

**The Role of Ecosystem Services and Adaptive Capacity in
the Resilience of Poor Urban Areas**

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Abstract

This thesis aims to understand the important features of resilience for individuals living in poor urban areas. There is currently little understanding of the role of ecosystem services, or the key components of adaptive capacity in these areas. As urbanisation continues apace, it is of utmost importance that we understand how to build resilience in slums and informal settlements. This thesis contributes to this challenge by finding determinants of adaptive capacity, the degree to which ecosystem services are used, and significant heterogeneities in slum adaptive capacity.

The research is based on empirical fieldwork in three slum areas in Kampala, Uganda. Study areas were chosen at differing distances from the city centre to the periphery, with data collected at the individual level. Mixed methods were used and included pre-study open interviews, a random survey questionnaire, and focus groups. A total of 720 questionnaires capture the bulk of the information, and contain two relatively novel methods – a presentation of adaptive capacity statements, and a social network analysis.

The thesis finds that slum residents use local ecosystem services very little but where there are green spaces, they are valued for benefits such as recreation or aesthetics. Slum residents tend to deal with problems with the help of others, and social networks are critical for adaptive capacity. Other significant determinants of adaptive capacity include innovation, feelings of control, and a sense of place. There are significant differences in adaptive capacities and social networks between slums areas, and specific population groups. These results give policy key features of resilience to build on, and highlight the importance of assessing where strengths and weaknesses lie. The determinants of resilience in poor urban areas are unique, but once understood, enable us to reduce vulnerability for a vast proportion of the world's population living in slums and informal settlements.

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Chapter 1: Introduction

1.1 Resilience in Poor Urban Areas

Urbanisation is changing the face of the planet. Between now and 2050 there are predicted to be an extra 2.8 billion people on the planet, and 90% of these will live in cities (UN-HABITAT 2010). The majority of this population growth will occur in the developing world, with Africa currently as the world's fastest urbanising region (UN-HABITAT 2008; Montgomery 2008; Lwasa 2010). Unfortunately, without serious policy intervention, the growth of many cities in Africa and other parts of the developing world is unsustainable and will lead to inhuman conditions for millions worldwide (Vermeiren et al. 2012).

At the forefront of this urbanisation process are the creation of slums and informal settlements. The rapid growth of these cities is not currently matched with the adequate provision of services, and the existence of slums has been described as 'visible evidence of systemic urban policy failure' (UN-HABITAT 2008). Many factors contribute towards the formation of slums including rapid rural to urban migration, high levels of urban poverty, insecure land tenure, policy stances towards the urban poor, as well as macro economic drivers. There are also multiple definitions of a "slum", however the central point is that there are already approximately a billion people, and will be an increasing number, living in vulnerable urban environments.

Slums are potentially very vulnerable places to live, often located in exposed areas such as steep hillsides or where they are vulnerable to floods (Hardoy & Pandiella 2009; Revi 2008; Jankowska et al. 2011). In addition to being highly exposed, slum populations often have internal vulnerabilities such as poor political representation and low adaptive capacity. Of course poor urban areas are not entirely 'negative' places to live and slum populations are far from uniform (Myers 2011; Simon 2011). Furthermore, slum

populations often exhibit great adaptive capacity in the face of various challenges. It is important therefore that positive aspects of the dynamics of poor urban areas, as well as the heterogeneities therein, are considered alongside their vulnerabilities.

Resilience, broadly defined as the ability to cope with and respond to shocks and challenges (Pasteur 2011; Walker et al. 2004; more refined definitions in Chapter 2), is a key property in poor urban areas. It is important therefore that resilience is understood in these contexts, so that the capacities and abilities that already exist might be built upon in order to improve livelihoods and well-being in those areas.

There has been some study of urban resilience (Ahern 2011; Baker 2012; Ernstson et al. 2010), although little at the local level. Furthermore there has been a significant amount of study on resilience to climate change, but this needs to link to more comprehensive considerations of resilience in urban areas (Brown & Kernaghan 2011; Waters 2012). It is also important in urbanising areas that social and ecological systems are considered together, in order to fully understand the dynamics of the urban system (Simon 2007). In this study, I consider both social and ecological aspects of resilience for poor urban populations, as well as the heterogeneities that exist between and within those slum areas.

There is now a rich literature on the ecology of urban areas (Pickett et al. 2011), and also some study on the benefits that urban dwellers receive from nature (Bolund & Hunhammar 1999; TEEB 2011). However there is still little study on the ecology of poor urban areas, or the 'ecosystem services' that exist therein. Regarding social aspects of resilience, frameworks now exist that help to understand resilience and adaptive capacity at the local level (Levine et al. 2011; Levine et al. 2011; Jones et al. 2010b). However with a few exceptions (Arup 2011), these frameworks are mainly framed on rural contexts. There is a need therefore to understand the key components

of social resilience in poor urban areas, or the determinants of adaptive capacity.

With the growing population living in slums and informal settlements, it is imperative that the resilience of these areas and their populations is understood. An increased knowledge of the social and ecological components of resilience in these contexts can contribute to efforts to build the resilience and increase the well-being of individuals living in these areas worldwide.

1.2 The Research Objectives

The aim of this thesis is to understand the important features of resilience for individuals living in poor urban areas. In particular, the aim is to add knowledge on the role of ecosystem services and determinants of adaptive capacity.

Previous research, as reviewed in Chapter 2, has described some determinants of adaptive capacity but rarely in an urban context at the local scale. Similarly the link between ecosystem services and well-being is clear, however there is little empirical work on ecosystem services in poor urban areas. Therefore, this study aims specifically to understand the role of key aspects of adaptive capacity, and the usage of ecosystem services, in the resilience of individuals in poor urban areas.

Based on a review of the literature review and pre-study fieldwork, three research questions are proposed in order to investigate these two aspects further (ecosystem services and adaptive capacity), as well as the heterogeneities that might exist. The three research questions that define this study are:

Question 1: What is the level of ecosystem service use in poor urban areas and how does that change across a city?

Question 2: For residents of poor urban areas, what are the most important aspects of adaptive capacity?

Question 3: How do adaptive capacities and social networks differ across poor urban areas and with time?

These three research questions are investigated through a case study of three slum areas in Kampala city, Uganda. Three slum areas are chosen at differing distances from the city centre to the periphery, and data were collected at the individual level through household surveys, in-depth interviews, and focus groups. A total of 720 questionnaires were collected across the three slum areas. The questionnaires included an adaptive capacity assessment tool, as well as a tool for carrying out social network analysis. The first two research questions are investigated through an assessment of the individual-level data, while the third question is answered by comparing these data across the three areas. The following section describes the layout of the thesis.

1.3 An Overview of the Thesis

This thesis is divided into eight chapters. The following chapter reviews the literature on the key subject areas of this thesis, namely urbanisation, resilience, ecosystem services, and adaptive capacity. It presents the challenge of urbanisation, and the widespread growth of slums and informal settlements in the developing world. Given the vulnerability of these areas, resilience is highlighted as a key trait for individuals living therein. The theory of resilience is also presented, as a theoretical background for the thesis. Ecosystem services, and adaptive capacity are introduced as ways to measure ecological and social components of urban resilience. From this opportunity, three research questions are developed.

Chapter 3 moves on to cover the research approach, research design, and methods used to implement these research questions. It introduces the interdisciplinary research approach, and mixed methods used to tackle the research questions. A case study research design is chosen, and a justification of the case study site given. This chapter includes a description of the three slum study areas, as well as the specific methods used including an assessment of adaptive capacity, and a social network analysis. Finally the different data analyses are explained, as well as a discussion of the robustness of the findings, and a reflection on the research process.

Chapters 4 to 6 present the results of the study. Chapter 4 presents the results of Research Question 1, on the role of ecosystem services in poor urban areas. The analysis of questionnaire data and focus group discussions finds that ecosystem services are in fact barely used by slum dwellers, and are poorly valued. Some of the barriers to ecosystem service usage are found, as well as the fact that residents do actually value certain services when/where they have access to them. An analysis of the characteristics of ecosystem service users also reveals which types of people use these natural goods and services in the slums.

Chapter 5 addresses the second research question, on the determinants of adaptive capacity. Adaptive strategies, capacities, and social sensitivities are explored, in addition to a detailed analysis of respondents' social support networks. The analysis finds the ways in which slum dwellers respond to shocks, as well as a number of determinants of adaptive capacity. These include socio-cognitive factors. In addition to these capacities, two different types of social support network appear to be important for adaptability.

Chapter 6 utilises the data from Chapters 4 and 5 to compare adaptive capacity and social networks between the three areas, between some specific population groups, and over individuals' duration of residence in an area. The chapter finds significant heterogeneities across all three: that the

level of capacities and social networks is unique for each slum, and does not increase or decrease uniformly; that different population groups (e.g. migrant groups) show highly different adaptabilities, which are mainly distinguished by the strength of social networks; and that local capacities increase with 'time', or the duration that respondents live in a slum area.

In Chapter 7 there is a synthesis of the key results from Chapters 4 to 6, presented as three crosscutting findings of the study. Firstly, the role of ecosystem services and adaptive capacity in the resilience of individuals in poor urban areas is described. Based on the key determinants of adaptive capacity, a model of adaptive capacity is proposed. Secondly, the heterogeneities in slum resilience are discussed. And thirdly, there are lessons from the study for how to improve frameworks and assessments of resilience in poor urban areas.

Finally in Chapter 8 some conclusions are put forward, potential limitations of the study discussed, and the ways in which the findings may affect research and policy are presented. Some future research directions are also proposed. In short, this final chapter summarises the contributions of this thesis to knowledge.

Chapter 2: Literature Review

2.1 Background to the Chapter

Chapter 1 introduced the objective of the thesis and rationale for investigating ecosystem services and adaptive capacity in poor urban areas. This chapter reviews the literature necessary for investigating this subject, from various disciplines of research. It covers four main areas of research that are useful to begin understanding resilience in poor urban areas: the process of urbanisation globally and in Africa, urban resilience, the role of ecosystem services in urban resilience, and the role of adaptive capacity. Knowledge gaps are identified from these literatures and three research questions developed that address those gaps, and the objective of the study. These questions form the outline of the thesis, after which the research design and methods are outlined in Chapter 3, and each of the three questions tackled in turn in Chapters 4, 5, and 6.

2.2 Urbanisation

2.2.1 Introduction

Urbanisation is changing the face of the planet, particularly in the developing world, where the rate of growth of urban areas is unprecedented (Montgomery 2008). At the 'forefront' of this global transition is the emergence of slums, which currently are home to over a billion of the world's population; this number may grow to 1.4 billion by 2020 (UN-Habitat 2006). Slum-dwellers face a variety of environmental shocks and social hazards, and resilience is key to coping with such vulnerabilities. This section outlines this context, from the global scale of urbanisation patterns and trends, to the formation of slums and the features of these areas.

2.2.2 Urbanisation Patterns Globally

Cities are currently home to over half of the world's 7 billion people. And the world is becoming increasingly urban. Between 1975 and 2000 there were 52 million new urban dwellers a year, 87% of which were in developing countries. Between 2000 and 2015, this figure will rise to 65 million a year, 93% in developing countries (Pelling 2003; Cohen 2004; Cohen 2006). What this will add up to is an estimated population increase of 2.3 billion people between 2010 and 2050, predominantly in less developed regions (UN-HABITAT 2010). By 2030, nearly 5 billion people, or 60% of the world's projected population will live in cities. This rapidly changing dynamic is due to a number of factors in addition to population growth, including rural to urban migration. Currently 1.3 million people a week are moving to cities, predominantly in developing countries (Grove 2009).

Much of this growth is happening in the developing world. Among developing regions, Sub-Saharan Africa has the fastest growing urban population, followed by South and Central Asia (Angel et al. 2011). To a broad extent, the population growth that the world will see between now and when its population stabilises will effectively be all urbanites, and in the developing world (Pickett et al. in press).

To be precise, urbanisation is now actually slowing in many developing countries. 'Urbanisation' can be used to describe the spatial growth of urban areas, the phenomenon of rural to urban migration, or an aggregate population increase in urban areas. Defined as an increase in the *proportion* of a country's (or regional/global) population however, urbanisation rates have been shown to be declining in Sub-Saharan Africa (Potts 2009). There is also much variation in urbanisation rates in African countries, and circular migration has become more common. Despite this, the rate of *growth* is still rapid – many African countries exceeding the rates of growth of large European cities during their fastest period of growth in the nineteenth century (Potts 2012). In fact, the rate of urban growth in the developing world is unprecedented for the earth (Montgomery 2008).

Regardless of urbanisation rates potentially slowing therefore (rural/urban proportions), the rapid pace of population growth in urban areas in the developing world is going to have monumental consequences for resource and service demands, policy and development intervention. This rapid urban growth, including rural to urban migration, is shaping the demands on cities in the developing world, which are often overstretched in terms of services and housing provision already (Schaffer & Swilling 2013; Sandal 2011).

2.2.3 Formation of Slums and Informal Settlements

As developing country cities face rapid population growth, they have struggled to meet the infrastructure and service provision needs of these extra people. The locus of poverty is moving from countryside to cities, in a process now recognised as the “urbanisation of poverty” (UN-HABITAT 2007). Partly as a result of this, one in three people in urban areas now live in slums (UN-HABITAT 2006; UN-HABITAT 2008). Rapid rural to urban migration, high levels of urban poverty, an inability of the urban poor to access land for housing, and insecure land tenure all contribute towards this process. At a more macro scale, economic cycles, trends in national income distribution, and national economic development policies also have an influence. The existence of slums has also been described as visible evidence of systemic urban policy failure (UN-HABITAT 2008). Moreover, an alternative explanation for their formation is that they are the outcome of deliberate policies to keep migrant and growing populations in segregated urban space. Crucially, slum formation is set to continue through Africa and in many parts of Middle East, Latin America and Asia.

Much of this slum/informal settlement formation occurs on the peripheries of urban areas as much as in the centre. As land in cities becomes increasingly sought after, and governments start evicting inner city slum-dwellers, the urban poor become increasingly marginalised. Hence poor

urban areas emerge on the periphery of cities. Indeed, the rural-urban interface, also known as 'peri-urban area', is changing rapidly due to mass in-migration of people and development of the land (Simon et al. 2004). This area cannot be easily defined (Jaquinta & Drescher 2008), but can be described as a transition or interaction zone, where there is a mix of urban and rural activities, and landscape features are subject to rapid modifications due to human activities (Douglas 2008). Peri-urban areas may suffer to a large degree given negative impacts of urban growth but without the benefits of services and assets provided by the city authorities (Eakin et al. 2010). The point is that the influence of urban areas on settlements will be non-linear and non-uniform in relation to distance from the city (Simon 2008), and peri-urban areas are a different context to the urban core. Thus poor urban areas in the centre of a city may differ substantially in form and internal characteristics (e.g. poverty, levels of social cohesion etc.) to those on the periphery.

In Africa, the continent that is projected to have the world's shortest urbanising period (Lwasa 2010) and has 6 out of 10 of the world's fastest-growing cities (The Economist 2011), slum growth is a massive challenge. In Sub-Saharan Africa 62% of city-dwellers already live in slums or informal settlements. With an urban population set to double from 2007 to 2030 much of this growth is, and will occur, in slum areas and slum and urban growth rates are almost identical (UN-HABITAT 2008; 2010). For various bureaucratic and political reasons, the lack of urban planning in Africa has contributed to this significant challenge (Kamete & Lindell 2010).

Unfortunately there is a lack of clarity about what constitutes a "slum". There are a wide range of definitions and ways to classify slum areas (Milbert 2006), and there is a dearth of data to assess urban poverty (Beall & Fox 2007). The United Nations define a slum as a "run-down area of a city characterized by substandard housing and squalor and lacking in tenure security." However a workshop in Nepal, organised to discuss and establish some slum criteria, in fact revealed how hard it was to define a slum even in

this individual context (NGO Forum 2004). In an attempt to come to some consensus, UN-HABITAT use the following characteristics to describe a slum-dweller: inadequate access to safe water; inadequate access to sanitation and other infrastructure; poor structural quality of housing; overcrowding; and insecure residential status (United Nations Human Settlements Programme 2003; UN-HABITAT 2006).

