables the consideration of how

institutions can best support coping capacities, whilst considering their role on adaptive capacity. Drawing on the evidence presented in this thesis, the role of institutions in shaping coping capacities, and what insight this can provide to understand adaptive capacities, as considered through autonomous and planned adaptation, can be examined through the use of resources, recognising and building local institutional capacity, and the need for polycentric frameworks, as is now discussed.

7.3.2 Resource use

Chapter 4 showed how livelihood strategies influence a household's available coping strategies, both shaped by household characteristics and the surrounding village context. These findings support the plethora of studies that empirically examine various coping strategies undertaken by households in rural sub-Saharan Africa (Cooper *et al.* 2008; Hisali *et al.* 2011; Osbahr *et al.* 2008; Quinn *et al.* 2011). Chapter 4 also highlighted the role of livelihood diversification in shaping household coping strategies. Livelihood diversification not only includes the expansion of activities undertaken by a household at any given time or place, but also migration of household members to activities elsewhere, and a shift to an alternate dominant activity rather than just an increase in the range of activities undertaken (Ellis 2000). Livelihood diversification can be seen as an autonomous process, in that it is shaped by pre-existing institutions within a community that a household may choose to utilise. Simultaneously however, planned interventions and wider institutions may increase a households' capacity to diversify (Forsyth and Evans 2013). For example, savings groups in Kigando and Kahendero that have been developed through interactions with civil-society support households to access loans that may enable start-up of diversified enterprises. Alternatively, NAADS (state support) may provide some households with small livestock which then enables them to diversify into small ruminant farming, rather than being wholly reliant on crop farming.

But how does this diversification shape coping and what implications does this have for adapting? Studies show that livelihood diversification supports households to cope in times of shock due to the spreading of risk across different activities (Baird and Leslie 2013; Goulden *et al.* 2013; Motsholapheko *et al.* 2011). In addition, Chapter 4 argued this is not just within a household, but also within a community where greater diversity in community activities increases the resilience of some coping strategies, i.e. savings groups.

Theoretically, diversification can support adaptive capacities and improve coping opportunities (McLeman and Smit 2006), for example by reducing the dependence on activities that have proved vulnerable to past shocks. This thesis contributes to the debate on diversification by arguing that diversification at a community level may reduce the resilience of some households. In Kahendero, the risk that households' determination to diversify into market-based activities will over-saturate the available market was not considered: if households specialise rather than diversify they may reduce their resilience to wider socio-political shocks despite increasing their resilience to environmental shocks. Further evidence of the need to critically consider the risks from diversification was shown in Chapter 5 . The networks in Kahendero (greater diversity of activities) showed lower levels of cohesion. Indeed social support as a strategy was used less by households in Kahendero than Kigando (Chapter 4). This suggests diversification can risk eroding social cohesion that builds up around particular activities.

Diversification will in part depend on the available resources. Therefore if the conditions exist to enable benefits from diversification, planned adaptation can support households to use resources in a manner which complements rather than conflicts with wider community options. Institutional frameworks that provide space for households to expand their options and not get locked-in to particular pathways are important. Diversification can bring added benefits to households by increasing their resource efficiency. By providing opportunities to engage in additional activities, households increase their labour capacity which can provide additional benefits alongside risk management. For example, NAADS support can result in increases to a household's income whilst spreading risk.

Baird and Gray (2014) have found that exchanges within households' social networks are evolving alongside livelihood diversification. They found within sub-Saharan African pastoralist communities, that such exchanges are declining as households diversify their livelihoods. Therefore as diversification increases, there is a double-risk that resilience could vary due to both the impact from diversification choices, as well as from weakening networks. Whilst not explicitly considering diversification on network structure, the evidence from this thesis suggests that these sorts of risks extend beyond pastoralist societies. With a more diverse range of activities, Kahendero was observed to have fewer households that provide support compared to Kigando, where the more homogenous community activity profile exists alongside a greater number of core households (Chapter

5). In other words, greater diversity has been observed alongside a less extensive network.

7.3.3 Local institutional capacity

Pre-existing cultural and livelihood specific practises provide the structure and experiences to support households to diversify into different activities. These informal institutions therefore play an important role in enabling households to diversify livelihood activities (if appropriate), or in supporting structures that households rely upon such as savings groups. One key finding from the analysis has been that while formal institutions are particularly important in shaping livelihood specific coping strategies, informal institutions are more important for non-livelihood specific strategies. Investment in specific coping strategies that are not dependent on a particular livelihood activity may be more important than other coping strategies given the uncertainty of future climate predictions in Uganda, alongside the variety of ways households may adapt their activities in the future. Therefore focusing on informal institutions that are important in the functioning of non-livelihood specific coping strategies ensures that households are not locked-in to particular coping or adaptation pathways as a result of current coping choices.

Informal institutions are most prominent at a local level. As Biggs *et al.* (2012) argue, the local level has direct links to resources and their appropriate use. These resources are already used in autonomous strategies. For example, low-cost irrigation techniques that use polythene bags suspended above crops are being used in some areas of Kasese district. These can be adopted by farmers with minimal resource investment. Informal institutions that encourage the sharing of such practices, for example, opportunities whereby farmers can visit other farmers and observe these techniques, provide a framework from which adaptations can be supported in a manner that may be considered as autonomous. Planned adaptations may be considered to be 'imposed' on a community or household, especially where political dynamics are involved and opposed by the community (Herrfahrdt-Pähle and Pahl-Wostl 2012). The evidence in Chapter 6 suggests that cultural institutions may be resistant to planned adaptation efforts, as a result of political and cultural dynamics. Therefore planned adaptation needs to recognise the way the internal structural constraints presented by informal institutions shape the success and uptake of planned adaptations.

Past research has argued that a strong local-scale system of social-ecological governance increases the likelihood that governance at other scales will be successful (Dietz *et al.* 2003). Increasing local institutional capacity in order to enable planned adaptations to be taken up through informal institutions can not only improve resource efficiency, but provides greater opportunity for the adaptation to be accepted by the community. Local capacity must be built up in line with existing institutions. Planned policy interventions however must be aware of these processes in a participatory manner so that autonomous adaptations can link up to wider scale processes. This will also contribute towards ensuring detrimental effects are minimised: informal customary institutions may retain the status-quo that inhibits novel practices and arrangements, as is often discussed with reference to transformative adaptation (Pelling 2011).