It is important to realise of course that slums are multidimensional in nature. They arguably require richer descriptions and definitions in order to fully understand and classify them. For instance some indicators may be clearly defined such as access to physical services, while others such as social capital are not, although tools such as social network analysis may contribute quantitative indicators in this regard (Borgatti et al. 2009). Furthermore, those definitions of 'squatter settlements' and 'slums' define them by their *lack*, of tenure and services for instance. As well as concrete classifications, statistics and indicators therefore, alternate ways of looking at urban poverty and slum life require deeper understandings of African urbanism and the informality of life in these spaces (e.g. Pieterse 2011; Dovey 2012; Dovey & King 2012). An important part of this is not seeing the term 'slum' as pervasively negative, as they have been described in some recent texts (Davis 2006a). As Simon (2011) points out, Peter Lloyd's article from 1979 on 'Slums of Hope?' put a more optimistic slant on the opportunities that exist in poor urbanising areas, and this is true of today. Slums have been shown to demonstrate extreme resourcefulness, and even potential for environmental conservation (Brand 2010; Crabtree & Kapoor 2012). A simplistic and overly simplified description of definition of slums is dangerous, as for one it reduces the vast heterogeneity of poor urban areas to one definition.

While sometimes pejorative, and also having a multiplicity of meanings, in another sense the term "slum" is pragmatically useful. 'Slum' is commonly used by locals in this study to designate their local areas and so is applied in

this research to describe the poor urban areas that match the criteria of the UN definition above.

There are clear benefits of living in urban areas, and reasons why people move to them. For instance there is the relative proximity of health care and availability of jobs, and there tends to be higher GDP per capita than in rural areas (e.g. in Asia, Ooi & Phua 2007).

However, slums and informal settlements are also particularly vulnerable to natural and man-made hazards, including disease (Pelling 2003; Davis 2006a; Revi 2008; Lwasa 2010). This is partly because they are highly exposed to shocks. Because poor urban residents lack the capital to afford living in other areas of the city, slums often form in marginal areas such as steep hillsides, floodplains or other areas that are at a high risk from climate change and other natural hazards (Chatterjee 2010; Baker 2012). Housing is often poor quality and tightly packed, and there is a lack of infrastructure, which increases the risk of hazards further (Hardoy & Pandiella 2009). For example in Dakar, Senegal, 40% of migrants who arrived in the last decade have moved to zones with high flood potential (see Foresight 2011). Similarly, immigrant populations in Mombasa, Kenya and Esteli, Nicaragua suffer disproportionately from localised hazards such as flooding and winds (Moser et al. 2010), while in Rio de Janeiro, Brazil, 20% of the population live in favelas that are particularly vulnerable to landslides and floods. In general, the most marginalised often live in the most dangerous areas (Dodman et al. 2012).

In addition to their high exposure to environmental stresses and natural disasters, slums face a suite of other vulnerabilities. For instance many slum-dwellers are excluded from the formal economy, so even small financial shocks can cause severe livelihood challenges. Levels of poverty and competition for opportunities mean that while some are able to build up assets when they move to urban areas, others are not able to accumulate enough to protect themselves (Mitra 2010). Slum residents often lack a

'voice' or political representation, especially in the case of migrants (e.g. Zimmer 2009). The lack of tenure rights means that individuals are less likely to invest in their dwellings, due to the threat of eviction. Finally the lack of tenure also often results in a lack of service provision, including water and sanitation, and waste removal (Revi 2008; Moser et al. 2010), and this results in greater impact of shocks when they come (Awuor et al. 2008). Therefore, in addition to the likelihood of high exposure to shocks, slum residents face both 'socio-economic vulnerability' as well as 'politico-legal vulnerability' (Moser et al. 2010). Against this challenging backdrop, slum dwellers often show remarkable adaptability and resilience, utilising social networks and local resources to get themselves out of poverty (Carpenter et al. 2004; Lyons & Snoxell 2005; Kumar 2013).

In summary, the current growth of urban areas (in the developing world) is unprecedented. Given the pace of this change and the inability to accommodate the service and housing needs of these new urban populations, slums and informal settlements are also growing at an alarming rate. These areas are notably vulnerable, both in terms of their exposure to shocks and hazards, and their inherent political and socio-economic vulnerabilities. As such, resilience is a key property for individuals living in these areas. In the next section, the concept and theory of resilience is explained. It is then broken down into social and ecological components of social resilience, which are then introduced.

2.3 Resilience

2.3.1 Introduction

In these rapidly growing urban areas, change will be highly likely both socially and ecologically. Especially in poor urban areas, the ability to deal with shocks and stresses will be critical for survival. Individuals living in these areas will face political change, changes in population dynamics and large rural-urban migration, as well as significant climate risks. Further, for many poor urban dwellers there will be the challenge of living in vulnerable

and exposed environments. Hence for these areas and their populations, resilience is a key property – both to understand the system and as a characteristic of the area or individuals therein. This sub-section introduces the meaning of resilience, how certain sub-components relate to each other, some important aspects of the theory, and the coupled nature of linked social-ecological systems.

2.3.2 Definition and Understanding of Resilience

Resilience is the ability of a system to deal with, and respond to, a spectrum of shocks and perturbations whilst retaining the same structure and function (Walker et al. 2004; Nelson et al. 2007).

The need to consider such a property emerged in part from pioneering analysis of ecological systems (Holling 1973). Holling's analysis of populations of predators and prey led him to realise that singular patterns of dynamics and relationships did not exist, rather there were multiple potential configurations, or 'stable states'. Given this finding, and the non-linear dynamics by which a system might shift into an alternate state, the value of persistence within a current state became clear. Further study showed how over-exploitation and simplification reduces the ability of systems to cope with perturbations and change (Berkes et al. 2000; Gunderson & Holling 2002), and evidence for multiple regimes and regime shifts built up across varied ecosystems (Folke 2006).

This aspect of resilience theory is rooted in the ecological sciences, as well as theoretical and mathematical modelling methodologies (Gallopín 2006; Janssen & Ostrom 2006). Further, the majority of empirical work on the subject has been primarily carried out in ecological systems. However as the discipline has evolved, resilience theory has been applied to the interface of environment and society and in doing so the unit of analysis has become the 'social-ecological system' (Gallopín 2006). It is well known that humans depend critically on the biophysical, and on ecosystem services (MEA 2005). At the same time, the world's ecosystems have been shaped by human decisions and direct impact, pushing many over critical thresholds

(Rockström et al. 2009). Hence in human-dominated landscapes such as cities where humans are reliant on natural goods and services but urban development is also strongly impacting nature (Alberti 2005; Gutman 2007), a linked social-ecological resilience perspective is useful.

The resilience approach emphasises the need to manage for change and to see change as an intrinsic part of the system, but it is also about the opportunity that arises out of disturbances. Carpenter and colleagues (2001) usefully break resilience down into the following three components: the capacity to buffer against change; the ability to self-organise; and the ability to build capacity and adapt.

Encompassed within the focus on managing change is an acceptance that complex systems will bring a certain degree of uncertainty. The prevalence of uncertainty in global challenges such as urbanisation, climate risks, and unpredictable shocks in everyday urban life suggests that attempting to control the natural world and generate perfect foresight is unachievable (e.g. Dessai et al. 2004). Hence resilience theory is not necessarily about 'stability', and in fact there may be trade-offs in managing for stability versus managing for adaptability and change (Nelson & Anderies 2009).

2.3.3 Important Aspects of Resilience Theory

In order to tackle these challenges of uncertainty and change, resilience theory contributes some core concepts. These include non-linear dynamics, multiple scales, slow and fast variables, and adaptive capacity. It is helpful to briefly introduce some of this resilience 'language'. Firstly the likelihood of a system remaining in a certain state is governed by both external perturbations as well as internal changes to the system. Furthermore, these two variable types (external and internal) operate on a very broad range of timescales (Carpenter et al. 2001). Slow variables are key to understanding thresholds in systems, so while it is important to take note of external shocks and threats, so too is it important to consider internal variables such

as social structures, education, cultural norms or individuals' mental models. Adaptive capacity deals with those intrinsic abilities to deal with shocks and stresses. Covered in more detail later, adaptive capacity refers to the ability of a system to evolve to external changes and thereby expand the range of variability with which it can cope (Nelson et al. 2007). This process is enacted through a series of 'adaptive responses', which are underpinned by social and physical preconditions. Adaptive capacity may apply at various levels from the individual to the community, and may be generic, or specific to particular challenges.

Another contribution of resilience theory is that when systems approach the limits of certain states, the transitions are often not gradual but rather non-linear across a threshold. Such shifts may be irreversible, or only possible to reverse over long periods of time (Scheffer & Carpenter 2003). Transitions may be triggered by internal (slow) variables and so in a social, urban context one should be aware of the power of those variables changing and thereby opening up new 'regimes'. This might look like alternate livelihoods for individuals, or the ability to avoid being affected by shocks such as floods. Finally, resilience theory raises the notion that multiple scales should be considered in order to understand a system. For instance, governance and ecosystem services interlink over multiple scales and so the scale of management should be carefully considered (Carpenter et al. 2009).

Resilience therefore provides a useful framework for investigating contested concepts such as the vulnerability of people and places. Resilience analysis investigates the resources that constitute adaptive capacity (discussed later in detail), which enables individuals and communities to be able to cope with different types of shocks and stresses (e.g. Eriksen et al. 2005; Marshall 2010). Resilience analysis also encourages cross-scale and dynamic examination of linked social-ecological systems, which might suggest radical policy outcomes for avoidance of maladaptation, traps and thresholds (Gordon et al. 2008; Barnett & O'Neill 2010). Resilience is increasingly being used in a number of literatures, ranging from climate

resilient development, to developmental psychology, to economic resilience (e.g. Lerner & Castellino 2002; Luthar 2006; Simmie & Martin 2010; Christopherson et al. 2010). Moreover 'resilience' is usually framed differently each time, in terms of the area of region of study (e.g. rural versus urban), and the challenge or threat being focused on (e.g. disasters, poverty, national security, climate change). To bring clarity on this issue in the context of assessing resilience, the Resilience Alliance suggest the first question that should be asked in any resilience assessment is 'The resilience of what, to what?' (Resilience Alliance 2010).

Resilience has also become an important urban policy discourse (Evans 2011) and has been usefully applied to city plans, for example in the now global "Making Cities Resilient Campaign", although Adger and colleagues (2011) point out that the primary focus of this project is on disaster risk reduction rather than a broader and more dynamic conceptualisation of resilience as discussed above. There are of course more general critiques of resilience, including the assertion that power asymmetries and significant social relations are underplayed (Leach 2008; Hornborg 2009). Despite these criticisms, resilience has proved to be a useful framework for understanding complex problems, taking a dynamic, multi-scale social-ecological system view of problems in context (Davoudi 2012).

At this juncture, it should be stated that there are a variety of definitions of resilience, even within the social-ecological literature discussed already. Firstly, I am not referring to the 'engineering resilience' definition which describes the ability to absorb shocks and how quickly the system 'bounces back', effectively staying the same (Holling 1996; Folke 2006). The other potential confusion lies with the relationship between vulnerability and resilience. Some authors view resilience as the direct opposite or flip side of vulnerability (Folke 2006), while others disagree. For instance Gallopín (2006) argues that resilience is a component of 'capacity of response', which in turn is a component of vulnerability.

This potential confusion is clarified if we consider the components of vulnerability and resilience. The vulnerability literature has generally agreed definitions (Adger 2006), and frameworks for analysis (Turner et al. 2003). Vulnerability consists of *exposure*, *sensitivity*, and *adaptive capacity*. Adger (2006) defines exposure as the nature and degree to which a system experiences environmental or socio-political stress; sensitivity as the degree to which a system is modified or affected by perturbations; and adaptive capacity as the ability of a system to evolve in order to accommodate environmental hazards or policy change and to expand the range of variability with which it can cope. While these terms are being used within a specific environmental change context, a discussion of their meaning helps to clarify our understanding of resilience. Some authors argue that adaptive capacity is a broad term, having the effect of modifying sensitivity, increasing resilience, and reducing exposure (Gallopín 2006). To others, adaptive capacity means system robustness to changes in resilience (Gunderson & Folke 2005), or a collective capacity to manage resilience (Walker 2006). Meanwhile some equate adaptive capacity with resilience, while others state that it is a component of it (Carpenter, Walker).

To be clear on meanings and definitions, this thesis does not use resilience as the direct opposite of vulnerability. However, it can be usefully measured using the same components of exposure, sensitivity and adaptive capacity. As Turner and colleagues (2003) demonstrate in their framework, all three components inter-relate. However I view exposure and sensitivity relating more closely, and both influenced by adaptive capacity (or 'adaptability', used interchangeably here). This conceptualisation lines up with the framework for social adaptation as described by Marshall (2010) and presented in their IUCN paper:

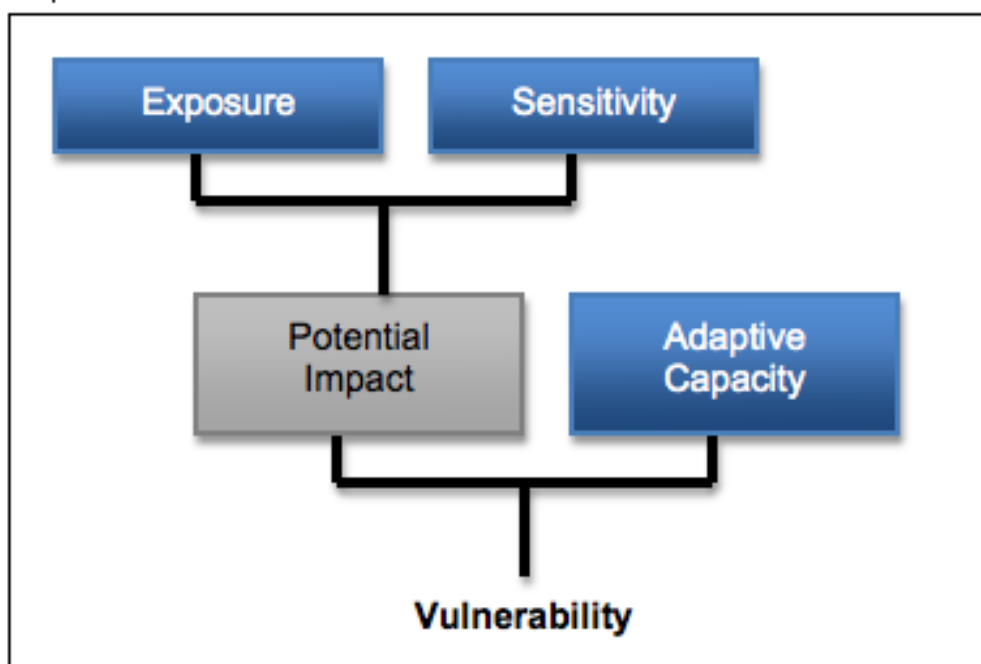


Figure 1: Simplified framework for social adaptation from Marshall et al. (2010). Presented with permission from author.

If resilience is the ability to deal with shocks and stresses whilst maintaining structure and function, adaptive capacity is discussed here as the ability to manage resilience, by altering exposure or sensitivity. In other words, as the Adger definition above suggests, adaptive capacity is about expanding the range of variability that is possible within a system (Nelson et al. 2007). This describes the theoretical role of adaptive capacity; Section 2.5.1 below goes on to discuss what this means in application.

There has been a fair amount of work within the vulnerability literature on how to reduce exposure to shocks, however the social science of adaptive capacity is still lacking clarity, including what it consists of and is determined by. In order to build resilience this knowledge gap needs to be addressed, and is one of the foci of this study.

This introduction to resilience has so far covered mainly an *ecological resilience* conceptualisation of the subject. There is one further set of concepts that are useful to consider for understanding rapid changes in

urban areas, which come from an evolutionary understanding of resilience. This perspective is visualised through Holling's famous model of the "adaptive cycle" (Gunderson & Holling 2002). The adaptive cycle model describes four distinct phases of change: growth or exploitation, conservation, release or creative destruction, and reorganisation. The model shows how systems can display a balance of emergence and stabilisation of structure and function, versus rigidification and decline, but that also opens up new possibilities. This brings about the notion that when systems collapse, there is a "window of opportunity" for alternate system configurations.

The key issue however is a number of paradoxes that emerge – flexible versus resilient, resilient versus transformational, and persistence versus change. The model of "panarchy" addresses these (Gunderson & Holling 2002). The panarchy model presents a number of nested adaptive cycles, at multiple scales that interact. This brings about the notion of resilience as a continually changing process, for instance where individuals may become resilient not in spite of adversities but because of being forced to face them (Davoudi 2012). Likewise, disturbances may not just be fast-onset 'shocks', but also slow-burning 'stresses'.

Most importantly for addressing the urban context as is the focus here, the adaptive cycle model introduces three pertinent concepts: resilience, adaptability, and transformability (Folke et al. 2010). In theoretical, system terms, resilience refers to the capacity of a system to continually change and adapt yet remain within critical thresholds. Adaptability (or adaptive capacity) is a part of resilience as described above, the capacity to adjust responses to external shocks and stresses and internal processes and thereby remain within the current system trajectory (i.e. expand the range of variability for that system). Transformability by contrast is the capacity to cross thresholds into new development trajectories. Transformational change at smaller scales enables resilience at larger scales. There is a need to acknowledge the dynamic interplay between persistence, adaptability,

and transformability as these consist the potential outcomes of systems (e.g. individuals) that face shocks and stresses (in addition to ‘failure’). These three concepts interplay across timeframes and multiple scales, and have importantly brought the role of institutions, social capital and social learning into resilience (Olsson et al. 2006). What is also important is how an understanding of adaptability will influence resilience and transformability. This sub-section has covered some important contributions of resilience theory, including definitional issues from a theoretical perspective. The next sections move onto the more applied aspects of measuring social resilience, what resilience means in urban areas, and the social and ecological components of that urban resilience.

2.3.4 Measurement of Social Resilience

As well as providing a framework for *understanding* change in complex social-ecological systems, resilience proposes methodologies to assess the ability of a system to deal with change. Furthermore, resilience takes a linked social-ecological systems view and has traditionally been applied mainly to ecological systems, however it has been applied to social systems too (e.g. Adger 2000; Adger 2002). Social resilience is defined as “the ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change” (Adger 2000). This definition focuses on the social system – the experiences of groups of individuals in society but acknowledges the link to the ecological, through effects of environmental change on the social system.

When applying the concept of resilience to assessments in the social world, Davoudi (2012) raises some important issues to bear in mind. For instance while adaptive capacity applies to ecological systems, it should be described as ‘tendencies’ rather than inevitabilities in a social system, given human ingenuity, technology and foresight. Further care should be taken with the notion of ‘self-organisation’ given the risk of ideological and normative discussions of self-reliance that might abdicate the role of government

responsibilities, say in managing vulnerable communities. Obviously in social systems there requires further consideration of what the 'desirable outcome' is, given that in ecological systems the conservation of ecosystem health is clearer. Finally as the critiques above mentioned, power and politics require consideration, and the question of 'resilience for whom?' This is not to say that resilience cannot be applied to social systems, just that it may require greater care.

In terms of assessment, there has actually been much greater application of vulnerability assessments in social systems (e.g. Füssel & Klein 2006; Luers et al. 2003; Eakin & Luers 2006) than 'resilience assessments' per se. Resilience assessment is a participatory process that engages stakeholders to see how their system has changed in the past, considering change dynamics, possible alternative states and critical thresholds, social networks, and multiple scales of influence. The Resilience Alliance have proposed a 'Workbook for Practitioners' with clear steps of the kind of aspects one should measure (Resilience Alliance 2010). However this is quite general and has had limited traction in anything other than rural contexts so far (e.g. Haider et al. 2012). There is therefore a need for further empirical testing of how to assess resilience, including in urban areas.

2.3.5 Urban Resilience

Given the challenges in the urban world described above, some studies have started to apply resilience thinking to urban areas. In broad terms, urban resilience is defined simply as "the ability of a city or urban system to absorb disturbance while retaining identity, structure and key processes" (Resilience Alliance 2007). However the notion of urban resilience is still a relatively new concept, and hotly debated (Ernstson et al. 2010). Some authors provide theoretical contributions from urban ecology and the human ecosystem framework, including the need to consider social and ecological heterogeneity (Pickett et al. 2004). Others have noted how developing nations still have negative attitudes towards urbanisation, which

adds to the challenge of urban resilience (Martine 2010). And only more recent work has proposed principles for urban resilience, such as multifunctionality, redundancy and modularisation, biological and social diversity, multi-scale networks and connectivity, and adaptive planning and design (Ahern 2011). However much of this study is mainly theoretical in nature and furthermore should be critically challenged in a developing country context where there is a lack of space, and a much greater importance of the unplanned and informal (Dovey 2012).

To date there has been little applied work on urban resilience, most providing frameworks and focusing at a broad scale and specifically on climate change (Brown et al. 2012; Tyler & Moench 2012; Leichenko 2011). A rare exception, the 'Asian Cities Climate Change Resilience Network' (ACCCRN) has been carrying out some fertile work with a number of South and Southeast Asian cities and have presented insights on identifying and applying resilience-building measures. They identify ten urban climate change resilience action areas, interventions at the city-scale that include: emergency management and early warning systems, resilient housing and transport systems, strengthening of ecosystem services, and diversification and protection of climate-affected livelihoods. Other work, especially in slum areas, that has addressed the finer scales of urban resilience has tended to focus on more narrow aspects of livelihoods, social networks or social capital, or specific issues such as water provision (e.g. Zimmer et al. 2009).

There has also been criticism of what urban resilience actually means in practice. Resilience has become a buzzword in urban-regional matters, sometimes being used interchangeably with sustainability, but authors have reported a difficulty in applying resilience as a new paradigm in planning practice. Indeed, what resilience means for urban governance is yet to be examined (Wilkinson 2012). There is currently a gap between the advocacy of social-ecological resilience in the scientific literature and its take-up as a policy discourse, and also the capacity to govern for urban resilience. There

is evidently a need to clarify how urban resilience might be operationalised in practice, as well as a lack of concrete examples (Collier et al. in press).

2.3.6 Social and Ecological Components of Urban Resilience

In order to move this understanding of urban resilience forward, it may have to be broken down into its constituent social and ecological components. In fact, given its focus on coupled social-ecological systems and challenges at the human-environment interface, resilience has been posited as being able to be a bridging concept between the natural and social sciences (Davoudi 2012). This will be important for understanding urban systems, as rarely have both social and ecological imperatives been brought together in the realm of urban studies (Pelling 2003). Two possible ways of bringing together social and ecological concepts to measure urban resilience are considering the role of ecosystem services, and adaptive capacity.

Ecosystem services is a concept that embodies humans within the social-ecological system and is often used in considering resilience (Folke 2006; Jansson 2013; Smit & Parnell 2012). Adaptive capacity is the social capabilities of the system (e.g. individual/community) that influence its resilience. In the next section, these two concepts are considered in greater detail, and how they might influence urban resilience.

In summary, resilience has been presented as a useful theory and set of concepts through which to understand change, desirable and undesirable, planned and unplanned. Resilience encompasses uncertainty, a consideration of both internal and external variables, and adaptive capacity. The relationship between adaptability, resilience and transformability has briefly been described, as well as the importance of multiple scales. Resilience can apply to people, places and ecosystems. Urban resilience is a fruitful new area of research, requiring further empirical grounding and practical application. In the next two sections the role of ecosystem services

and adaptive capacity within urban resilience are considered, as ways to measure the social resilience of poor urban areas.

2.4 The Role of Ecosystem Services in Urban Resilience

Resilience in poor urban areas will be made up of both social and ecological components, both of which contribute towards individuals' adaptive capacity. Ecosystem services (abbreviated to ESS in this study) are the "aspects of ecosystems utilised (actively or passively) to produce human well-being" (Fisher et al. 2009). As such, they represent benefits that humans derive from nature as the ecological 'assets', or components of individuals' adaptive capacity. The Millennium Ecosystem Assessment (MEA 2005) identified four types of service: provisioning services (material or energy outputs from ecosystems); regulating services (services that ecosystems provide by regulating the quality of air and soil or providing flood and disease control etc.); supporting services (that underpin all other services, biodiversity); and cultural services (non-material benefits that people obtain from contact with ecosystems including aesthetic, spiritual and psychological benefits) (TEEB 2011). The role of ecosystem services in the resilience of individuals in poor urban areas is the focus of this section.

2.4.1 A Definition and Classification of Ecosystem Services

There are in fact a range of definitions of ecosystem services that have evolved over the course of research into ecosystem services (e.g. Daily 1997; Costanza et al. 1998; MEA 2005; Nahlik et al. 2012 for review). Some of these definitions refer to ecosystem attributes, whilst others refer directly to the benefits that the ecosystems provide. A significant development was by Boyd and Banzhaf (2007) with their concept of *Final Ecosystem Goods and Services* (FEGS), which emphasised the ultimate entity in nature used by humans to acquire a benefit. As such this was described as a 'beneficiary approach', that whether utilised passively or actively, focused on the way in which beneficiaries categorise ecosystem goods and services. The FEGS approach has been popular in part because of the ease of understanding by

the general public (Nahlik et al. 2012), and is used in this study as the working ecosystem service concept.

Fisher and colleagues (2009) make a few final distinctions on the basis of Boyd and Banzhaf's approach. They note the difference between benefits and services, distinguishing intermediate services, final services, and benefits. An example in an urban area would be a natural spring function (intermediate service) leading to the provision of water (final service), the benefit of which would be either drinking water, or bathing water. Secondly, they point out that ecosystem services are ecological in nature. Aesthetic, cultural and recreational values therefore, which are valued by humans and so provide welfare benefits, are both final services, and benefits (when they are appreciated and valued). Depending on the provision of that service, the benefit results in either a gain or loss in welfare. Thirdly, services do not have to be utilised directly, i.e. they are not just direct end-points. This study makes use of this latter approach, focusing on the benefits that urban dwellers receive from urban ecosystems, however the term 'ecosystem service' (ESS) is also used more generally in general discussion.

It has also been noted recently that one must be aware of "ecosystem disservices" in order to fully understand the impact of ecosystems on human well-being (Lyytimäki et al. 2008; Lyytimäki & Sipilä 2009; Escobedo et al. 2011). There is no widely agreed definition, although Lyytimäki and Sipilä (2009) describe them as "functions of ecosystems that are perceived as negative for human well-being". They have mostly been described in agriculture, for example nutrient runoff or pest damage. However many studies describe ecosystem disservices without using that term; for example pest species in crop management, or fear related to urban areas, or health risks caused by ecosystem functions (see Lyytimäki & Sipilä 2009 for review). Ecosystem disservices may be from natural phenomena, such as floods or wild fires, or man-made such as toxic substances or deliberate manipulation of the ecosystem, however that divide is obscure. Lastly it is important to consider how users value and perceive these services, as the

same function may be a service to some, and a disservice to others. Thus, ecosystem disservices should be included in an integrated assessment of the importance of ESS in an area.

While the concept of ecosystem services originally had a different starting point as a philosophical concept (Norgaard 2010), most applications of the ESS framework are now with respect to economic valuations of nature. There are still challenges including a lack of understanding of 'production functions' (Barbier 2007) and lack of information to be able to move the science forward rapidly (Tallis et al. 2008; Daily et al. 2009). While economic valuations of ESS have received criticism (Nunes & van den Bergh 2001; Norgaard 2010), ESS do not necessarily have to be applied in an economic framing (Vira & Adams 2009). In fact, the framework may be used to identify benefits that contribute to socio-cultural values, or to resilience (Gómez-Baggethun & Barton 2013).

2.4.2 Importance of Ecosystem Services for Livelihoods and Resilience

On a global level, the importance of ESS for the well-being and survival of humanity is clear (MEA 2005; TEEB 2010; Rockström et al. 2009). There is certainly a link between ESS and many aspects of quality of life, as well as maintaining long-term resilience to shocks (Barthel et al. 2010). However there has been little empirical study, especially at a local level, of the links between ESS and resilience. Ecologically the evidence is lacking to prove the link between the sustenance of ecosystem services and resilience (Jansson & Polasky 2010). Socially, there is also more work to be done on understanding how ESS affect livelihoods and resilience, especially of the urban poor.

While well-being does not tie directly to resilience, many studies have now shown the link between ecosystem services and well-being. In general, it has been found that poorer people tend to be more reliant on ESS due to natural-resource-based livelihoods and their vulnerability to natural

hazards (TEEB 2010). Cilliers and colleagues (2012) also found that relatively poorer residents of an African city used provisioning services more. As such, ecosystems represent poverty alleviation options (ESPA projects; ISET-Nepal 2006). By contrast, a World Bank study (2008) found that it was neither the richest nor poorest who actually benefited the most from local ecological goods and services.

Hence it appears that there is a link between poverty and ecosystem services. However there are a number of caveats to this linkage and gaps in empirical evidence. The 'Ecosystem Services for Poverty Alleviation' (ESPA) studies were in peri-urban, rather than urban settings; the World Bank study actually reviewed entirely rural studies. Essentially, while it appears that a linkage between ESS and poverty is likely, there is still little understanding of how different aspects of well-being are affected by changes in ESS and how different people use ESS (Raudsepp-Hearne et al. 2010), especially in urban areas.

2.4.3 Distribution of Ecosystem Services

In addition to a somewhat unclear linkage between well-being and ecosystem services, there is a relative dearth of knowledge on the distribution of ESS and who benefits from their delivery. Generally, there are trade-offs between ESS across space, time and through power dynamics in social systems (Rodríguez et al. 2006; Bennett et al. 2009) and so it is important to understand who benefits from the delivery of ESS from natural systems, especially in the context of poverty (Daw et al. 2011). In addition, there is a risk that a 'robust' supply of ecosystem services, sustained through a resilient social-ecological system, may maintain an unjust social system where the distribution and access to ecosystem services 'falls unevenly among the present and future population' (Ernstson 2008).

More specifically for urban areas, there are multiple demands for land so trade-offs are highly likely, especially as land becomes degraded in rapidly

urbanising cities (Vira & Adams 2009). An example from Phoenix shows water procured from farmers selling irrigated lands, only to create concerns for food security (Ernstson et al. 2010). This will be most acute in rapidly growing, developing country cities where there is less protection of urban green space. In terms of demand, there is also little research on how demand for ESS changes spatially when urban residents have specific needs (McDonald 2009), or the supply/demand ration of ESS (Kroll et al. 2012).

Therefore, as well as understanding how ecosystem services may influence the resilience of poor urban areas, it appears further research is required on how those benefits are distributed between different groups or types of people.

2.4.4 Ecosystem Services in Poor Urban Areas

It has been suggested that a sustainable provision of ESS is critical for urban resilience (Ahern 2011), however the types of services that might be utilised in poor urban areas are yet to be clearly identified. Urban ecosystems are certainly very different from rural ones in that they are highly patchy and subject to more human-induced disturbances, but ecosystem properties have also been a part of the urban fabric for a very long time, possibly since cities started to occur and they are now a rapidly expanding feature of urban planning (Ernstson & Sörlin 2009). This is not necessarily the case currently in the developing world however.

For one, the process of urbanisation has the potential to strongly negatively impact the local environment (Kestemont et al. 2011), resulting in the delivery of few ecosystem services in these areas. In addition to local impacts, urbanisation affects the connectivity of ecosystems at a broader scale (Grimm et al. 2008). Urban development fragments, isolates and degrades natural habitats, it simplifies and homogenises species composition, and disrupts and modifies cycles of energy, water, and nutrients (Alberti 2005). On the one hand we understand a range of

ecological processes that are affected by urban dynamics (Pickett et al. 2011), but at the same time we do now know “the effects of different urban forms, densities, land use mix, and alternative infrastructures” on ecological systems (Alberti 2010). Urban areas are not inherently bad for biodiversity and in fact the Millennium Ecosystem Assessment showed that urban ecosystems were more biodiverse than rural monocultures, and made up only 2.8% of land area (MEA 2005). However it seems likely that the effect of urbanisation on highly degraded areas such as slums is to greatly reduce the level of ecosystem service provision. The ways in which this might occur, and the ESS that are still available, requires further investigation.

Alberti and Marzluff (2004) make an interesting theoretical assertion that as the process of urbanisation occurs, there will be two alternate states that an urban area will move towards – a ‘sprawl attractor’ that leads to a domination of human services and ecosystems too degraded to produce ESS, or a natural vegetation attractor where ESS dominate in terms of meeting people’s basic needs. In the context of this study, by this rationale the system would move towards the ‘sprawl’ attractor with the provision of very few ESS services. It has also been hypothesized that impacts on ecosystem processes change predictably with distance from the urban centre (McDonnell et al. 1997) but empirical evidence has challenged this hypothesis (Alberti 2010). Ultimately whether poor urban areas are still able to provide local ESS requires further empirical testing.

In terms of what types of ecosystem services exist in poor urban areas, there is again little evidence to go by. Most studies of urban ESS have been in urban green spaces in the developed world in cities such as Stockholm (Bolund & Hunhammar 1999; Ernstson 2008; Lyytimaki et al. 2008; Vejre et al. 2010), with rare cases in the global south (Roberts et al. 2011). It is hard to generalise studies such as Bolund and Hunhammar (1999) from Sweden to poorer urban contexts given the vast differences in context (developed country green spaces to rapidly urbanising, highly contested urban spaces

with little protection), although it is known that urban green spaces are not valued as much in developing countries (Cilliers 2009).

One approach has been to focus on individual benefits from urban green spaces, and the following have been demonstrated: health benefits (Tzoulas et al. 2007; Brown & Grant 2005), positive influences on child development (Taylor et al. 2001), a positive influence on the longevity of senior citizens (Takano et al. 2002) and benefits for physical activity and overall mental health (Bird 2007; Bird 2008). Another approach has been to investigate specific types of ecosystem in urban areas. A handful of studies have investigated specific types of ecosystem or green space in developing countries, including wetlands (Lannas & Turpie 2009; Schuyt 2005) and urban gardens (Sarel Cilliers et al. 2012), urban forests (Shackleton 2006), food gardens (Altieri et al. 1999), and wider benefits from green spaces generally (Roberts 2010; Kitha & Lyth 2011).