7.3.4 Polycentric frameworks

Local capacity must be built in line with existing social institutions (although recognising where status-quo may/may not be retained). Given the plurality of institutions involved in shaping community livelihoods and coping strategies, it is important to recognise polycentric arrangements: building capacity to enable the local to lead on co-management activities is important to ensure traditional institutions that currently support autonomous strategies are not weakened. Polycentric and participatory institutions that enable this self-organisation are crucial to strengthening the adaptiveness of a system, and therefore a community (Djalante *et al.* 2013). Moreover, the discussion on diversification shows how household and community perspectives result in different considerations of whether diversification is beneficial or not. Therefore considering the multiple scales and actors involved in difference coping activities, can help to more towards a better understanding of the relationship between coping and adaptive capacities. It is not possible to state that institutions that support coping capacity automatically enable or constrain the development of adaptive capacity for any one household. However, the polycentric perspective that has been adopted in this thesis has highlighted the value of considering such impacts.

Chapter 5 considered the informal and formal support mechanisms: when informal support networks are weak, dependence on formal support increases. For example, savings groups (VSLAs) or Government or NGO-led programmes may provide coping

mechanisms or disaster relief to households. Both the formal mechanism and the informal social exchanges of support are important to different households at different times, with core households influencing access to the network. For example, the analysis has shown that planned interventions by NAADS supports households to diversify, with this support often being provided through community groups such as savings groups, which in turn helps contribute towards informal support networks.

Networks provide important local mechanisms that enable coping strategies, and are recognised as important risk spreading mechanisms (Leary *et al.* 2008). Adopting a polycentric perspective recognises the value these informal networks play in enabling entry points where planned adaptation can enhance existing autonomous adaptation (including both coping and adaptation, as outlined in Figure 7.1). However, using informal networks as access points can have negative impacts. Using existing structures reinforces the 'status quo' within the power dynamics of the network. For example, households that cannot currently access either formal or informal networks remain disconnected from both support structures if existing mechanisms are used in future planned adaptations. Therefore planned adaptation must acknowledge the benefit of informal support mechanisms but ensure that local injustices are not manifested through planned activities. For example, local savings groups clearly have benefits. They are locally run and therefore place limited resource demands on planned adaptation budgets. However, minimum savings targets that are unachievable to the poorest groups must be investigated and evaluated by external support (be this NGO projects, or state-led support) to ensure the most vulnerable groups can access these programmes, rather than just replicating existing group dynamics.

There is a need to recognise the value of institutions at multiple levels in shaping coping options. The importance of local informal institutions was identified in Chapter 6 , specifically within non-livelihood specific coping strategies. The way external interventions affect local and indigenous institutions thereby strengthening and weakening different coping strategies is complex (Niang *et al.* 2014). Therefore, there is a need to consider the value of institutional arrangements at different levels in the role planned adaptation has on autonomous adaptation in order to unravel this complexity. Planned strategies will not automatically strengthen a household's resilience. In fact they could weaken it depending on the impact of (local) institutions. The idea that planned adaptations at one level may not fully account or connect with adaptation processes at other levels or scales is what

Thornton and Comberti (2013) refer to as the 'mitigation-adaptation disconnect'. Thereby recognising how planned adaptation from national or district levels interacts with local institutions involved with autonomous adaptation contributes towards ensuring planned adaptations complement rather than conflict with autonomous adaptation. Policies that recognise and account for this cross-scale dynamic can improve the resource efficiency of adaptation planning. Polycentric perspectives therefore consider the multi-scale, multi-level, multi-actor actions that shape coping capacities. However, this currently favours the impact planned adaptations have on other planned or autonomous adaptations, but not how autonomous impact on planned adaptation, or importantly how coping impacts longer term adapting. There is no evidence that autonomous adaptations are considered and being fed into policy goals and objectives.

An important element of polycentricity is that institutions conform to an overarching system of rules. This thesis argues that regardless of the scale, level or actor involved, institutions should seek to support household coping and adaptive capacity. Polycentric arrangements provide opportunity for different levels of governance to 'step-in' when other levels fail, or cease to function effectively (Biggs *et al.* 2012). In relation to the case of the evidence presented here, when the government is unable to provide a particular service or resource, civil society has been seen to support service delivery (Chapter 6). However, this set-up provides space for civil-society to replace state-led support, but little opportunity to reflect whether such mechanisms are actually the most suitable through which to deliver such support.

7.4 From theory into practice

This research has provided increased theoretical understanding on the role of institutions in short term coping and this chapter has considered the potential implications this has for longer term adapting. Moving beyond the academic debate, this section provides practical recommendations to policy and decision-makers and the practitioner community. The way networks and local institutions shape coping strategies are context specific. Therefore trying to characterise lessons from the evidence presented in this thesis based on two case-studies would not be suitable. However, by identifying characteristics within these case-studies that enable or even hinder coping provides a starting point from which to support future adaptation actions and investigate their potential risks and benefits.

Therefore there is a need to expand the evidence that this thesis has analysed by undertaking further additional studies. This could help substantiate the current findings, but also could identify additional important contextual factors that were not apparent in the two cases investigated in this thesis.

From the evidence presented in this thesis and discussed in this chapter, two main policy recommendations are identified: the need for legislative and policy frameworks that facilitate formal and informal institutional interactions that enable planned adaptation to complement autonomous adaptation; and the need for local informal institutions to be recognised and help shape national strategies.

Legislative and policy frameworks for adaptation remain fragmented, with national policies often insufficiently accounting for autonomous local adaptation strategies (Stringer *et al.* 2009). Inadequate consideration of context specific social-cultural factors such as local informal institutions can act as a barrier to enhancing coping capacity, which in turn may have negative impacts on a household's future adaptive capacity. Frameworks that enable lessons and experiences learnt in one area or project to be shared across contexts can help identify additional options that might not have been considered. Uganda is starting to develop such activities: the CCU are involved in implementing the first NAPA projects in Uganda, and NARO (the National Agricultural Research Organisation) have also been involved in field visits to share ideas and best practice amongst district officials. However, these processes involve high resource demands and have thus far only really targeted ad-hoc projects or institutions beyond the local level. Creating processes through which these lessons can be more easily exchanged without high resource demands involved in physical visits and ensuring these are then disseminated to the local is important, although designing practical, functional processes to do so remains a challenge.