In terms of ecosystem services, urban agriculture has perhaps received the most attention in poor urban areas (Lee-Smith 2010a; De Zeeuw et al. 2011; Eriksen-Hamel & Danso 2010; Crush et al. 2011). These studies found mixed reports but generally support the notion that urban agriculture has the potential to help feed Africa's cities. A comprehensive review of urban and peri-urban agriculture in East and West African cities by Lwasa and colleagues (2012) also found that it had positive impacts on food security, urban livelihoods, and enhancing ecosystem services.

Evidence for other specific ecosystem services that might be of importance in the resilience of slum dwellers is lacking for poor urban areas specifically, so is reviewed from urban areas in general. For provisioning services, agroforestry may be of importance from the sale of timber products. Poor urban residents may also derive benefits from sources of drinking and bathing water. However the likelihood is that for most poor urban areas, the proximity to forests will be prohibitive to access these types of benefits. A study of 'desakota' (peri-urban) regions suggested that these types of

urbanising areas will host more systemic, intangible services as opposed to tangible or provisioning services (ISET-Nepal 2008), which may actually have equal or greater value than direct services in urban areas (Vejre et al. 2010). Regulating services in urban areas may include regulation of local microclimate (Tidball & Krasny 2007), fruit crops and trees that provide shade, wind breaks, and flood control from vegetation cover (Lwasa et al. 2012 for review). A previous study in two townships in Durban found that disease regulation and natural hazard protection (flood control from riverine buffers in peri-urban townships) were highly important for the well-being of township residents. In short, it appears that regulating services may be some of the most important services for the urban poor. They play an important role in sustaining livelihoods, and providing capacity for recovery and regeneration following shocks (Bennett et al. 2009).

Finally there is very little in the ecosystem service literature on valuing cultural services, especially in urban areas. However Gómez-Baggethun and Barton (2013) describe how cultural values may consist of place values, a sense of community and identity, physical and mental health, social cohesion, and education values. Aesthetic benefits and spiritual benefits are other potential categories of cultural values (Church et al. 2011). However these have received little research attention in poor urban areas.

Synthesising these studies in order to get an idea the types of ecosystem services that might be of importance in the resilience of poor urban areas/individuals are:

Provisioning: fuel wood, drinking water, water for washing/bathing, urban agriculture/crops;

Regulating services: water filtration, wastewater purification, protection from natural hazards, disease regulation, air filtration, surface water drainage, noise reduction; and

Cultural services: aesthetic values – pleasant scenery, recreation, inspiration, social relations, e.g. around community gardens.

Meanwhile this short review has highlighted some significant knowledge gaps in terms of the distribution of ESS benefits, how ESS contribute to aspects of well-being and resilience, as well as the contribution of urban green areas to community social networks, business value chains and household property values (Schäffler & Swilling 2013). In conclusion, there is still certainly a dearth of knowledge about the role of ecosystem services in poor urban areas.

In summary, up-to-date definitions and classifications of ecosystem services provide a good framework to assess ecological resources in poor urban areas. However there is currently little understanding of the linkages between ESS and well-being in urban areas, let alone between ecosystem services and social resilience. Given trade-offs in ecosystem services it will be important to understand the distribution of benefits too, i.e. who benefits from ESS provision. There is particularly little understanding of non-economic values. This knowledge gap will be addressed by the first Research Question presented at the end of this chapter. Having addressed potential ecological sources of resilience, the next section discusses the social components of urban resilience.

2.5 Social Components of Urban Resilience

In general terms, adaptive capacity is the capacity of a system to evolve to external changes and thereby expand the range of variability with which it can cope (Nelson et al. 2007). While ecosystem services in the previous section represented ecological components of individuals' resilience, adaptive capacity represents the social components of individuals' ability to adapt to shocks and stresses. In this section, I move from the theoretical definition of adaptive capacity introduced in Section 2.3.3 and mentioned above, to a working definition for measurement of urban resilience. Adaptive capacity is discussed in relation to other related concepts, I then introduce what the literature suggests in terms of assessing adaptive

capacity, and finally what determinants one might examine that influence adaptive capacity.

2.5.1 Definition and Meaning of Adaptive Capacity

Section 2.3 described how both vulnerability and resilience literatures have contributed to the concept of adaptive capacity, and in fact adaptive capacity somewhat bridges the two literatures and frameworks (Engle 2011 for review). Adaptive capacity relates to resilience in that resilience describes the overall ability of a system to respond to a stress while adaptive capacity describes the ability to increase the range of variability of the system. More specifically, adaptive capacity is a human property of the system, the ability to respond to external stimuli in order to take advantage of the opportunities or moderate the damages (Gallopín 2006; Brooks et al. 2005). In practice, this process occurs through a series of ‘adaptive responses’, which are underpinned by physical and social preconditions, or a set of capitals and the ability to mobilise them. The adaptive responses may be reactive i.e. they are autonomous reactions to events, or proactive in that they are planned for future shocks (Tompkins & Adger 2005). Adaptive capacity may also apply at various levels from individual to community to national, and may be generic i.e. to a variety of shocks and stresses, or specific to certain external changes (e.g. climate change).

Adaptive capacity refers to capacities that enable adaptation, just as ‘coping capacity’ refers to coping, or ‘transformative capacity’ to transformation. The review of resilience above described the difference theoretically between adaptability, resilience, and transformability. In terms of capacities, there are also useful distinctions to describe the different levels to which human societies and individuals can practically adjust to external change. At the lowest level there are key capacities that allow humans to ‘cope’, for example in extreme weather events by moving their possessions to safe places. Adaptive capacity goes beyond this minimum asset base or basic response to responses that enable individuals or societies to build and grow

from the shock. Finally in periods of radical change, or transformation, the set of preconditions is different again, such that the individual/household/community is able to navigate fundamental change to the system, such as a shift in livelihoods. Thus by referring to adaptive capacity, one is referring to more than something that just allows individuals to 'cope', but as well as enabling adaptation, adaptive capacities may 'feed into' the potential for transformation.

In the context of slums and poor urban areas, adaptive capacity will allow individuals to respond to shocks and stresses so that livelihoods and daily activities are not fundamentally or critically disrupted. For example, adaptive responses will allow individuals to continue in their income-generating activities, or even seize new opportunities in the aftermath of the shock. Adaptive capacity reduces sensitivity to shocks, it increases adaptation choices and enables individuals to cope with surprise and uncertainty. In terms of a more applied definition of adaptive capacity that is useful in this context therefore, it is here defined as the preconditions necessary to enable adaptation (to maintain or increase quality of life), including social and physical elements, and the ability to mobilise these elements (adapted from Nelson et al. 2007). This will be the working definition of adaptive capacity in this thesis.

2.5.2 Assessment of Adaptive Capacity

While there is now considerable literature on the meaning and definitions of adaptive capacity, there is less empirical grounding of how adaptive capacity may be assessed. Having said this, research on characterising and measuring adaptive capacity and resilience of different social systems has grown steadily (Yohe & Tol 2002; Janssen & Ostrom 2006; Schröter et al. 2005).

Just as adaptive capacity definitions are captured in both vulnerability and resilience literatures, the two different approaches can also contribute towards the assessment of adaptive capacity. The benefit of vulnerability

assessments is in their use and application of metrics and aggregate indices which can be helpful in making generalisations and policy recommendations; the resilience approaches, by contrast, tend to pick up more of the context-specific and dynamic variables through descriptive case studies and system models (Engle 2011). A few authors now have recommended incorporating aspects of both approaches in measuring adaptive capacity (Eakin & Luers 2006; Berman et al. 2012). Resilience approaches tend to bound the systems solely around the ecological system (Engle 2011) but this does not necessarily have to be the case to still take a social-ecological systems view (Waters 2012).

Engle (2011) has pointed out that there are in fact many benefits in focusing on adaptive capacity assessments. Firstly it is an 'organising concept', and a potential point of departure for construction of practical indices of vulnerability (Yohe & Tol 2002). It is a capacity humans can shape, and while resilience may be normatively positive or negative in different contexts (see discussion of poverty traps in Waters 2012), adaptive capacity is a universally positive system property – "a system simply cannot have too much of it and it is never described in negative terms" (Engle 2011). Another reason for taking an adaptive capacity approach rather than a vulnerability focus is that there may be more psychologically motivating outcomes from describing situations in terms of having more or less adaptive capacity, as opposed to indicators that highlight negative system properties (as in vulnerability assessments). Adaptive capacity is also relatively translatable to practitioners: while vulnerability, adaptation, or resilience-based approaches address challenges and their solutions, adaptive capacity assessments focus on the way in which those solutions may be met, e.g. the assets and capacities that might be built upon or improved. In terms of encompassing the full range of factors that might influence how well humans adapt to shocks, adaptive capacity is also useful because it links adaptation literature on environmental and climate change, and research that focuses more on human motivation and 'sociocognitive factors' (Brown & Westaway 2011).

There are of course challenges with assessing adaptive capacity too. For one, while the benefits of combining vulnerability and resilience approaches are clear, combining the two is still a challenge. The two approaches have different weaknesses, for instance resilience approaches are criticised for insufficiently dealing with the social aspects of social-ecological systems, while the vulnerability approaches are criticised for insufficiently dealing with the ecological aspects (Adger 2006; Janssen & Ostrom 2006). Other specific challenges include scales, the latent nature of adaptive capacity, varying methods, and interpreting literature that is mainly focused around climate change.

Choosing the right scale at which to operationalise adaptive capacity is a challenge. Most resilience assessments will bound the system and assessment according to the ecological system, however social, cultural and political boundaries that may be more policy-relevant are unlikely to align with that. Furthermore, many studies will focus on broader regional or national assessments that are cost-effective and efficient, however unable to capture local impacts and available resources (Engle & Lemos 2010). There is some literature now that describes adaptive capacity assessment at the community scale (Jones et al. 2010b; Levine et al. 2011; Berkes & Ross 2013), although little still that focuses at individual or household scale (Paavola 2008; Vincent 2007).

Another significant challenge of measuring adaptive capacity is its latent nature, i.e. it can only be measured after it has been realised or mobilised. However there are ways to address this, such as empirically investigating past shock events, and using this as a proxy for future adaptive capacity; and investigating structures, relationships and processes, rather than specific adaptation. Measurement methods have also varied greatly (including surveys, modelling, mapping, and ethnography) and this provides a challenge in terms of choosing assessment protocols. As for the challenge of

choosing the scale of analysis, it is a challenge to combine generalisable indicators, and measures that can be made context-specific (Engle 2011).

Finally, much of the adaptation literature is around climate change (Nielsen & Vigh 2012), and it should be questioned whether the same indicators apply to other shocks. Most studies that have incorporated vulnerability and resilience approaches have also focused on adaptive capacity in the context of climate shocks (Berman et al. 2012; Cinner et al. 2012; Gupta et al. 2010; Paavola 2008). This might be problematic when trying to translate adaptive capacity assessment to poor urban contexts, where climate change may not be the most urgent or significant challenge (whilst perhaps having an impact on other shocks) that individuals face. However it is likely that the determinants and aspects of adaptive capacity from climate change adaptation literature will correspond to other shocks too. Alternatively, it might be more advisable to focus on general resilience (or generic adaptive capacity), as it may be hard to pinpoint specific adaptive measures linked to climatic perturbations for instance (Nielsen & Vigh 2012), and furthermore there may be trade-offs between specific resilience to different shocks (Waters 2012).

Despite these challenges, some recent studies have incorporated key factors of adaptive capacity and carried out assessments using a range of indicators (e.g. Cinner et al. 2012). The next challenge is to work out what are the determinants of adaptive capacity, which then may be measured.

2.5.3 Determinants of Adaptive Capacity

Determinants are the broad range of factors that influence the outcome of something, while indicators are tools to interpret and monitor the levels of presence or absence of factors. In the case of adaptive capacity, the determinants may come from multiple different 'sources' including structural factors that are outside an individuals' control, objective factors such as income or education levels, to more socio-cognitive factors that

influence an individual's agency. In fact, the social science of adaptive capacity is as yet uncertain, and potential determinants originate in multiple different disciplines, from psychological resilience to well-being to climate change adaptation. Given this confluence of research themes, the uncertainty in adaptive capacity determinants is partly due to the contested nature of development, progress and well-being.

In an attempt to measure adaptive capacity, some studies reduce certain aspects of social resilience down to single components. For example Ainuddin and Routray (2012), taking their lead from previous examples, use "community trust" as their indicator for social capital, which is one of a few components of "social resilience". By contrast, Marshall and colleagues (2010) describe a wider range of adaptive capacity characteristics including the perception of risk, level of interest in change, and employability, amongst a list of sixteen factors. A wide range of potential determinants from multiple studies is discussed here in order to capture the possible influences on adaptive capacity.

Firstly it should be stated that the set of preconditions for adaptive capacity is likely to differ according to the scale of analysis and specificity. Furthermore, given the dynamic nature of most systems, adaptive capacity will differ in nature with time; what is necessary for periods of opportunity and growth will differ to periods of crisis and reorganisation. Throughout, a portfolio of options is key. (Having said this, it is likely in poor urban areas that the set of challenges and therefore capacities required is relatively consistent.)

The environmental change literature suggests three main areas of adaptive capacity determinants: resources, structure, and agency. Resource constraints have been shown to be significant determinants of adaptive capacity (Adger 2003), even in poor urban areas (Moser et al. 2010). 'Resources' may refer to assets specifically, or more broadly to social relations (Pelling & High 2005), or information and knowledge. 'Structure'

refers to factors such as social class, religion, gender, ethnicity, and customs. 'Agency' on the other hand refers to more subjective, socio-cognitive factors that influence individuals' adaptation choices. Refining these factors somewhat, earlier work was able to pin down key determinants of adaptive capacity. For instance (Yohe & Tol 2002) suggest eight determinants of adaptive capacity: the range of available technological options for adaptation, the availability of resources and their distribution, the structure of critical institutions, the stocks of human and social capital, access to risk spreading mechanisms, the ability of decision-makers to manage risks and information and the public's perceived attribution of the source of the stress and the significance of exposure to its local manifestations. The International Panel on Climate Change (IPCC) also came up with a similar list of factors (Smit & Pilifosova 2003). Yohe and Tol (2002) concluded however, that "many of these variables cannot be quantified, and many of the component functions can only be qualitatively described".

Determinants such as assets, the availability of infrastructure, and technology are important factors, and research efforts into the component assets of sustainable livelihoods for instance has provided a foundation for determinants of adaptive capacity. However most of this research, especially from a global environmental change and human adaptation background, has mainly been based on objective phenomena and system approaches (Nielsen & Vigh 2012; O'Brien et al. 2010), and has given less attention to more subjective factors. More recently however there has been a shift from purely objective factors to a more complex, nuanced view that includes subjective and relational aspects of adaptive capacity (Brown & Westaway 2011).

Given their more recent focus in the adaptive capacity literature, attention is now given to some of these more subjective factors, and also to governance, which is a critical factor of adaptive capacity. While some of the studies and factors considered here address the national or regional scale, they are

addressed here and it is discussed later how that might influence local adaptive capacity.

Perhaps the most growing adaptive capacity literature recently has been around institutions, governance and management (Yohe & Tol 2002; Brooks et al. 2005; Agrawal 2008; Engle & Lemos 2010; Gupta et al. 2010; Hill 2013b). Influencing adaptive capacity in significant ways, it has been described that there is a “fundamental contribution of governance to reducing the vulnerabilities of people” (Adger et al. 2007), and governance and institutions are “critical determinants of adaptive capacity and resilience” (Engle & Lemos 2010). For example, there is a need for institutions to deliver the benefits of any resource or asset or intervention to the population that it serves. In fact, there are many different components of ‘institutional adaptive capacity’ (Gupta et al. 2010) or types of governance determinants. These include the law, rights, and policies (Hill 2013b). The scale of governance influence that is assessed is usually higher than the local level, however governance is key for building resilience at local (e.g. through local leadership), regional, and national levels (Hill 2013b).

Governance also has an affect on determining the conditions for land tenure in an area, which again will affect the adaptive capacity of individuals locally. Insecure or lack of land tenure, along with housing finance, are key reasons why people in slums do not look after their local environments, or invest in their housing (UN-HABITAT 2010). These actions, or lack of, will greatly impact the degree to which those individuals will be able to adapt to shocks, not having infrastructure that is able to resist the impact of shocks such as floods.