Local institutions have to date played a limited role in the formation of national adaptation policies and strategies (Niang *et al.* 2014). In Uganda, there has been some progress towards including formal civil society institutions in this process, especially in the recent formulation of the Climate Change Policy (Barihaihi 2012), yet there remains limited inclusion of community-based knowledge. The civil society input has largely occurred from national NGOs drawing on knowledge that has been generated from selected adaptation projects. Whilst important, this remains focused on planned NGO activities, and efforts must be made to account for autonomous adaptations and to identify important informal

and formal institutions at the local level that are involved in these autonomous adaptations. Explicitly acknowledging the institutions involved in autonomous adaptation is necessary to ensure planned adaptation efforts are effective, but also to ensure that marginal groups known to be at risk of an increased level of vulnerability are provided with adaptation support that they can access. Identifying these local institutional dynamics becomes the first step towards targeting adaptation and development interventions to increase local institutional capacity. This in turn improves the resource efficiency of adaptation efforts in Uganda, and elsewhere.

Chapter 8 Conclusions

8.1 Summary of contributions

This thesis has examined the institutional dynamics of household coping capacities to climate variability. In doing so, it has been possible to also reflect on the implications of this for household adaptive capacities to climate change. Using a case-study approach, this research has drawn upon the SLF in order to prioritise a local household perspective whilst examining cross-scale institutions, which otherwise remain under-examined in adaptation research. A multi-method, multi-level approach was used enabling triangulation of data, and the flexibility that is necessary to examine informal institutions. To unpack the role of institutions in shaping household coping capacity, SNA was combined with a more traditional approach to institutional analysis to fully explore the different institutions that shape this capacity. Understanding how institutions shape coping and the possible implications this may have for adaptation is important in order to ensure adaptation and development interventions do not inadvertently reduce households' capacity.

This thesis has provided empirical evidence on the different coping strategies households in two communities in rural Western Uganda undertake in response to floods and droughts (Chapter 4). The relationship between coping strategies and livelihood activities showed that households with more market-based livelihoods tended to rely on economic activities regardless of hazard, whilst poorer households and those with non-market based livelihoods adopted different hazard specific coping strategies, for example, savings, or social support. Diversification of livelihood activities is argued in the literature as an important adaptation strategy, especially as a means to spread risk in the face of climate variability and change. However, for diversification to help strengthen household coping and (potentially) adaptive capacities, it is important to acknowledge the surrounding contexts that influence livelihoods. Chapter 4 identified that diversification may increase risks for some households, depending on

the household and village contexts. Therefore, there is the need for a more nuanced understanding of how diversification can benefit households and communities.

In addition to diversification and livelihood strategies, social support structures found in community networks provide important informal coping mechanisms (Chapter 5). Examining social networks showed that support networks differ under different climatic hazards, in both villages fewer households rely on the support network during droughts than floods. In particular, support networks showed lower levels of bonding ties than the literature has previously argued: social support mechanisms characterised by bridging ties (with a lack of bonding) can be used to cope during floods and droughts. Access to these networks were found to be influenced by particular 'core' households within the villages, and whilst this enables some households to engage with these support structures, it also restricts others depending on local power dynamics and social-cultural institutions.

Chapter 6 investigated the way different institutions shape the coping strategies and networks analysed in Chapter 4 and Chapter 5 . These relationships were analysed from a polycentric perspective showing that such interactions occur at all levels, and by numerous different actors. Therefore seeking to strengthen household coping capacities cannot be undertaken in isolation of national and sectorial policy drivers. The analysis provides novel empirical evidence on the way institutions affect the nexus between livelihood strategies and coping to climate shocks, particularly the importance of informal institutions. Furthermore, a polycentric perspective highlights the dynamic positive and negative interplays between different institutions, and how these manifest between different autonomous and planned adaptations. Current 'institutional gulfs' within the enabling political frameworks restrict planned adaptations in complementing autonomous adaptations.

Chapter 7 synthesised the evidence from all three chapters to use the knowledge generated throughout the thesis to reflect on how institutions affect household coping capacity and what this may suggest for the development of adaptive capacity. Institutions play a significant role in shaping household coping capacities and the associated coping strategies. Whilst coping in the short-term does not automatically enable households to adapt in the longer term or contribute to adaptive capacity, particular coping strategies may lock households in to particular pathways. Non-livelihood specific coping strategies present options that remain

flexible to the different livelihood choices that may arise through future adaptation. These coping strategies are dominated by informal institutions, which need to be recognised within planned adaptations to ensure they are not weakened or restricted by policy.

There remains a challenge in operationalising coping (and adaptive capacities) within policy planning and adaptation projects. This thesis suggests that the relationship between autonomous and planned adaptation can be a viable option to operationalise coping and adaptive capacities, thus enabling decision-makers to identify where institutions can support both coping and adapting. Informal institutions make a substantial contribution to shaping non-livelihood dependent coping strategies. Diversification has been argued here as not necessarily suitable in all contexts. Therefore, given uncertainty over future livelihoods, informal institutions related to non-livelihood specific coping strategies will become increasingly important.

Full understanding of the relationship between household coping and adaptive capacities remains unresolved. In order to enable household adaptive capacities to develop, formal policies and institutional frameworks for adaptation must recognise and enable community participation in adaptation planning. That is to say that the variety of autonomous adaptations that occur at the local level need to become acknowledged in planned adaptation. Moreover, adaptation and development interventions that seek to increase local institutional capacity will contribute to greater resource efficiency in resource-scare environments such as in administrative and political systems of sub-Saharan Africa.

Methodologically, this thesis has shown the value of applying SNA methodologies in climate adaptation research. The results here have suggested that network structures for coping differ from those identified under natural resource management foci. It is not possible from the analysis presented here to identify certain village characteristics that lead to particular network structures. Development of further empirical studies of community support networks would help to develop an understanding of the pattern of macro network structures that exist in particular rural communities. SNA is criticised for being a time consuming research tool, for both the researcher and participants. However, it provides a useful analytical tool from which to gain insight into complex social structures, such as institutional dimensions, and

further use and development of the tool may help to reduce the resource demands associated with it.

The development of the P-AIL framework provides a conceptual contribution to understanding adaptation in rural livelihoods. The framework extends previous understanding (Agrawal 2008) and argues the need for a polycentric perspective in adaptation. This explicitly considers informal as well as formal institutions at multiple scales, multiple levels and by multiple actors. This thesis has shown that such a perspective not only helps identify different institutions that shape coping, but also helps unpack the different ways institutions articulate with each other.

8.2 Implications

The results and analysis presented in this thesis are specific to Kasese district in western Uganda, in particular the communities of Kigando and Kahendero. Whilst, the results should not be generalised to other contexts, even in Uganda, they provide valid insight into institutional dynamics in relation to coping and adaptation, as well as identifying key areas to prioritise research elsewhere.

In summary, the research reported in this thesis raises the following key outcomes:

1) Adaptation and development planning must acknowledge the local-level informal dynamics that influence household coping and adaptation. This will help in the consideration of issues of power and agency that occur within these structures and the associated status quo.

2) To support building coping and adaptive capacity, specific focus must be given to the polycentric nature of household coping and adaptation decision making. Whilst, polycentric governance has been considered within the social-ecological governance literature, the SNA has shown how community networks used during times of coping are substantially different to those identified in broader natural resource management studies. Therefore more attention needs to be given to understanding these systems further.

3) Local decision-making structures are nested within wider decision-making systems. Local participation needs to occur from the outset of policy planning, rather than attempting to consider the impact of local strategies when mapped onto pre-existing plans. This inevitably demands resources to support local institutional capacity building and accountability processes.

4) Enabling political frameworks need to be developed that support the dissemination and uptake of best practice. This will help maximise resource efficiency and prevent adaptation 'failures' from being repeated elsewhere.

5) Adaptive and coping capacities have gained attention in the literature, yet are not easily operational. Considering how autonomous and planned adaptations link with these different responses provides tangible goals for decision-makers. Theoretically, it remains important to continue to unpack how different capacities are formed, but to ensure the findings can be operationalised through alternative concepts if necessary.

8.3 Limitations

In aiming to move towards a better understanding of the relationship between coping and adaptive capacity, this thesis examined the different coping responses undertaken by households in the case-study villages, and undertook a network and institutional analysis of these responses. Largely, the thesis has shown that issues surrounding the coping and adaptive capacity transition and vulnerability-resilience research agenda remain unresolved. Whilst this thesis has been able to examine the institutional dynamics surround coping, and how this shapes differing levels of vulnerability and resilience of households, the challenges outlined at the start of this thesis related to examining adaptive capacity remain.

Whilst this thesis has examined the institutional dynamics of coping, institutions remain complex and contextual. It is not been possible to draw out key interventions that would overcome the issues identified in this thesis in general, given the context specific nature of institutions. To do so, more evidence beyond that examined in this thesis would be needed.

A further limitation in this research relates to the scale at which the analysis is undertaken. Focus is placed mainly on the household and community scales. This results in particular limitations for the scope of analysis. For example, the focus in the network analysis was on within village (internal) ties. Whilst this was necessary to ensure an analysis of potential reciprocity, it prevented an analysis of ties that might be important for adaptation (i.e. access to information only available outside the village). Therefore additional insight could be gained by considering the networks and ties that exist beyond the village. Further, intra-household ties (i.e. between members of the same household) could also reveal additional insight that has not been captured by the present analysis.

A key limitation of this thesis has been in the ability to empirically examine the role of institutions in shaping household adaptive capacities. Through investigating coping capacity, it has been possible to speculate about the implications this will have for adaptation and adaptive capacity, however the impact that institutions have on shaping adaptive capacity is still unresolved. Furthermore, this extends to the corresponding issue of understanding the formation of given levels of transformational capacity (see argument in section 2.2.3)

8.4 Priorities for future research

The two villages of Kigando and Kahendero provided differing contexts from which this research was able to explore a range of factors that shape coping capacity. Extending the analysis presented here to further cases would provide more detailed examination of how factors differ across different contexts. That is to explore whether further case-studies similar to Kigando and Kahendero reveal similar results, or whether they enable additional factors to be identified.

Applying the P-AIL framework on the case-studies presented in this thesis is just the first trial of the framework. As highlighted earlier in the thesis, there are several institutions that shape livelihoods within rural African societies, of which this thesis has only been able to examine a few. There is a need to expand the institutional analysis conducted here to one that encompasses all institutions within a SES. Analysis needs to recognise the multi-sectoral

nature of governance challenges. Whilst studies that examine specific issues are valuable, such as the coping capacities analysed here, it is important to ensure other studies seek to integrate the full spectrum of interactions that these early studies identify. Therefore research that seeks to develop and test the P-AIL framework further and indeed develop alternative polycentric institutional analyses which recognise the relationship between the informal and the otherwise dominant public-private-civic characterisation can only serve to enhance our understanding of the institutional dynamics involved in adaptation to climate change and wider environmental change.

8.4.1 Developments from this thesis

There remains a large amount of data collected for this thesis which has not been analysed. As the analysis progressed it became apparent that certain data would not support the narrative or overarching results that were evolving. The first of these relates to the impact of floods and droughts on different crop types. The data recorded includes farmer's perceptions of how different crops are affected during times of floods and droughts. Integrating this data alongside the pre-existing analysed data can help address questions such as are farmers that grow the same crop in the same village affected differently by different hazards? Does this differ depending on the farmer's priority of particular crops?

The second extension from the data presented in this thesis is to undertake additional SNA. Specific data on the types of inter-household exchanges remain to be further analysed. The analysis presented here includes the overarching support networks which comprised physical resource exchanges, and information exchanges. Specifically, the data recorded during the survey includes whether exchanges are based on food, money, equipment, news, advice etc. This has partly been analysed in the development of this thesis but requires a more labour-intensive analysis that could not be conducted within the time available.

There is opportunity to explicitly recognise the temporal dynamic of this study. This study provided a 'snap-shot' of coping and adaption within the two communities. Repeating this study and re-visiting the communities of Kigando and Kahendero in a future longitudinal study would help explicitly focus on how capacities have changed over time, using the research in

this thesis as a baseline. In doing so, additional factors that shape household coping and adaptation may be identified.

Finally, this thesis has examined issues relevant to coping and adaptation debates. However, to further understand the progression of coping capacity to adaptive capacity demands further research. To start to address these issues, there is a need to focus on relational methodologies, such as SNA. Moreover, supporting this alongside alternate methodologies that include qualitative analysis of relationships will help support increased understanding of these issues.

This thesis has also raised several questions surrounding the use of vulnerability and resilience perspectives to help understand the institutional dynamics of adaptation. There is a need for research to engage in the debate about the use of the two approaches to better understand what they can learn/provide for each other, and how this can be of use to understanding the dynamics that shape not just coping and adaptive capacities, but wider social-ecological system. For example, work is started to consider the value of examining social-ecological and social-technical approaches (Foxon *et al.* 2009). Similarly there is scope to start to consider what social and systems theories can offer to understand vulnerability and resilience approaches.

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Appendix 1 Household Questionnaire

Interviewer:	
Village:	Household ID:
Date:	Name of interviewee:
Relation to household head (if applicable):	

N.B. This sample survey is for use in the full thesis. This includes questions that were asked only in Kahendero and not in Kigando.