At an individual level, factors that involve agency and social relations become even more important. Agency refers to the ‘ability to mobilise’ part of the adaptive capacity definition, with respect to the assets and preconditions necessary for adaptation. Agency is defined as one’s independent capability or ability to act on one’s will (Brown & Westaway

2011). It has been stated that “we can never adequately understand human actions simply by examining objective environmental conditions alone. Instead, we must always look within the person and attempt to see the world from his or her perspective in order to approach an understanding of human behaviour” (from Hjelle & Ziegler in Brown & Westaway). As well as overcoming the view of seeing people as powerless victims of change, agency is an important determinant of adaptive capacity.

Agency is made up of various socio-cognitive factors, and to date there has been little empirical analysis of these ‘psychosocial factors’ (Grothmann & Patt 2005). Furthermore, there has been little consensus from the resilience literature on the role of agency, and even the social dimensions of resilience are poorly specified (Bahadur et al. 2010). However outside the climate/global environmental change literature there is much discussion of how decision-making is affected by motivation and perceived abilities. In fact, one of the case studies from the important paper by Grothmann and Patt (2005) shows how socio-cognitive factors explained more of the adaptive behaviour than typical objective socio-economic factors such as home ownership and household income. Arguably the omission of such factors has led to the emphasis in adaptive capacity literature on financial, technical, and institutional constraints (Kuruppu & Liverman 2011; Brown & Westaway 2011). However, some of these factors are likely to even transcend ethnic, social class and geographic boundaries. Therefore, there is a need to understand the role of these socio-cognitive factors further.

One of the most important of these subjective factors is *perceived* adaptive capacity (O’Brien et al. 2010; Kuruppu & Liverman 2011). This relates to how a problem is perceived and how that perception influences attitudes about responses. As such, it goes beyond knowledge, information and resources. At a regional level, it will be important how a problem is characterised, by whom, and how that influences collective adaptive capacity. Individually, factors such as self-efficacy, empowerment, optimism, self-esteem or innovative thinking will also play a part. Kuruppu and

Liverman (2011) break perceived adaptive capacity down further in order to understand the process, including the role of risk experience appraisal, cognitive biases, risk and adaptation appraisal, and social discourses. Perceived adaptation efficacy refers to the belief that adaptive actions will be effective; perceived self-efficacy refers to the perceived ability to carry out the responses; and perceived adaptation costs refers to the cost of taking the response. It is important to note how past experiences can enhance self-efficacy beliefs (e.g. with the time that individuals live in an area), and the importance of an 'intention implementation plan'.

There is also some empirical evidence that these socio-cognitive factors affect adaptive capacity, although much of this comes from specific indigenous communities. Kuruppu and Liverman (2011) review studies from the Himalayas, indigenous Arctic populations, and indigenous people in Australia. It will therefore be helpful to assess the importance of these factors in more generic, heterogeneous, urban contexts. Other specific factors from the literature that are worthy of further research focus include self-efficacy, and locus of control (the extent to which individuals believe they can control events that affect them).

Learning is also likely to be an important factor, and in fact the ability to maintain response capacity is predicated on the capacity for learning (Nelson et al. 2007). Both adaptive governance and adaptive management literatures focus on the idea of 'learning by judicious doing' (Hill 2013a). Indeed, learning is a vital component for building experience and flexibility (Pahl-Wostl 2009).

Aside from the socio-cognitive factors, social networks are likely to be one of the most important determinants of adaptive capacity. The role of social networks in markets and economic action has been studied by social scientists especially sociologists for decades (Coleman 1988; Granovetter 1985; Borgatti et al. 2009). Much literature exists documenting the role of social networks in industry or economic development (Lyons & Snoxell

2005; Adama 2012), however the importance of social networks for individuals has also been described in well-being literature (see Brown & Westaway 2011 for review), as well as adaptive capacity (Adger 2003; Pelling & High 2005). James Scott in 1986 described social networks as the “weapons of the weak”; social networks may provide autonomous solutions for development. The study of social networks has also bolstered research into the ‘informality’ of urban spaces (Lindell & Utas 2012), and the complexity of social networks should also be considered when trying to understand adaptive capacity (Meagher 2005).

Finally, there is a large body of literature on place, and attachment to place, and the links to well-being. Lewicka (2011) reviewed forty years of place attachment research and found that place-attached persons were more satisfied with life overall, have stronger bonding social capital and local ties, and trust people more. Place attachment also links to aspects of cultural ecosystem services described above. Gómez-Baggethun and Barton (2013) describe cultural services as a source of social cohesion, shared interests, and neighbourhood participation. Furthermore, there is a link between environmental degradation and place (Albrecht et al. 2007). The suggestion is therefore that attachment to place (perhaps via the formation of social networks), whether directly or indirectly, will influence adaptive capacity.

Little of the literature mentioned in this review of adaptive capacity determinants comes from empirical work in poor urban areas. However it has been shown that there can be relatively high levels of trust and social cooperation in slums (Carpenter et al. 2004), and how functional social networks can be in these contexts too (Lourenço-Lindell 2002b; Lyons & Snoxell 2005; Berrou & Combarous 2012). Given the lack of government intervention and service provision in many of these areas, it is useful to distinguish between individual, and state-provided sources of adaptive capacity. For instance in some contexts external factors such as insurance schemes, government benefit schemes, and NGO projects may be important for the resilience of individuals (Salick & Byg 2007), however in slum areas

this is less likely. This often means the urban poor are particularly vulnerable (Gasper et al. 2011).

Satterthwaite (2012) makes the distinction between “accumulated resilience” and more ‘bottom-up’ forms of resilience therefore. He notes that in higher-income countries urban resilience (e.g. to climate change) often comes in the form of infrastructure and services provided mainly by the government, whereas in the developing world, and especially in slums, urban resilience takes the form much more of inbuilt, bottom-up assets, capabilities and networks. As the examples above demonstrate, as well as notable efforts through savings groups (e.g. Hardoy & Pandiella 2009), these bottom-up facets of adaptive capacity can have profound positive influences on the resilience of poor urban areas.

Lastly, while most of the studies reviewed here either focus on specific aspects of adaptive capacity or at higher scales than the local, a few studies have focused on local adaptive capacity and give an indication of potential adaptive capacity determinants for this study. Cinner and colleagues (2012) come up with eight indicators of vulnerability of coastal communities, which might also be useful for urban adaptability: capacity to anticipate change, occupational mobility, occupational multiplicity, social capital, material assets, technology, and infrastructure. The other two studies are practitioner reports that review the literature and come up with frameworks for local adaptive capacity, and urban resilience.

Arup, in their ‘Characteristics of a Safe and Resilient Community’, undertook a review of community resilience and disaster-risk reduction studies and frameworks. Admittedly at a city scale, the key characteristics of urban resilience that emerged in their framework are useful to consider in terms of determinants of adaptive capacity. These were: infrastructure and services, economic opportunities, natural resources, being organised, knowledgeable and healthy, and being connected. ODI (Levine et al. 2011) also reviewed the literature for a framework of local adaptive capacity that is made up of the

following aspects: asset base, institutions and entitlements, knowledge and information, innovation, and flexible and forward decision-making and governance. These review frameworks should both be considered for their contributions to important determinants of urban resilience/adaptive capacity.

There is therefore a wide range of potential determinants of adaptive capacity, from a diverse body of literatures. While there is some consensus in the most important determinants, there has been little empirical verification of the correlation between different principles or determinants and adaptive outcomes, particularly at local and regional scales (Engle 2011). This assessment, along with the formation of indicators, requires further research therefore.

In summary, adaptive capacity represents the social components of individuals' resilience. Bridging both vulnerability and resilience approaches, it is a powerful means of assessment that has the benefits of being a positive attribute that is translatable to practitioners too. A number of determinants of adaptive capacity have been proposed in the literature, including a growing focus on subjective or socio-cognitive factors. However these determinants still require empirical testing, especially in urban settings.

2.6 Understanding Resilience in Poor Urban Areas

In this chapter I have reviewed the literature on urbanisation, resilience, urban ecosystem services and adaptive capacity. In this next section the most relevant contributions from these concepts are considered, and opportunities for furthering our understanding of urban resilience, especially in poor urban areas, are identified. From these knowledge gaps, a set of research questions is proposed as a basis for the research.

The review of urbanisation revealed the rapid pace of growth in the number of people living in urban areas, which is primarily occurring in the developing world, including Africa (Montgomery 2008; Angel et al. 2011). Due to a number of factors but in large part due to the rapid pace growth in the number of people outstripping housing and service provision, slums and informal settlements are growing at approximately the same rate as the urban areas. Slums are often highly vulnerable areas to live, both in terms of their exposure to hazards, and their inherent socio-economic and political vulnerability. Understanding how individuals living in these areas can best adapt and survive will be a useful contribution to knowledge.

The study of resilience has provided a concept to investigate uncertainty and change, the dynamics and multi-scale aspects of systems, as well as their linked social-ecological nature. Resilience has also become important recently in the urban policy discourse (Evans 2011). The concepts of exposure, sensitivity and adaptive capacity (Turner et al. 2003) help to understand the resilience of different systems, and how they might be assessed. Despite an initial bias in some literature towards ecological systems, the resilience of social systems has now been investigated, however rarely at the local level in urban systems. It will be necessary to carry out these assessments if our understanding of urban resilience and its nuances and heterogeneities is to increase.

Social resilience is contributed to by both social and ecological components. Ecosystem services is a useful framework for which to measure those ecological components. Understanding and definitions have improved in recent years (Fisher et al. 2009; Nahlik et al. 2012) such that rigorous classification systems can now be applied. However this has rarely been carried out in urban systems (TEEB 2011), if at all in poor urban areas such as slums. At a broad level, it is known that ecosystem services contribute to well-being (MEA 2005; TEEB 2010), however the link to resilience, especially urban resilience is far from empirically grounded as yet. Therefore, in order to build this understanding of urban resilience, the

following questions arise: How do ecosystem services contribute to resilience of individuals in poor urban areas? Do ecosystem services exist even in those degraded spaces? If so, what are the specific services that are valued locally?

Socially on the other hand, adaptive capacity provides a great starting point for measuring the social components of urban resilience. Adaptive capacity bridges vulnerability and resilience literatures (Engle 2011), and benefits from both approaches in different ways. In order to measure adaptive capacity, determinants need to be considered, and the possible range of determinants is wide-ranging. As well as structural factors, and more objective determinants such as income, assets, or access to infrastructure, more recent literature has highlighted the importance of more subjective factors, agency or socio-cognitive determinants. Again there has been little empirical work on the determinants of adaptive capacity in poor urban areas, so the following types of questions arise: What are the most important determinants of adaptive capacity? Can subjective factors be measured alongside more objective indicators of adaptive capacity?

Finally, both ecosystem services and adaptive capacity literatures have revealed that there are often significant differences in the degree or availability of these components of resilience within the one geographical area being investigated (Daw et al. 2011; Chatterjee 2010). It will be highly important to pay attention to these 'heterogeneities' for the sake of equity considerations too (Ernstson 2008), as well as the fact that trade-offs may emerge between service users, or different groups of people (Rodríguez et al. 2006; Nelson & Anderies 2009). This means that it will be important to simultaneously ask questions regarding the heterogeneity of urban resilience: Who benefits from local ecosystem services? Are there differences in adaptive capacities within a slum area? What are the key determinants that differ? And finally, given the dynamic nature of urban resilience, how do these components change with time?

In order to address the research opportunities identified, the following three research questions are considered in this thesis:

Question 1: What is the level of ecosystem service use in poor urban areas and how does that change across a city?

Question 2: For residents of poor urban areas, what are the most important aspects of adaptive capacity?

Question 3: How do adaptive capacities and social networks differ across poor urban areas and with time?

Chapter 3: Research Design and Methods

3.1 Introduction

Chapter 2 reviewed the literature around understanding the resilience of poor urban areas. From this, three research questions were formalised broadly pertaining to ecosystem service use, adaptive capacity, and heterogeneities in space and time. This chapter introduces the research approach and design of the study, and the methods used in order to obtain the data to answer these three questions.

3.2 Research Approach

Given the nature of the overarching research question and the focus on both social and ecological aspects of resilience, an interdisciplinary research approach is taken for this thesis. The frameworks and methods that are drawn upon for the study come from natural science disciplines such as ecology and geography (especially investigation into ecosystem services), as well as social science disciplines such as development sciences, psychology, and sociology (especially adaptive capacity investigations). Therefore, the study takes a necessarily mixed research approach (Robson 2002; Brewer 2006; Bryman 2012). The primary research paradigm under which I study is positivist, consistent with natural science disciplines and about building and testing theories (Corbetta 2003; Bryman 2012). The researcher (myself) is also seen as detached from the phenomena observed. Most of the methods come from a positivist approach such as the quantitative analysis of questionnaire data (described below), however some of the qualitative methods drawn from the social sciences such as pre-study interviews and observation are more along the lines of interpretivism (Bryman 2012). This latter paradigm assumes more of a connection between the researcher and the researched, which was the case in in-depth discussions with local slum residents for example (Corbetta 2003).

From an interdisciplinary research approach, mixed qualitative and quantitative methods are employed in this study. Such a mix of qualitative and quantitative methods is a legitimate approach in social research (Robson 2002; Brewer 2006; Bryman 2012) and especially useful for research into issues at the human/environment interface. Quantitative methods assume that the world can be objectively measured and social scientists reveal the nature of that world by examining the relations between elements. The bulk of the data collection was like this, such as the adaptive capacity assessment. However in order to incorporate a more interpretive and inductive ontological viewpoint, that human actors and the social world are more interdependent and shaped by external situations, requires more qualitative methodologies. When used, qualitative techniques are applied in a more positivist way, to offer explanations of understanding the system's behaviour (Corbetta 2003; Miles & Huberman 1994).

The research approach of the thesis is both deductive, and in some ways inductive. It is deductive, or 'top-down', in that research questions are framed from *a priori* viewpoints of the issues and then the study involved answering those research questions and applying previous theory. The main section of fieldwork was deductive but there was also an inductive approach to the first phase of fieldwork, which involved exploration of study areas, transect walks, open interviews and observation of the areas and communities. This was more 'bottom-up' in that the information gathered during this phase of open investigation informed the latter parts of the study. By combining a bottom-up (inductive) and top-down (deductive) approach, the study is context-sensitive but also speaks to wider urbanisation and urban resilience questions (Bryman 2012).

The study uses multiple methods, which combine to give strong explanatory power as a part of case study research. The multiple methods allow the examination of different aspects of resilience, from the ecological to social, as well as specific aspects such as social network analysis. The other benefit is that this approach allows triangulation of data to verify findings, which is

employed in some of the analysis particularly in comparison of population groups' adaptive capacity in Chapter 6.

The ideal approach for an investigation of resilience would be to study at multiple scales, preferably considering the scales both above and below the scale of primary research focus (Walker et al. 2004). However the principal focus of this study is at the individual level, and later discussions pick up considerations at higher scales. Adaptive capacity is a local characteristic (Yohe & Tol 2002), hence the fine-detailed analysis here. While many studies of livelihoods, for instance, focus on the household level, the scale of analysis here is the individual, as specific factors are analysed that differ from individual to individual (e.g. sex, age, duration of residence), and the study is interested in not just heads of households. Higher-level analyses are carried out by aggregating individual level data and using focus groups to tease out community perceptions and challenges.

It is also important to understand what is meant by certain terms when relating to different scales. The 'community resilience' literature actually often does not define "community" (e.g. Adger 2000; Cutter et al. 2008; Magis 2010). In this study, "community" is an entity that has geographic boundaries (Norris et al. 2008), and quite simply refers to the individuals that live and work therein. Communities are composed of built, natural, social and economic environments, although the primary description here is the collection of individuals that are more than the sum of the parts. The individual-level focus is self-explanatory, exploring the resilience of separate individuals who live in an area.

In summary, the research approach in this study has both interdisciplinary and mixed methods, incorporating both inductive and later deductive modes of enquiry and qualitative and quantitative methods. It is guided by the research questions and theoretical concepts introduced in Chapter 2, and in the following section the design of the research is explained, followed by the methods utilised in order to gather the necessary data.

3.3 Research Design

Based on the research approach described above, the study was designed in order to gather the detailed empirical data that was needed to answer the research questions. A singular case study design (Bryman 2012) was used to do this, with Kampala in Uganda as the chosen study city, based on certain criteria relating to urbanisation and research practicalities. A brief background to the country, especially its history of urbanisation is presented in this section, as well as the context for the growth of Kampala and the effects this has had on the city and surroundings. In the backdrop of this, the policy context for urban development in the city is then described. Finally the 'transect' design of study sites that was used is explained, with three slums at differing distances from the city centre. A brief background to each of the three slum areas is given.