Household Survey: Transforming coping capacity to adaptive capacity

Purpose: to identify the mix of activities that make up the livelihood portfolio of households in the case villages; identify an overview of the impact of floods/droughts on the households; identify the social networks that exist within these livelihood activities.

The interviewer will not ask words or sentences in this font. These are either instructions or prompts for the interviewer, or opportunity for observations to be noted. Additional observations made during the survey should be recorded in the space near the question, and discussed with the lead researcher afterwards.

FOR ALL QUESTIONS:

If respondent does not know, record as "not sure"

If they refuse to answer, record as "refuse"

If question is not relevant, record as N/A

If you are not sure, write what respondent has said and it can be discussed after.

Have you:

- ☐ ***Taken consent?***
- ☐ ***Asked if they are willing to take part in a further interview?***
  - ☐ ***Good/talkative/open***
  - ☐ ***Quiet/shy***

Section A: ***Demographic information to determine the composition of the household, dependents, etc. This will provide context to the responses provided in later sections. (Household is defined as those who live on the same land (although may be in separate buildings) and contribute to that households upkeep – i.e. might send remittances)***

NAME: (respondent first)	1. Relation to HH head (wife, sister, son, daughter, father, etc..)	2. Gender (male, 0; female, 1)	3. Age	4. Is person present or absent in village? (present, 1; absent, 0)	4.a Does this person contribute to household activity (yes, 0; no, 1)*	5. Education level (and year, i.e. Primary 5).
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						

I.e. Are they involved in providing for the household, or must they be provided for (i.e. they do not work for either subsistence or cash). <u>If they are absent, yet provide remittances, this is recorded as a yes.</u>

Section B: ***This section investigates the types and levels of assets of households, as well as the mix of livelihood activities they undertake.***

6. What are the main activities that **YOUR HOUSEHOLD** participates in? Please list in order of **importance** of the activities' contribution to your households' livelihood. Indicate how important the activity is by splitting 10 seeds between each activity. ***(Each row should add up to 10 seeds***) ***(Crop farming is one activity, and livestock keeping is a separate farming activity)*** ***(Activities can also be household chores, market trading etc, or even working in business (record type of business etc).***

   a. WET SEASON

HOUSEHOLD Activity (WET SEASON)						Comments
Primary activity	Seeds	Secondary activity	Seeds	Tertiary activity	Seeds	

   b. DRY SEASON

HOUSEHOLD Activity (DRY SEASON)						Comments
Primary activity	Seeds	Secondary activity	Seeds	Tertiary activity	Seeds	

7. Do these activities differ from those undertaken by your community 20 years ago?
   □A lot (1) □ Some (2) □ A little (3) □ No (4)
   □ Other (5) please state

   _

   a. If yes, why? (List each separate reason) (Let respondent explain first and then ask if there is any other reason – environmental, social, political, economic etc). ***Write what respondent has said – i.e. do not just put 'environment'***

   _

   _

   _

   _

The following questions ask information about the physical and natural assets of the individual/household

'On farm and off-farm' activities: (answer if directly use the products obtained or receive payment for work on other peoples land).

8. Do you (or household) have land you grow crops on? (***If yes, continue. If no, go to Q9).***

□Yes (1) □ No (2)

a. How much of this land do you own?_____acres

b. How much of this land do you rent from someone else?_____acres

c. How much of this land do you rent out to others?_____acres

d. Do you allow anyone else to grow crops on your land for free?

□Yes (1) □ No (2)

If yes, how many acres is this? _____acres

9. Do you (or your household) work on any land that you do not own or rent? (***If yes, continue. If no, go to Q10***).

□Yes (1) □ No (2)

a. Do you receive a wage for this labour? □Yes (1) □ No (2)

b. If yes, how much is this (state *day*/*week*/*season*)?_____UGX

10. Please fill in the table below for all crops that you grow:
Once respondent has listed all crops grown, please get them to identify their 4 most important crops (consider both subsistence and cash). Write 1-4 in column b to indicate this importance (1 is most important, 2 is second most important, etc).

a. Crop	b. Importance	c. Additional comments

For the 4 crops identified above, fill in the table below based on the respondents answers to how it is affected by flood, how it is affected by drought, and why the crop is grown.

d.Crop	e. How affected by flood?	f. How affected by drought?	g. Why do you grow this crop?
	Out of 5 seeds: 0 seeds is no impact, 5 seeds it total loss of crop (***both can be 5/5)***		(1, cash; 2, subsistence; 3, both)
1.	/5	/5	
2.	/5	/5	
3.	/5	/5	
4.	/5	/5	

As a guide (used to help clarify responses):
0 seeds – no impact
1 seed – some small impact but yield and quality generally not affect
2 seeds – greater impact - quality or yield reduced
3 seeds – over half the crop affected either in quality or yield
4 seeds – almost all the crop devastated but some could be harvested and used
5 seeds – total loss of crop

11. Do you (or your household) keep any livestock?
(***If yes, continue. If no, go to Q13***).

□Yes (1) □ No (2)

a. On what land do you keep these animals? □ Own land (1)
□ Rental (2)
□ Leasing(3)
□ Community (4)

12. Please fill in the table below for all livestock that you keep:
Once respondent has listed all livestock kept, please get them to identify their 3 most important animals (consider both subsistence and cash). Write 1-3 in column b to indicate this importance (1 is most important, 2 is second most important, etc).

a. Livestock/animal	b. Importance	c. Additional comments

For the 3 animals identified above, fill in the table below based on the respondents answers to how it is affected by flood, how it is affected by drought, and why the animal is kept.

d. Animal	e. How affected by flood?	f. How affected by drought?	g. Why do you keep this animal?
	Out of 5 seeds: 0 seeds is no impact, 5 seeds is flood/drought killed all animals. (***Both can be 5/5***)		(1, cash; 2, subsistence; 3, both)
1.	/5	/5	
2.	/5	/5	
3.	/5	/5	

'Non-farm' activities:

13. Do you (or household) undertake any fishing activities?
(If yes, continue. If no, go to Q15).

□Yes (1) □ No (2)

a. Do you earn a wage for fishing for someone else? □Yes (1) □ No (2)

b. If yes, how much is this? _____UGX (day/week/season)

14. Please fill in the table below for each type of fish you catch:

Once respondent has listed all fish caught, please get them to identify their 2 most important ones (consider both subsistence and cash). Write 1 and 2 in column b to indicate this importance (1 is most important, 2 is second most important).

a. Product	b. Importance	c. Additional comments

For the 2 fish identified above, fill in the table below based on the respondents answers to how it is affected by flood, how it is affected by drought, and why the fish is caught.

d. Fish	e. Why do you catch this fish?
	(1, cash; 2, subsistence; 3, both)
1.	
2.	

15. This question refers to the some of the items that your household has. For each of the following items, please fill in the table based on how important the item is to you for

a) general daily use : 1. Very important
2. Important
3. Neither
4. Unimportant
5. Not at all important

and b/c) during a flood /drought using:
1. Increased importance
2. Decreased importance
3. No change

Asset/ equipment	Do they own this item? (Y or N)	a. Used daily					b. During flood			c. During drought			d. Comments
		1	2	3	4	5	1	2	3	1	2	3	
Radio													
Motorcycle													
Push bicycle													
Mosquito nets													
Generator													
Solar panel													
Mobile phone													
TVs													
Lanterns													
Torch													

16. How often do you attend a market to exchange/sell your goods and/or purchase goods (choose one)?

    - ☐ Daily (1)
    - ☐ 2-3 per week (2)
    - ☐ Once a week (3)
    - ☐ Once a month (4)
    - ☐ Less than once a month (5)

17. How far must you travel to reach this market (choose one)?

    - ☐ <2km (1)
    - ☐ Between 2-5km (2)
    - ☐ Between 5-10km (3)
    - ☐ Between 10-15km (4)
    - ☐ More than 15km (5)

18. How do you travel to this market (choose as many as apply)?

    - ☐ By foot (1)
    - ☐ By private motorbike/pushbike (2)
    - ☐ By *boda-boda*/*piki-piki* (3)
    - ☐ By car/taxi (4)
    - ☐ By informal lift share on passing vehicles (5)

19. Can you attend this market as often as you would like to? ☐ Yes (1) ☐ No (2)
    a. If no, what factors restrict this access (choose as many as apply)?

    - ☐ Distance (1)
    - ☐ Cost (2)
    - ☐ Family responsibilities (3)
    - ☐ Labour responsibilities (4)
    - ☐ Other (specify): (5)

_ _

_ _

==========

Section C: The next section asks about the social networks that exist within the village in relation to your livelihood activity.

Ask if there are any organisations that are also relied on/whether any of the individuals are members of organisations/why respondent is or isn't a member of that organisation.

20. Apart from members of your household, on a normal daily basis, who provides you with support that enables your household to manage when you have a problem?

(Resources – anything that is a physical item – money, equipment, transport etc)

(Information – anything that is not physical – environmental conditions, new practices, market prices etc)

	Name	Where do they live (Kahendero 1/2 = 1/2, elsewhere, state name)	How they support you: ***(note type of support)***		Importance (1-4)	Family	Friend	Villager	Professional	Organisation (if applicable)
			Resources	Information						
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										
11.										

***1 is very important, 2 important, 3 fairly important, 4 not important**. 1 might include this person being the only one who can provide this support, or someone who you rely on all the time, whereas 4 would be someone who you rely on for a good or service that could be provided by someone else etc.

21. When there is a **flood**, **apart from people in your household**, who do you rely on for information or support to enable you as a household to cope with the drought and the affect it has on your household's activities? (***Not one specific activity***)

	Name	Where do they live (Kahendero 1/2 = 1/2, elsewhere, state name)	How they support you: ***(note type of support)***		Importance (1-4)	Family	Friend	Villager	Professional	Organisation (if applicable)
			Resources	Information						
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										
11.										

***1 is very important, 2 important, 3 fairly important, 4 not important**. 1 might include this person being the only one who can provide this support, or someone who you rely on all the time, whereas 4 would be someone who you rely on for a good or service that could be provided by someone else etc.

22. When there is a **drought**, **apart from people in your household**, who do you rely on for information or support to enable you as a household to cope with the flood and the affect it has on your household's activities? (***Not one specific activity***).

	Name	Where do they live (Kahendero 1/2 = 1/2, elsewhere, state name)	How they support you: ***(note type of support)***		Importance (1-4)*	Family	Friend	Villager	Professional	Organisation (if applicable)
			Resources	Information						
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										
11.										

***1 is very important, 2 important, 3 fairly important, 4 not important**. 1 might include this person being the only one who can provide this support, or someone who you rely on all the time, whereas 4 would be someone who you rely on for a good or service that could be provided by someone else etc.

Section D: This section asks information about climate variability and climate change, as experienced by the individual/household

23. Do you think there have been changes to the weather you experience now compared to what the community experienced 20 years ago? (**If yes, continue. If no, go to Q26**).

    □Yes (1) □ No (2)

24. If yes, would you agree or disagree with the following statements:

	(1) Strongly disagree	(2) Disagree	(3) Neither agree nor disagree	(4) Agree	(5) Strongly agree
The rainy season lasts longer					
When it rains it is more intense					
The rains are more unpredictable					
Overall there is less rain now than before					
It is hotter in the rainy season than before					
It is hotter in the dry season than before					
The drier season lasts longer than before					

25. How do you know this?
    - □ Seen it for myself (1)
    - □ I've been told stories from others in village (2)
    - □ I've been told about this from those outside the village (3) (i.e. extension workers, NGOs…)
    - □ I'm not sure (4)

*Thinking about the last major flood/drought event you experienced **in Kahendero**:*

26. When was the last major flood you experienced?_____
(Note: this should be greater than expected flooding in the wet season, and should be from the last 20 years).

a. How long did the **flood** disrupt your activities for?

- Less than a week (1)
- Between 1-2 weeks (2)
- Between 2 weeks and 1 month (3)
- More than 1 month (4)

b. Was there a warning about the flood before it happened?

- Yes (1)
- No (2)

c. Did you change your livelihood activities as a response to this warning?

- No (1)
- Changed some activities (2)
- Undertook additional activities (3)
- Changed all activities (4)

d. How many people in your household were injured from the event?
_____people

e. How would a similar event (of the same size) affect you now?

- Would affect us **less** (1)
- Would affect us **more** (2)
- Would affect us the **same** (3)
- Don't know (4)

27. When was the last major drought you experienced?_____
(Note: this should be an actual drought and not just the norm that might be expected within the dry season. It should also be from the last 20 years).

a. How long did the drought event disrupt your activities for?

- Less than one month (1)
- Between 1 and 2 months (2)
- More than 2 months (3)

b. Was there a warning about the drought before it happened?

- Yes (1)
- No (2)

c. Did you change your livelihood activities as a response to this warning?