3.3.1 Case Study Design

Detailed empirical research was needed to answer the questions on the ways in which residents of poor urban areas utilised ecosystem services, and the factors that influenced their adaptive capacity. Case studies are good for asking "how" and "why" questions, such as 'how do certain factors influence adaptive capacity?', or 'how do slum dwellers utilise ecosystem services?' (Robson 2002; Bryman 2012). Therefore a case study approach was taken, in order to gather the breadth and depth of data required for this research.

For an investigation into urban resilience in poor urban areas, it would have been interesting to compare multiple sites in different contexts or continents. Such a comparative approach would have revealed interesting insights into differences and similarities of urban resilience at the local level, however for the depth of empirical work required in this study a singular case design was chosen. The research required significant background investigation and setup of research contacts, relatively in-depth scoping and

pre-study to assess and choose the most appropriate research methods and study design, as well as piloting, refining and executing the rollout of hundreds of questionnaires as described below. Given this level of empirical work, a single case study was chosen.

3.3.2 Country Case Study Selection and Justification

The choice of study site was based on a number of factors. The primary consideration was for an urban area that was rapidly growing so as to capture what the important aspects of urban resilience are under these conditions of change; within this it was important that there were areas of urban poor given the research interest in the prolific number of slums in the developing world. Further, the study area required good research contacts in order to initiate the research, and considerations of safety were also taken into account. From this process, a long list of potential cities was drawn up that included Asian cities in India and Vietnam as well as African cities in Uganda and South Africa. A shortlist was then explored further, from which the city of Kampala in Uganda was chosen.

Uganda has a population with a growth rate of 3.3%, one of the fastest in the world (World Bank 2009). It is still in early stages of a demographic transition, having had death rates drop but without a drop in birth rates yet, and so has seen sharp population growth in the last twenty years. The country is still predominantly rural (less than 20% urban) but growth rates in urban areas are higher than in rural areas, which has meant the country has gone from having only 6.7% in urban areas in 1980 to 14.8% in 2010. Indeed, over the past thirty years, population growth rates in urban areas have been almost double what they have been in rural areas (Mukwaya et al. 2012). The classification of urban areas changed in 2002 to areas that are legally gazetted with town, municipal or city councils; at the time of writing there were 110 urban areas in the country. With such high rates of urbanisation, the country is a prime candidate for examining urbanisation and changes that this is causing.

One significant feature of Uganda is the primacy of Kampala as a city. Kampala is very much dominant as an urban centre, with 80% of the country's industrial and service sector firms located there, and it generates more than half of the country's GDP (Giddings 2009). This primacy may be declining as secondary cities are now growing more quickly than Kampala. The growth rate of Kampala is also very high, with figures ranging from 3.7% (UN-HABITAT 2009) to 5.6% (Vermeiren et al. 2012). Reasons for the growth of Kampala include population dynamics, industrialisation, rural-urban migration, and economic growth leading to labour shifts.

The country is also suitable with respect to studying poor urban areas, with high levels of poverty in urban areas. Uganda is making strong and regular progress at reducing poverty in both rural and urban areas, although high levels still remain (Mukwaya et al. 2012). Rural areas have relatively higher levels of poverty, however inequality is higher in urban zones. Urban areas of Uganda contain both households with very high levels of consumption and the very wealth working in dynamic areas of the economy, as well as large number of the very poor. In terms of food security as another indicator of poverty, the percentage of calorie-deficient households is higher in urban areas (Mukwaya et al. 2012).

These changes are causing a rural-urban transformation of the country too. As well as a shift in the population from 22.4% in 2002 to 29.3% in 2010 of people living in urban agglomerations (Mukwaya et al. 2012), there is a shift in the amount of wealth from the agricultural sector to the service sector. However this is not actually accompanied by a shift in employment out of agriculture, due to an inability of more modern sectors to provide adequate employment. This results in high levels of unemployment in urban areas, especially in the formal sector. Given the growth path of the country, sustainable urban development and management should be of high priority.

Uganda therefore fitted the decision criteria well, showing rapid population growth in recent decades, high rates of growth in urban areas where there are also high levels of inequality and poverty, and a rural-urban shift that is affecting the country as a whole. The city of Kampala was chosen as the focal city for the study, which is described in some more detail in the next section.

3.3.3 Case Study Description: Kampala City

Kampala, the capital city of Uganda, is located on the northern shores of Lake Victoria and covers 195 sq. km. of land. It is situated on 24 low flat-topped hills that are surrounded by wetland valleys (UN-HABITAT 2009). The city hosts 40% of the country's urban population, and 4.9% of the total population (Muinde 2013). The predicted population of the city for 2010 is 1.6 million (UN-HABITAT 2010) although the population of the city nearly doubles during the day when workers commute in to the city. The 2000 census showed that by night there were 1.2 million inhabitants, though by day 2.5 million (UN-HABITAT 2009). Of these, some 85% of inhabitants live in informal settlements or slums (UN-HABITAT 2010).

In short, the urban system in Uganda has primarily colonial origins. Prior to the British colonial rule, the only population concentrations that could be described as urban were the royal capitals of pre-colonial kingdoms. The economic imperative of colonial rule however meant that in the decades following the establishment of a British protectorate in 1894, new urban centres formed as centres of commerce and administration. With the need for new labour in these towns, the urban African population grew quickly. By 1962 there was 5 to 6% of the population in urban areas (Mukwaya et al. 2012).

However the recent growth of the city has been even more rapid. This has largely been influenced by rural to urban migration (Nyakaana et al. 2006), however recent evidence suggests that rural-urban migration has slowed during the most recent inter-censal period (Potts 2012). Potts (2009) points

out that in-migration is no longer rapid for certain African cities including Kampala. However the city is still growing at a rapid pace in terms of geographical area and population, and different slum areas are changing all the time (Nyakaana et al. 2006; UN-HABITAT 2010). This growth can be observed on the following map:

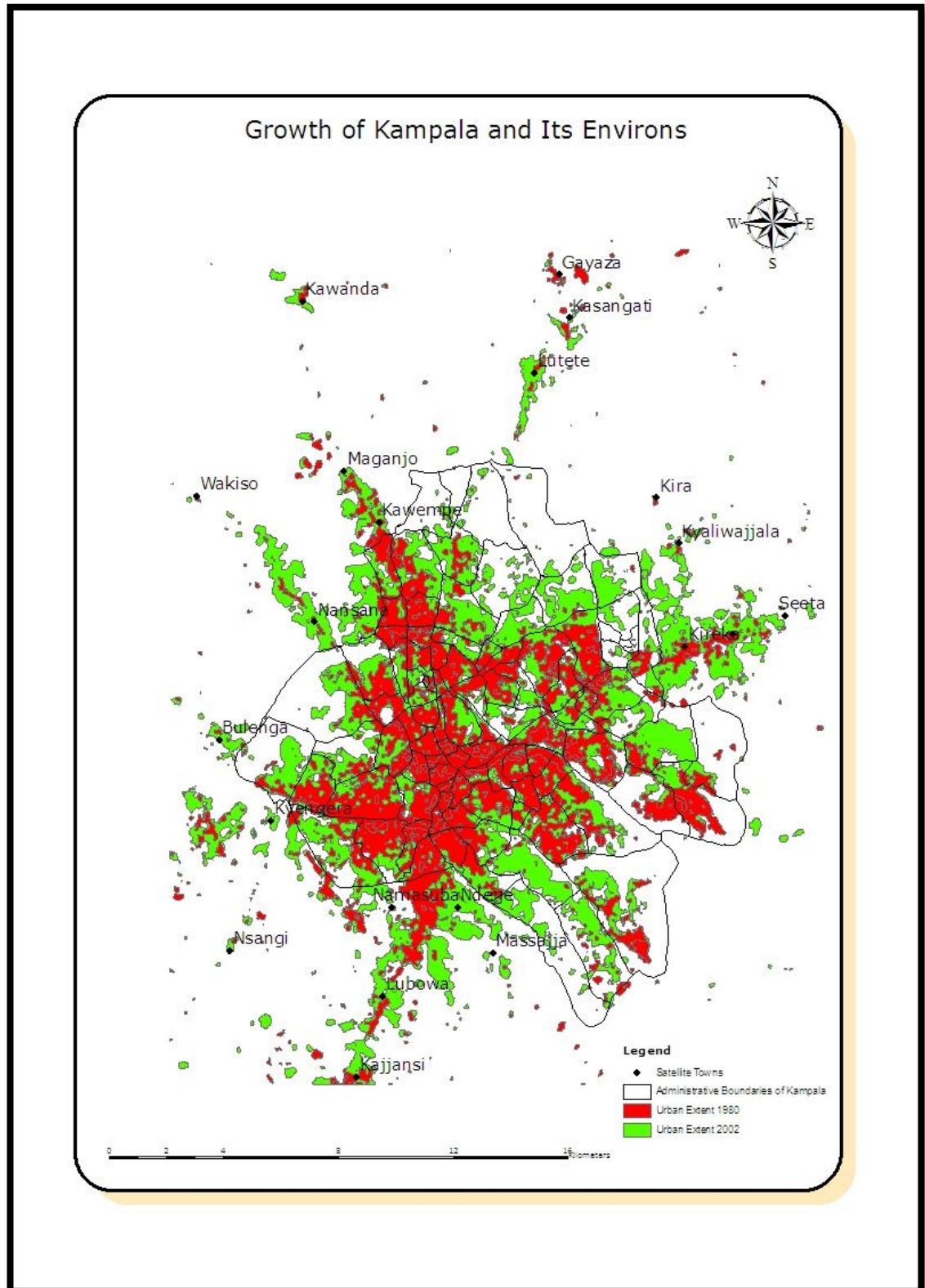


Figure 2: Map of growth of Kampala and its environs, between 1980 and 2002, from Nyakaana et al. (2006). Generated from satellite images. Presented with permission from one of the authors.

The growth of Kampala is characterised by sprawl into rural areas, engulfing former satellite towns. However this growth and expansion is associated with a lack of infrastructure provision and social services, as well as poor planning. One area of impact that results from this expansion is environmental degradation. Nyakaana and colleagues (2006) reviewed policy for the city in some depth as well as secondary data and remote sensing/GIS techniques, and found a notable amount of environmental degradation as a result of growth of the city. As a consequence, environmental challenges are putting pressure on the existing infrastructure, such that poor settlements especially cannot cope, and there is a deteriorating level of well-being amongst slum dwellers. Within the city, the space that was earmarked for open and green spaces is being allocated and developed over. Corruption, as well as a scarcity of prime land, mean that key open spaces and green belts are being allocated for development (Uganda Ministry of Local Government, 2010). Therefore the urbanisation process in Kampala has resulted in environmental degradation, and a reduction in green and open space within the city.

In addition to environmental degradation, increasing demands have led to a deficit of service provision in Kampala city. Due to the growth of the city as described, there has been an increased demand for employment, land for housing, social services and for infrastructure. Rising land prices and growing poverty have also meant a reduced ability for the population to access decent shelter (Mukiibi n.d.). Instead, most housing provision has come from unplanned and informal settlements (Vermeiren et al. 2012). With the dominance of informal housing, there is an extra pressure on existing infrastructure. This leads to inadequate sanitation and water supply, intermittent electricity, as well as over-burdened transportation. Employment opportunities are underfunded and with a slowly growing economy, many slum dwellers resort to coping strategies to survive that make some of the problems worse. In combination with failed implementation of urban structural plans, there are problems of accumulating solid waste, congestion, poor sanitation and wetland

degradation on the edge of the city. The result is a deplorable living environment for many of the urban poor, and with that an exacerbated vulnerability to shocks and stresses.

This inadequate service provision and growth of much informal housing has led to a large number of slum areas in the city (see Figure 3 below). Slums in the city are located in high-risk areas. Many of these are in the valleys of the city, meaning they are also prone to flooding (Lwasa 2010). Most wells or springs in slum areas are contaminated from the high water table and there is only safe water coverage to 55% of the city. The health and flood risks associated with this are exacerbated by the inadequate solid waste collection at only 55% coverage of the city. Build-up of solid waste prevents the escape of flood water, and the poor provision of toilets and latrines means that many of these overflow, further contributing to the contamination issues, resulting in severe health risks from infectious disease such as cholera, typhoid and dysentery (UN-HABITAT 2009). The map in Figure 3 shows the location of the main slums in the city of Kampala:

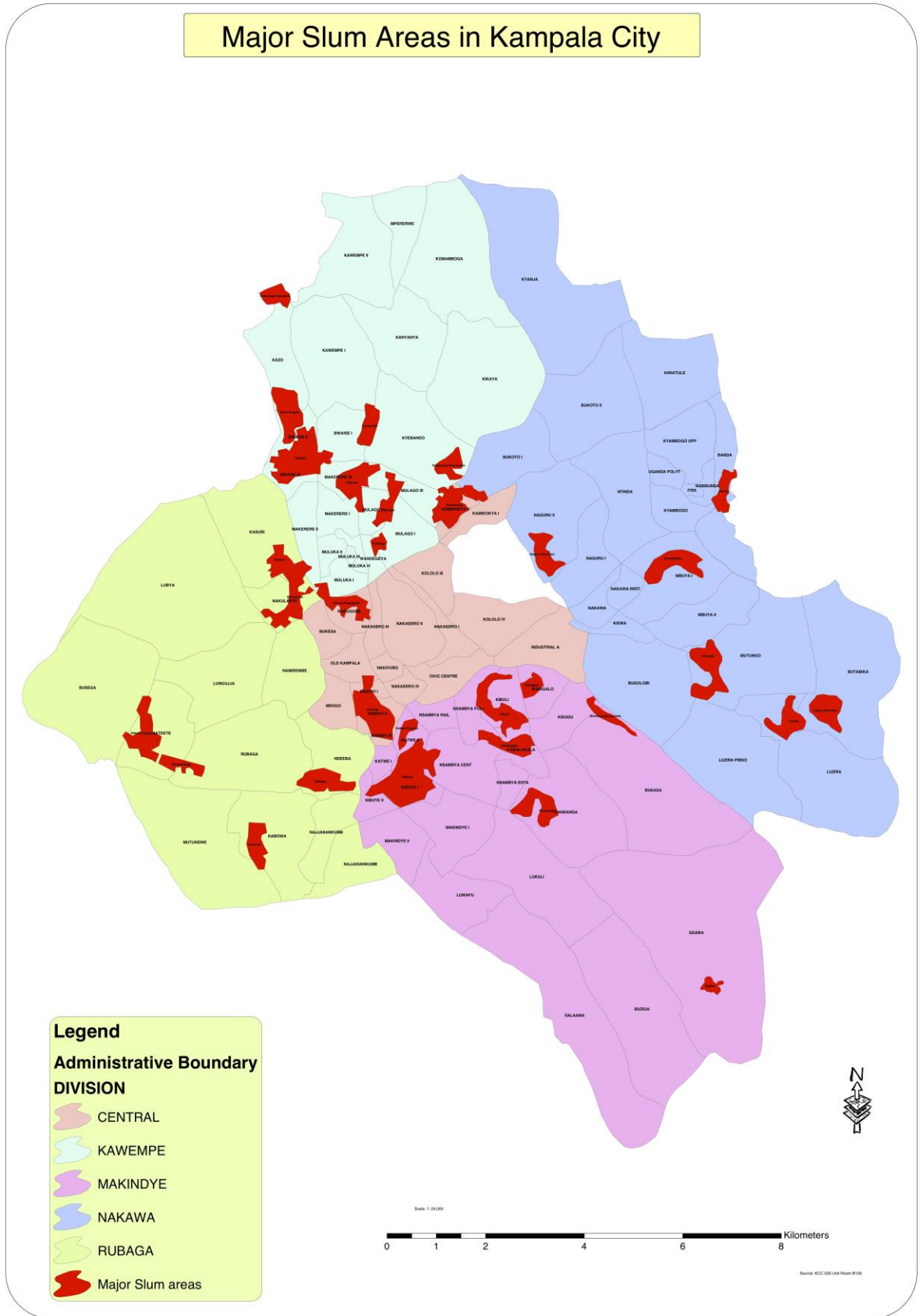


Figure 3: Map of major slum areas of Kampala city. Provided courtesy of (and with permission from) Kampala KCC GIS Department.

The slum areas in the city are also characterised by large numbers of migrants, from both other areas in Uganda, as well as international migrants. The 2002/3 Uganda National Household Survey found that half of Uganda's heads of household had migrated out of their location of birth, although this number reduced to 10% for those that had migrated within the last five years. Large numbers are moving to Kampala, mainly for economic motivations, meaning that just less than half are born in the city (Mukwaya et al. 2012). However on reaching the city, there are 25% not employed at all, the majority of whom are women without adequate skills to have gainful employment. In addition, in most slums there is widespread hunger, lack of food, poor income, gender inequalities and a lack of tenure for most (Slum Aid 2009). In fact, the tenure situation in Kampala is particularly difficult for many slum dwellers due to the characteristic of land holding where there is a separation of land ownership from the ownership of developments on the land (Muinde 2013). It has been argued that without any policy interventions, inhuman conditions will exist for the majority of the urban population in 2020 and 2030; millions will live in flood-prone areas by 2030; and without new roads, the majority of the city's population will have limited mobility meaning that participation in the formal economy will be difficult (Vermeiren et al. 2012).