- No (1)
- Changed some activities (2)
- Undertook additional activities (3)
- Changed all activities (4)

d. How many people in your household suffered from the event?
_____people

e. How would a similar event (of the same size) affect you now?

- Would affect us **less** (1)
- Would affect us **more** (2)
- Would affect us the **same** (3)
- Don't know (4)

END

Have you:

- ***Thanked the respondent for their time?***
- ***Asked the respondent whether they have any questions they want to ask?***
- ***Asked the respondent if they would be willing to take part in the future in an approximately 1 hour interview if they are selected.***
- ***Completed all the boxes on the front.***

Appendix 2 Interview Protocols

Interview protocol for SSI with Households: Kigando and Kahendero

1. Can you tell me why you do the activities you do? (from survey)
   - *Who influenced this choice (family/cultural etc)*
   - *Could you explain to me any customs or norms that you follow in these?*

   a) Are there any restrictions or constraints you experience in these activities?
      - *Prompts: available resources/skills/rules (land arrangements/markets etc)/ local legal system/administrative authority.*

2. How do you plan for your activities?
   - *Are there any customs you follow to do this?*

   a) What sort of time-scale do you plan for (*monthly/season/year/longer*)
      - *Extension services/ where/how do you access information for this?*

3. Are there any organisations that you rely on to do these activities?
   a) Are there any you would like to be a member of but aren't? Why not?

4. What activities do you think you'll be doing in the future?
   a) Would you like to do anything different? Why can or can't you do this?

Specific flood/drought questions:

5. Thinking about the major flood event in _____ (*year given in survey)* can you tell me what you did to cope with the event?
   - *Why did you do this in particular?*

   a) Have you always done this when there is a flood?
      - *Why/how have these strategies changed over time*
      - *Have there been any opportunities for you to change these strategies? Have you taken advantage of them?*

   b) Is there anything you would have preferred to have done but didn't?
      - *Were there any restrictions or rules that meant you couldn't do this?*

   c) How did what you do actually work out?
      - *Did it help or hinder? If it hindered, why do you think this is?*
      - *Did anything stop it working? Rules? Other people?*
      - *Did you consider the future when you choose these strategies?*

   d) How has it enabled you to cope with floods that have happened since?
      - *Was there anything that you did that you knew would have an impact on your ability to cope with future events?*

   e) Have you been able to prepare in advance for any of these future events?

6. *Repeat the question for the last major drought event (as mentioned in HH survey)*

The following questions explore the issues surrounding the third objective of this research, to identify the institutions that affect the ability of communities to build up adaptive capacity.

7. Could you tell me about the sorts of activities that you do as a community?
- *What are these for/ why do you do them?*

a) When do members of the community come together?
- *Cultural or religious practices?*

b) Who leads these activities?

c) Who is able to participate in these activities?
- *Can anyone be part of this?*
- *Does it include all members of the community?*

d) How do these activities impact on your livelihood?

e) Do you do anything that you particularly feel helps you to be better prepared for a flood or drought?

8. Could you tell me about any organisations that are working with your village?
- *NGO/ Government/ Other?*
- *How do they support you/ what do they do?*

a) Are any of them currently working with you?
- *Are there any that you would like to be working with your community that are not at the moment?*
- *Do you know why they are not currently working with you?*

b) Are there any that you feel are preventing you from doing as well in your activities?

9. You mentioned various people in the survey that helped you when there is a flood or drought, for example. Why do you go to these people for assistance?
- *Why do you not get support from people in the village?*
- *Did externals used to live in the village – out migration? When?*

OR

Various people mentioned that you help them when there is a flood or drought, for example. Why do you think these people come to you for assistance?
- *Have people always asked you, or do you go to assist them even if they haven't come directly to you.*

10. How do you think you would cope if floods and droughts were to happen more often?
- *Either more years or, for example, more floods each year?*

11. Is there anything you would like to add about how you are able to respond to floods and droughts?

Additional questions asked in Kahendero (to be asked to specific households):

1. Could you tell me more about the migration that happens in Kahendero?
   - Do you know what makes people decide to leave permanently?
   - What about the seasonal migration, where do people go, to do what and why?

2. Could you tell me about what made you decide to move here to Kahendero?

3. I've heard there have been issues surrounding the authorities trying to resettle your community? Could you tell me more about this and what's happened in the past?
   - Do you know why they are trying to resettle you?
   - How do you feel about this?
   - Is this a recent issue, or has it been going on for some time?

4. Could you tell me about how fishing has changed here in Kahendero over the years?
   - What about changes in the number of boats or crews that fish?
   - And have your techniques changed?
   - How has the management of the lake changed over time?

5. You mentioned in the survey that taxes used to encourage people to work, and now no more. Could you tell me more about this?

6. Why do you think there are several different activities here in Kahendero?
   - Is there anything that prevents you from doing more activities than you are at the moment?

Multi-level key-informant interview (KII) guide:

Local government

1) Could you explain to me what your work/role is in local government?
    a. How does your work support the livelihoods of the local communities

2) How do you support your community when you hear that a flood or drought might happen soon?
    a. Could you tell me about the type of support you get from outside the village?
        - *Barriers/enablers/rules/restrictions*

3) Could you please tell me about land ownership in the village?
    a. How is it organised, divided up, shared, passed-on?
    b. Are there ever any conflicts about land?
        - *How are these resolved?*

4) Could you tell me about how the village mobilises itself and supports each other?
    a. Has this changed over time?
    b. Did you used to do things you don't anymore? Why not?

5) Could you tell me about how the community copes with floods and droughts?
6) How does this affect how they can cope with the next major flood or drought that occurs?
    a) What would help the village to cope better with floods and droughts?
    b) What are the current barriers to this?

7) Are you (or are you aware of the village being) concerned about what will happen in the future (*not necessarily climate change specific*)?

NGOs/extension workers

1) Can you please explain to me the work that you undertake with your organisation?
    a. How does your work relate to floods and droughts?
        - *Is this in advance of an event, or after it in response to it?*
    b. How do you decide what programmes/activities to work on?

2) How did you come to work with the communities you are (incl. case-villages)?
        - *Did the village come to you? Are you told by another person/organisation to work there?*

3) Could you tell me how you share information and knowledge between each your organisation and the village?
        - *Is everyone in the village able to access this?*

4) How do you think the village is currently able to deal with floods and droughts?
        - *What do you think is preventing people coping so well?*

5) How do you think the village is currently dealing with the risk of future changes in climate?
        - *What do you think are the barriers to adapting to this?*
        - *Do you think how they cope with a flood or drought now is affecting their ability to cope in the future?*

6) Could you tell me what you understand adaptive capacity to mean?
    a. How would you describe the level of adaptive capacity the village currently has?
    b. How do you feel the village's current activities are impacting on their level of adaptive capacity?