The slum areas of Kampala are vulnerable to a large number of threats. As mentioned, one significant external environmental challenge is flooding, which is a threat to a number of slum areas including Kalerwe, Bwaise, Kawempe, Zana, Ndeeba and Kanyanya (some shown in Figure 3). In addition to their physical location, poor housing, inadequate water supply, sanitation and waste management systems all contribute towards high exposure to flooding (Lwasa 2010). Damage to wetlands reduces the ability of these areas to regulate runoff, increasing flood impact (amongst other contributing factors such as catchment area changes and developments in the city). These events hit poor urban settlements and destroy infrastructure including roads, culverts, drainage systems, houses and water

supply (Douglas et al. 2008). Furthermore observed flood events are increasing (Tenywa, MM et al. 2008), and are likely to continue to do so with climate change, which will also affect poor urban areas through increased heat stress given the low quality housing. There are not just major threats but minor threats that disrupt the daily life and well-being of individuals in these slum areas. These include vulnerability of livelihoods and loss of income, sickness due to health threats in the area, and loss of life of loved ones, which often affects livelihoods too.

In terms of resilience, there is a paucity of data profiling adaptive capacity in Kampala (Lwasa 2010). On a basic level, it is clear that communities have inequitable and inadequate access to basic infrastructure, which compounds any weaknesses in adaptive capacity. Poverty levels are up to 30% below the poverty line, and unemployment is up to 40% in some areas. With regard to adaptation interventions, there are a few exemplary projects, however these are yet to have been scaled up (Lwasa 2010).

Despite these significant urban challenges, the policy environment in the city comprises a slow process of initiating an urbanisation policy (UN-HABITAT 2009), failure of urban planning and guidance systems and laws, and continued organic growth of unplanned settlements in the city. A 'National Urban Forum' was established, with the aim of providing a platform for dialogue and participation amongst stakeholders to influence policy and legal reforms for sustainable urban development. However at the time of research this initiative appeared little more than a launch and vague presence online. However a strategy for 'Transforming Settlements of the Urban Poor in Uganda' (TSUPU) has been launched, targeting five secondary cities in Uganda with aims around: three development targets around slum dwellers engaging in securing their rights and honouring their responsibilities; improved access to municipal services; and inclusive urban development policies and strategies. This project is the outcome of Cities Alliance work partnering with AcTogether as the local partner organisation for 'Slum Dwellers International' (SDI).

While the National Urban Forum seems to have had little impact as yet, the Kampala City Council (KCC) have a 'Strategic Reform and Vision 2015'. This document states that the key bottlenecks to development for the city are: a high population concentration fuelled by rural-urban migration phenomenon; inadequate technical, institutional and human capacity to implement programmes effectively; the fact that the city is located on a hill drained by numerous streams and wetlands which present challenges in terms of planning, drainage and sanitation; and the fact that the majority of people stay or sleep outside the city and hence do not 'pay allegiance' to the city (KCC 2007).

Finally there are numerous local organisations working on slum development issues. Two important organisations that I worked with are noted here. Slum Dwellers International's local partner organisation, AcTogether, are working alongside the government on issues of necessary evictions, attempting to resettle and compensate where possible. In short, they are carrying out enumerations of the city's slums, as well as working to secure tenure, basic services, and information. The other local organisation that was contacted for this study was Slum Aid Project (SAP), who are working in many of the slum areas where fieldwork was carried out. SAP primarily work to facilitate slum development processes and build capacity for other organisations to emerge.

The information given in this section is to provide background information relevant to the challenges faced in Kampala city, for which urban resilience is required. In summary, like many other African cities, the city has experienced rapid growth that has outstripped the provision of services and housing, resulting in large slum growth. These areas face both environmental challenges including flooding, as well as very challenging living conditions. A number of policy ventures have been initiated, though it appears in Kampala much work is still yet to be done.

3.3.4 Transect and Selection of Study Sites

Within the city of Kampala, three separate study sites were chosen in order to get a fuller picture of resilience in different parts of the city (see locations in Figure 4). The research design involved choosing study sites along a 'transect' from city centre to periphery, in order to investigate differences along this gradient, and to make inferences regarding the temporal dimension of urbanisation occurring as cities grow outwards. Administrative areas of different slums were used along this transect, for ease of demarcation and implementation of the research (e.g. consultation with local leaders).

During the pre-study, a number of transects and slum areas were considered and explored, from the centre of the city northwards, westwards and roughly southwards. This involved trips to the slum areas accompanied by volunteers or staff from local slum organisations. After this, study areas were chosen on the basis of a transect that incorporated three quite distinct areas, that included slums that were still growing as well as 'older', and also considering fieldwork practicalities regarding transport to study sites. The three slums chosen were the parishes of Kisenyi II, Mulago II, and Bwaise II, which were from city centre to the northern edge of the city (shown by pinpoint locations in Figure 4). The three slums represented a slum right in the centre of the city where urbanisation and pressures for land are causing rapid, almost daily changes to the urban landscape (Kisenyi), a slum half-way out from the centre where there is still a little space but development continues apace (Mulago), and thirdly a slum area on the edge of the city where there are still areas of green space, a surrounding wetland, and which is on a key transport route of the city (Bwaise).

The locations of the three slum areas can be seen on the map of the city below, which shows markers for where interviews were carried out. While the 'middle' slum Mulago appears relatively far out, it was exactly half the public transport cost from city centre to the peripheral slum, which somewhat represents the distance in financial terms to the city centre.

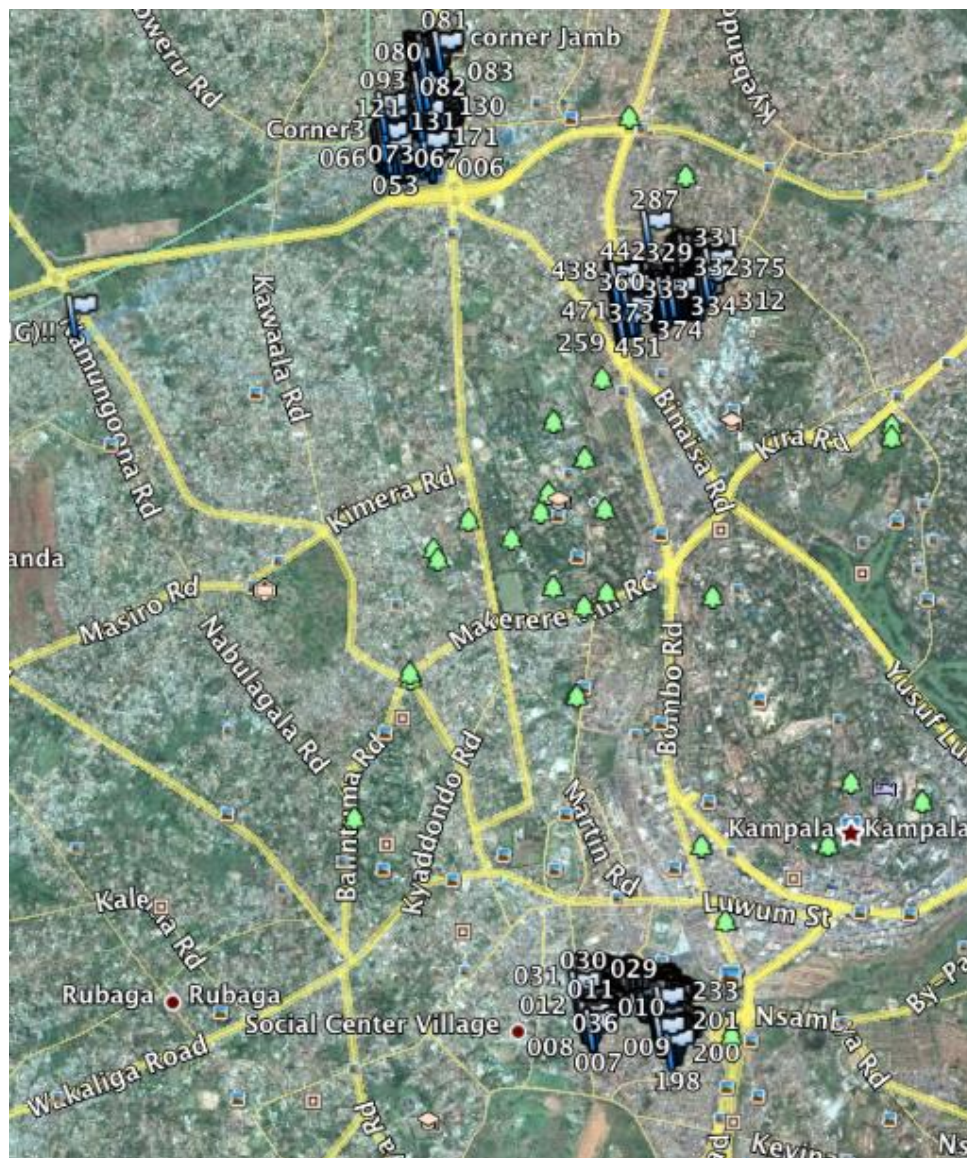


Figure 4: Map of part of Kampala city, showing the three slum study areas. Map taken from Google Earth (2013), with pinpoints (flags) showing questionnaire locations.

3.3.5 Description of Slum Study Areas

In general, there is a real dearth of detailed information on the slum areas in Kampala (Dobson et al. 2011). However the following information describing the three study areas comes mainly from a few reports put together by AcTogether, from recent enumerations work (Dobson et al. 2011; AcTogether 2011).

Kisenyi, the city-centre slum, is the largest slum in Kampala and one of the oldest too. It is amongst the key productive areas of downtown Kampala, even adjoining the Central Business District (CBD). Kisenyi is made up of three parishes Kisenyi I, II, and III; Kisenyi II was chosen for this study given that it is where significant residential zones are, and a range of different slum zones too. There are 5,390 households in Kisenyi II (at time of recent report). The history of the area is that during Amin's regime (1971-1979) there was a commitment to development projects in this central area, which meant that Kisenyi received a health centre, attracted more and more people to the area and saw a decade of development. The previous swamps disappeared and there was an influx of people who built dwellings, businesses and haphazard pathways through the area, without guidance. There were a variety of enterprises and a few water taps and sewer lines were put in.

The area generally represents vibrancy as well as tremendous hardship. There are now many small businesses in the area including vendors, metalworking, and tailors. There are some roads and public taps, however the majority still have no access to dumping grounds (76%) or private toilets (53%). There is some flooding in the lower-lying areas, and very poor sanitation overall. Security of tenure (or lack of) is a big problem in Kisenyi owing to the proximity to the CBD, high land values, and new development proposals. There are a large percentage of tenants (83%) and low rents for most dwellings: 50% pay between 10k and 50k Ugandan shillings (between £2.50 and £12.50 per month). Many of the workers in Kisenyi actually live elsewhere and commute in to work in the area. Three 'zones' (administrative areas within a slum) were chosen to sample from, which represented the whole area and included areas right down at the bottom of the slum by the market where there was a lot of economic activity, as well as areas further up the hill where it was primarily residential dwellings.

Mulago II was the 'middle' slum, on the way north out of the city but still firmly within the main area of Kampala. There is little specific background

information on Mulago. It is a slum area near the main hospital of the city and has a wide range of dwellings from good standard houses in doctors' residence areas, to very poor areas with very high (violent) crime rates. For the statistics relating to service provision, it is likely to be of a similar condition to Kisenyi, if with slightly higher levels of services overall. Most residents live and work in Mulago, although some commute in. There is less commercial activity than in the other two areas, although there is a central market area. One key factor is that Mulago II is on a hill and so flooding is less of a threat to slum dwellers. There are also more open areas and green space, for example a degraded football pitch on the slope leading down to the main road.

Bwaise II is on the periphery of the city, three miles north of the city centre, bordering the Northern Bypass. With a population of 90,000, Bwaise is one of the most densely populated areas of Kampala despite being on the periphery. Being on the city edge, there is a diverse mix of spaces, with some larger areas of clear space. But there are also some zones within the slum that are tightly packed and ridden with pollution, drainage problems, and high crime rates. There is also a distinct lack of services and housing is low quality.

Sitting on a wetland, Bwaise is badly affected by flooding for many months of each year when large areas are underwater for up to days at a time. Many houses have even sunk into the ground and/or been abandoned. There are serious solid waste issues, poor sanitation and lack of toilet provision. High groundwater even pushes excreta out of toilet pits, creating major health hazards. There is much public disposal of human waste and some people even let sewage wash out of latrines when it rains as they cannot afford the emptying. There are serious sanitation issues in Bwaise, with high levels of cholera, dysentery and typhoid. As well as these communicable diseases, the area is prone to malaria due to its marshy nature and there being many breeding sites for mosquitoes. Like Kisenyi, there are a large proportion of tenants (73%) and some housing is even cheaper than Kisenyi as it gets

flooded and is barely inhabitable for part of the year. There is also a mixture of residential and commercial activity in the area, with economic activities including boda boda riding (motorbike taxis) and selling of vegetables. Unlike Kisenyi, most residents work and reside in Bwaise. The area also has a large number of people who are unemployed, and many engaged in crime, prostitution and drug abuse.

3.3.6 Timing of Research Activities

Prior to any fieldwork, there was extensive background research and literature review, over the course of a year. The fieldwork for this research was then carried out in two phases. Phase I comprised pre-study scoping work and piloting of methods as described below, and was carried out between October and December 2010. From January to March 2011 there was a period of method development and organisation of further fieldwork research activities. Then Phase II comprised the bulk of the data capture, over 8 months between March and December 2011. Finally data entry and analysis was carried out throughout the year 2012, with the write-up of results in 2013.

3.4 Methods of Data Collection

3.4.1 Overview of Methods

Within this case study design of three slums along a transect of the city, methods were chosen in order to answer the three research questions outlined at the end of Chapter 2. In short, methods were required to obtain data from slum residents on the level of ecosystem service usage and demand, as well as their levels of adaptive capacity and determinants thereof. Given the importance of social networks as a determinant of adaptability, and the uniqueness of social relational data, a specific tool was used to capture social network data as well. The three main research questions were broken down into sub-questions (found at the start of results chapters, 4-6) so that the different aspects of each question could be

tackled (e.g. level of ESS use versus distribution, versus analysis of ESS user characteristics). Those questions were then used to identify data needs. In this 'reverse planning' way, the methods and specific questions were identified.

Questionnaires were the primary method to capture the bulk of the data used for the analysis in this thesis (Robson 2002), and 720 questionnaires were carried out in the three slums (roughly 240 in each). As well as general questions and investigation into ecosystem services, the questionnaire included specific data capture tools: an adaptive capacity statement ranking exercise, and an ego-network analysis (Marshall et al. 2008; Hanneman & Riddle 2005; both described in more detail in Section 3.4.4). Focus groups (Morgan 1996) were used to complement these quantitative data, especially with the comparative research questions in Chapter 6. The overall timeframe of method implementation involved qualitative/ethnographic work at both ends of the research too. At the front end, as part of a 'pre-study', qualitative data collection helped to select the right challenges to focus on, questions to ask, appropriate wording, as well as giving enough contextual understanding to investigate the issues sensitively. There was also a period of piloting and refining the questionnaire after this. The qualitative work at the tail end of the research then allowed greater interpretation of results and understanding of certain phenomena, such as the differences in adaptive capacity between groups. The following section describes each of these methods, as well as the sampling strategy for the implementation of the questionnaires, and the way in which the fieldwork was managed overall.

3.4.2 Pre-Study Qualitative Work

The aim of this exploratory phase of fieldwork was first to identify the most appropriate slum areas in the whole city as study sites and to get an overall picture of the layout of slums and their differences across the city. With the help of local NGO representatives, I explored a large number of the slum

areas in the city. Another aim of this pre-study work was to identify the most pertinent shocks and challenges in these areas, as well as any possible sources of ecosystem services that people were using. This then informed the ways in which resilience was investigated (e.g. general or specific resilience), as well as the ways in which ecosystem services were measured.

The other objective of this phase of research was to pilot various methods to test which might be most appropriate to gather the data required (Bryman 2012). Various methods were piloted including open interviews, Q-sorts, pile-sorting (Gollin et al. 2004), and ranking of statements. The ranking of statements method was chosen for use in Phase II, which involved presenting interviewees with statements capturing different aspects and determinants of adaptive capacity and asking whether they agreed or disagreed with them. Once this method was chosen, informal in-depth interviews were carried out to generate some of the statements needed for this method (described in more detail in Section 3.4.4.4 below). These deep interviews enquired about how slum residents responded in times of crisis, how they perceived local nature, what changes they observed in the area, and generally the ways and strategies through which they adapted to shocks. Those interviews were then transcribed for development of the statement ranking tool later. In addition to this work, I developed fieldwork contacts including local slum organisations and local leaders, arranged the necessary permits, and visited relevant local projects.