District and government officials:

1) Can you please explain to me the work that you undertake (with your organisation)/what your role involves?
    a. How does your work relate to floods and droughts?
        - *Is this in advance of an event, or after it in response to it?*
    b. How do you decide what programmes/activities to work on?

2) How do you feel this work specifically supports local rural communities, and their livelihoods?
    a. How does the community get involved with this work?
        - *Are people/ households selected by you or do they volunteer?*
        - *Can everyone participate?*
        - *How do your programmes get down to the community level?*

3) What do you (and your organisation) understand adaptive capacity to mean (in the context of climate change)?
    a. How do you think rural communities are adapting to climate change?
        - *What do you think are the barriers that are currently preventing this?*
    b. How do you feel what is currently done now in these communities, for example to cope when there is a flood or drought, is affecting their ability to cope in the long term?
        - *What do you think needs to be done to address this?*
    c. Could you tell me about how you think what these people currently do could be developed into more long term adaptations?
    d. Could you tell me about any other limitations that communities face in their abilities to build up this capacity to adapt with future changes?

4) Could you tell me anything else about how you (or your organisation) are currently working to support communities, such as these, adapt in the long term?
    a. What are the challenges that you experience in trying to do this?

5) Is there anything else you can tell me about how floods and droughts, and also the impact of climate change will affect rural communities in Uganda?
    a. What else do you think needs to be done to address this?

Appendix 3 Ethical Approval: Consent forms and information sheet

University of Leeds

Development of Climate Change Coping Capacity to Adaptive Capacity

Name of Researcher: _Rachel Berman_____

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 January 2012 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/will not)* be linked with the research materials, and I (will/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 and will inform the principal investigator should my contact details change. ☐

_____ _____ _____

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.

Sustainability Research Institute
SCHOOL OF EARTH AND ENVIRONMENT

UNIVERSITY OF LEEDS

Transforming Climate Change Coping Capacity to Adaptive Capacity

You are being invited to take part in a research project. Before you decide 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.

Floods and droughts are known to have a negative impact on the livelihoods of rural communities in Africa. For generations communities have been 'coping' with these hazards, yet they remain vulnerable to future hazards events. In addition, climate change is now recognised as adding additional stress to these climate sensitive livelihoods. Research into adaptation to climate change has tended to focus on coping strategies, predominately in the short term. This research intends to investigate how coping strategies can be transformed into longer term strategies that help build adaptive capacity. This centres on the role that institutions have in enabling, constraining or maintaining a certain adaptive capacity. Past research on climate change adaptation has recognised institutions as important to this process, but there remains little research into the actual role they have in the process of transformation from coping to adapting.

Uganda has been selected for case-study research as it ranks high in those countries vulnerable to climate change. In addition, it is prone to both flood and drought hazards, and is highly dependent on agriculture. Research will be conducted in two villages in Kasese Districts between January and June 2012.

You have been chosen because of your involvement in organisations working within this research area or working in the case-study area, or because you live and work in one of our two 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) and you can still withdraw at any time without it affecting any benefits that you are entitled to in any way. You do not have to give a reason.

Centre for Climate Change Economics and Policy

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

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 will also be invited to take part in a survey questionnaire prior to this interview. This will last no more than 1 hour. These questions will help us understand how individuals and communities in Kasese district use different strategies to cope with and adapt to change.

Whilst there are no immediate benefits for those people participating in the project, it is hoped that this work will inform future climate adaptation policies.

All the information that we collect about you during the course of the research will be kept strictly confidential. 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 end of 2012. 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:

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

Thank you for taking part in this project.

Centre for Climate Change Economics and Policy

Appendix 4 Homophiliy analysis: full between and within group densities

Tables show within and between group densities. Homophily is found when within group densities are greater than between group densities. Where this is statistically significant, results are shown in bold.

Kigando

Livelihood strategy

Category (n)		**Daily**			**Flood**			**Drought**	
Livelihood	**Crop**	**D.Crop**	**Service**	**Crop**	**D.Crop**	**Service**	**Crop**	**D.Crop**	**Service**
Crop (28)	0.041	0.022	0.068	0.037	0.016	0.043	0.028	0.016	0.059
Diversified Crop (69)	0.022	0.026	0.106	0.019	0.016	0.087	0.014	0.019	0.082
Service (11)	0.012	0.035	**0.121**	0.012	0.014	**0.091**	0.000	0.027	**0.083**

Gender (of household head)

Category (n)	**Daily**		**Flood**		**Drought**	
Gender	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Male (84)	**0.041**	0.017	**0.030**	0.012	**0.032**	0.009
Female (24)	0.033	0.007	0.017	0.022	0.020	0.000

Wealth

Category (n)	Daily				Flood				Drought			
Age	**EP**	**P**	**M**	**RW**	**EP**	**P**	**M**	**RW**	**EP**	**P**	**M**	**RW**
EP (39)	0.043	0.028	0.019	0.059	0.019	0.028	0.022	0.053	0.031	0.018	0.017	0.058
P (27)	0.032	0.016	0.029	0.058	0.031	0.009	0.013	0.072	0.025	0.006	0.013	0.060
M (23)	0.037	0.016	0.022	0.073	0.018	0.018	0.008	0.041	0.019	0.014	0.008	0.043
RW (19)	0.015	0.014	0.018	**0.094**	0.018	0.008	0.000	0.044	0.028	0.000	0.000	**0.067**

EP (Extreamly Poor), P(Poor), M (Moderate), RW (Relatively Wealthy)

Age and education are not shown due to limited homophily across attribute.

Kahendero

Education

Category (n)	Daily			Flood			Drought		
Age	**N.E**	**1^e**	**2^e**	**N.E**	**1^e**	**2^e**	**N.E**	**1^e**	**2^e**
N.E (44)	**0.016**	0.004	0.004	**0.023**	0.007	0.004	**0.018**	0.007	0.000
1^e (96)	0.009	0.006	0.004	0.011	0.008	0.005	0.011	0.007	0.003
2^e (48)	0.011	0.009	0.003	0.009	0.007	0.000	0.010	0.008	0.000

N.E. (No education), 1^e (Primary education), 2^e (Secondary education)

Livelihood, gender, age and wealth are not shown due to limited homophily across attribute.