3.4.3 Piloting and Survey Development

On the basis of the pre-study research a questionnaire was drafted, designed to capture information on the ecosystem services that slum residents used, their adaptive capacity, social networks, as well as background information on their household, migration history, perceptions of the area, and relations with their 'village' (rural area they came from/is their home village of relatives). The details of the specific assessment tools are described later.

Questionnaires were written in English then translated with the help of a language tutor, as well as local field assistants who I met through a local NGO and Makerere University. During this time field assistants familiarised themselves with the questionnaire. It was then taken into the field to be tested. After each successive scoping trip into one of the slums, areas of improvement to the questionnaire were discussed with the field assistants, and it was amended accordingly. This ensured that questions were both relevant and understandable when translated into the predominant local language in Kampala, Uganda. During this time I also learned key phrases that were necessary for me as lead investigator to understand, as well as how to introduce the study in the local language, when meeting slum residents.

This phase also included training of field assistants, so that all were fully competent in implementing the research methods, as well as consistent across assistants. After initial training with the team I worked with in piloting the survey (in Kisenyi), I ran successive trainings in Mulago and Bwaise, where new field assistants joined and were also trained in part by previous assistants.

3.4.4 Questionnaires

Questionnaires were the primary method of data collection, and they included a combination of tools and quantitative as well as qualitative information collection. Given the individual-level focus mentioned earlier, the survey was administered at the individual level. This was to allow disaggregated analysis according to individual traits such as gender, age, or duration of residence. The administration of questionnaires was primarily in Luganda (local language) or other language if more appropriate (e.g. Swahili for some slum residents, by field assistant fluent in Swahili), as well as via translation by myself. I took notes during interviews, which were useful for later analysis and cross-referencing.

3.4.4.1 Sampling Design

The first sampling decision for the study of the three slum areas was the number of questionnaires to be carried out. A number of questionnaires was required so that statistically significant comparisons could be made between the three areas, in order to answer Research Question 3. A 'power analysis' was executed in order to work out the sample size required (Corbetta 2006; Bryman 2012). According to a 2002 census, the populations of Bwaise II, Mulago II, and Kisenyi II were roughly 17,000, 14,000, and 11,000 respectively. Using these figures therefore, and a 95% confidence level, a sample size of 240 would give a margin of error of just over 6% (Raosoft 2010). This was deemed acceptable and so the study aimed to sample 240 individuals in each of the three areas. This made up a total of 720 questionnaires that captured the bulk of the information for the study.

In terms of how those 240 were sampled from each slum area, first of all a number of zones were chosen from each. These are administrative 'sub-areas' of each slum, as recognised by local authorities and well known by the community. During the pre-study research I identified suitable zones in each slum, to give a cross-section of the area as a whole. Then within these zones I carried out a stratified random sample of the population. The sampling strategy was to start at each of the four corners of the zone (again usually easily identifiable by roads junctions, water channels etc) and walk in towards the centre, attempting to survey every 5 households. The GPS points of some of the respondents are shown in Figure 5 and 6, and the rough pattern of moving from corners of zones towards the centre can be observed also. Of course this was not always carried out accurately due to the irregular pattern of slums and practicalities of speaking to people who were available. Prior to starting any research, permission was requested through the Local Commission (LC) of the area, showing them the National Research Permit I had been granted, and complying with any specific requests that they had.

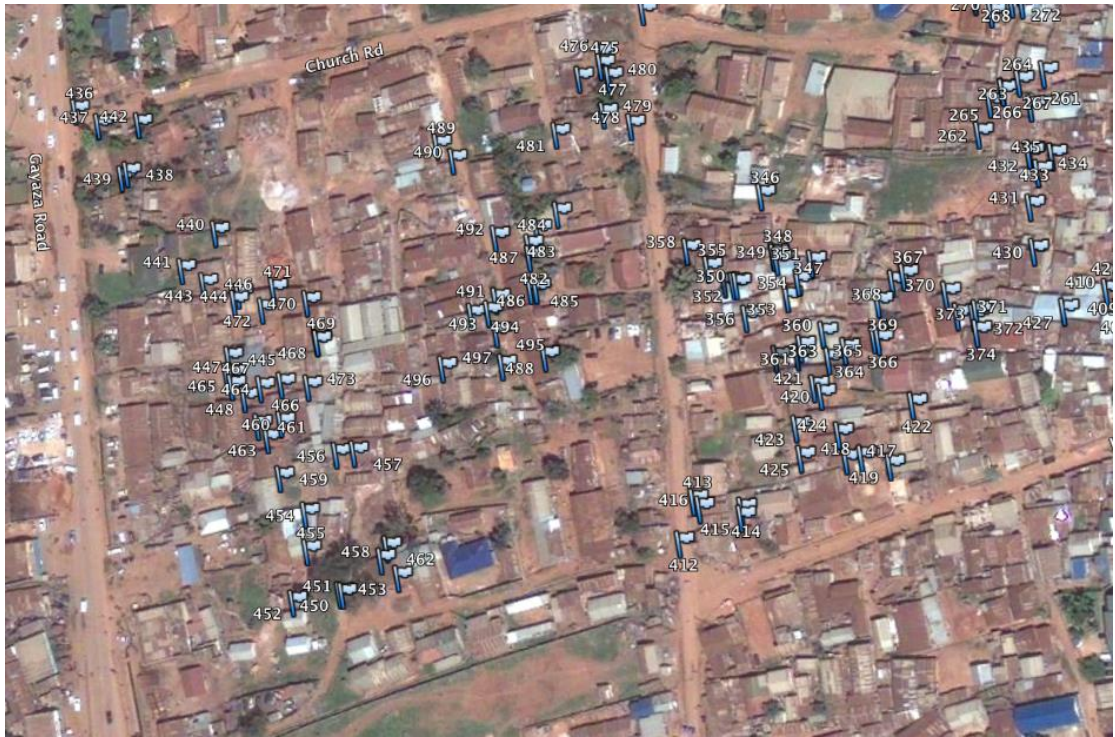


Figure 5: Google Earth image of two zones sampled in Mulago II. Pinpoints show questionnaire locations, and layout of sampling strategy.



Figure 6: Google Earth image of another zone that was sampled in Mulago II, showing locations of questionnaires (respondents).

3.4.4.2 Content of Questionnaire

The questionnaire included questions to obtain data that would allow all of the main research questions of the thesis to be answered. The questionnaire as used in the field can be seen in Appendix 1. It comprises an initial background section that includes questions that allow consideration of income, house type and household information. Next is the section on ecosystem services that is described in more detail in the following section. The third section contains questions on shocks and challenges that the respondent has faced, as a precursor to asking about the ways in which they responded and the adaptive capacity assessment as explained in more detail in Section 3.4.4.4. An 'ego-network analysis' followed this (Hanneman & Riddle 2005, Ch 9), which also related to the challenges mentioned in the previous section, and gathered more detailed information on individuals' social support networks for the research sub-questions in Chapter 5. Finally the respondent was asked some more general questions around remittances, wealth and education (for possible analysis that is not included in the scope of this thesis) as well as their general feelings for the area. The general livelihood and background questions (first and last sections) were informed from a number of other questionnaires including other surveys carried out locally by AcTogether, by Uganda National Bureau of Statistics surveys (UBOS 2009), and by World Bank Living Standard Surveys (World Bank 2012); the ecosystem service questions were derived personally after pre-study work (see below); the third section on impacts and responses I developed using the model of Marshall and colleagues (2008); and the social network section was adapted from common social network questions as in Halgin and Borgatti (2012), and DeJordy and Halgin (2009).

3.4.4.3 Ecosystem Service Measurement

The assessment of ecosystem services (ESS) measured *demand for* and usage of local ESS, as opposed to the availability of all ESS, or the function of certain services such as regulating services. This was because I was interested in the preference for, and level of usage of those services. Assessment of regulating services for instance would require secondary

data or in-depth study of individual services using detailed local measurements or models (Nowak et al. 2009; Sanchirico & Mumby 2009). Instead closed questions were used to investigate the usage of provisioning services, while an open-ended question was used to tease out the demand for all other types of services and benefits, for example cultural values etc.

Having ascertained the most relevant services in the pre-study, the following ecological benefits were enquired about in the closed questions: food source, amount of food grown, livestock kept or sold, sources of water for bathing and drinking, and sources of fuel for cooking and lighting. The exact questions can be found in the second section of the questionnaire in Appendix 1.

The open question was carefully phrased after multiple efforts to translate a phrase that represented ecosystem services, 'nature' or 'anything natural in the area'. The aim was to tease out any ecological benefits (e.g. from regulating or cultural services) that residents appreciated or utilised in the area, to later code and analyse these. The focus groups described in Section 3.4.5 were also used for this purpose. The goal was therefore to cover all potential ESS benefits to the slum residents, some specific ones in detail (closed questions) but also covering other services and benefits too (open questions and focus groups). The methods were designed to measure this full range of ecosystem services that residents were demanding, or utilising. Given the lack of guidance from state-of-the-art studies or manuals for measuring ecosystem services in these contexts (Burgess et al. 2011; TEEB 2010), the methods are suitably ad hoc, whilst at the same time fit for purpose.

3.4.4.4 Adaptive Capacity Assessment

The assessment of adaptive capacity was carried out by presenting respondents with statements that they were asked to either agree or disagree with. These statements represented various strategies and determinants of adaptive capacity. The assessment covered a range of

shocks and stresses, and focused on 'everyday resilience' as opposed to specific shocks like climatic events. However respondents were asked about the most significant challenges that they had faced recently in their life. In this way, the assessment addressed the kind of challenges that would require capacity in the future too, whilst focusing on major events would capture capacities for responding to smaller stresses too.

The assessment included a wide range of adaptive capacity determinants, from the literature review in Chapter 2 in combination with insight on the importance of certain factors from pre-study fieldwork. Marshall and colleagues' (2007) methodology inspired this method, with personal help from the first author. As per that research, determinants of adaptive capacity were split into 'social sensitivities' and 'capacities'. Capacities refer to the abilities each individual has at their disposal to respond to shocks and take advantage of the opportunities, while sensitivities refers to the characteristics of how that individual relates to their surroundings – their place, community, and their employment. This latter concept is important because it determines to what extent the individual is affected by the shock. In addition, 'adaptive strategies' were investigated, which are the actual actions that individuals carry out in response to a shock/times of crisis. A "crisis" here refers to a significant event that the respondent has referred to that has challenged or disrupted their livelihoods, such as loss of income, sickness, or flooding. Overall, an attempt was made to cover a breadth of factors that might influence adaptive capacity, whilst taking into account some practical considerations of interview length.

The way this was actually carried out was as follows. Respondents were asked in the section prior to the adaptive capacity assessment to consider the most significant challenges that they had faced in the last year. Considering these events and challenges, respondents were then asked how they actually responded to them. Statements were orally presented, and respondents asked if they strongly disagree, disagree, agree, or strongly agree with each statement (marked on a 1-4 Likert scale). Using this scale is

especially useful to quantify and compare attitudes as results can be standardised and contrasted. The statements covered the three areas as mentioned: strategies, capacities, and sensitivities, and were in part derived from the pre-study open interviews mentioned above. The first section of strategies was consistently introduced by prompting about challenges that occurred “this last year” so that respondents were reporting on events and strategies actually employed, rather than hypothetical responses which are much less reliable.

The three sub-sections of factors (Sections I-III) are shown below, as well as the way in which the sections were introduced:

Section I: Adaptive Strategies

“Please think about the way that you dealt with those problems over this last year.”

- i) Adaptive mobility (moving in times of crisis)
- ii) Getting help
- iii) Self-efficacy (ability to deal with problems as individuals)
- iv) Learning from others

Section II: Adaptive Capacities

“Please now think about your current and future situation and how much you agree with these statements.”

- i) Feelings of control
- ii) Belief in change locally
- iii) Readiness to leave
- iv) Innovation
- v) Job flexibility
- vi) Options to change
- vii) Planning & reorganisation

Section III: Social Sensitivities

“These questions are now about you and your local area.”

- i) Appreciation of environment
- ii) Attachment to place
- iii) Feelings for village
- iv) Attachment to occupation
- v) Networks strength
- vi) Networks width
- vii) Employability

Each determinant shown here was represented by a number of statements so that they could be triangulated. The statements were sorted as part of the analysis described in Section 3.5.1 below. The statements were randomised and negative statements were also used to help validate each concept (with scores later inverted to correspond with others). The way in which the scores from each individual, reflecting agreement or disagreement with the statements (i.e. 1-4), is described in Section 3.5.1 below.

3.4.4.5 Social Network Analysis

In order to find out some more detailed information about the social support that individuals received and the types of social networks that enabled this, a form of social network analysis was carried out. Social network analysis is a tool that can be used to measure a wide range of network types, where the ‘nodes’ may differ from organisations to individuals to countries (Hanneman & Riddle 2005). The tool enables an analysis of both the structure and composition of those networks. There has been a growing amount of network research in the physical and social sciences, in order to explain social phenomena in disciplines including sociology, psychology, and economics (Borgatti et al. 2009). A full social network analysis requires surveying 80 to 90% of the population (Hanneman & Riddle 2005), which for this study was not possible given the proportion of the slum residents who were available to participate in the questionnaire at any one time. Therefore an “ego-centred network

approach” was taken, which analyses the network connections of separate independent individuals within a sample of the population (as per the research design in this study; DeJordy & Halgin 2008). This approach is drawn from social network research (Wasserman & Faust 1994) and is also known as a ‘personal network research design’ (Halgin & Borgatti 2012). An ego-network is defined as one actor’s set of connections with others (Wellman 2007).

In the context of this study therefore, an ego-network consisted of the group of people who helped out an individual in times of crisis (corresponding to the adaptive capacity assessment above). Information was gathered from each respondent (or in social network terminology, “ego”) about their social support network, i.e. those individuals who helped them in times of crisis. The respondent was first asked about those specific times of crisis or challenge that they had mentioned in the previous section (not naming of course if inappropriate). By referring to the same shocks, this section is thus comparable with the adaptive capacity analysis. Respondents were asked how many people (“alters”) helped them during that time, and those names were written down (a ‘name generator’). Only first names or initials were used for anonymity. Then ‘name interpreter’ questions were asked, about the ego’s perceptions of attributes of each of those alters. This included how much help was given by the alter, what type of help, how long the ego knew them for, what their relationship to the alter was, whether they were from the same place of origin or not, where the alter stayed, and what job the alter did. Finally, to investigate the relationships between an ego’s helpers, in other words alter-alter relations (the links in the network), the ego was asked whether each alter knew the others, either not at all, as ‘just friends’, or closely. While this process potentially provided a lot of data, the number of alters was often low; there was a maximum of ten alters to be included and this was rarely reached. The datasheet also allowed the questions to be answered quickly. The datasheet can be seen as part of the questionnaire in Appendix 1 in Section 4 of the questionnaire. The way in which these data were analysed and used is explained in Section 3.5.1.

This was the last major tool of data capture in the questionnaire. Other straightforward, background questions were included at the start and the end of the questionnaire and can be viewed in the Appendix. Once all the questionnaires had been carried out, the fieldwork moved on to capture some of the richer qualitative data using focus groups.

3.4.5 Focus Groups

Focus groups were carried out right towards the end of Phase II of fieldwork, so that they were informed by previous empirical research and used to add qualitative information to certain aspects of enquiry. The topics that were covered during the focus groups included anything natural the participants enjoyed in the area, details of how they responded to problems and the sense of community and social cohesion in their area/migrant group, their reasons for moving to the area and the problems and opportunities there, and further details relating to their specific demographic.

The sampling for the focus groups was strategic, based on preliminary results and empirical observations. I attempted to focus on a range of migrant groups for some of the investigations comparing groups in Chapter 6, a range of age groups from young men to older women, as well as a range of relative wealth, and cover all three slum areas. The groups included: Somalis migrants, Karamajong migrants, local residents in one of the poorest areas, young men in Mulago, young women in Bwaise, and older women in Kinseyi. Through this 'segmentation' process, it builds a comparative dimension to the focus group design, and facilitates discussions as participants are more similar to each other (Morgan 1996). The focus groups were standardised to some extent so that they could be compared. However given the open-ended and discursive format of them, they were also emergent to some extent in that topics would vary given the interest and relevance to each particular group. As such, topics were suggested but

not 'forced' and while led, discussions also followed the flow of each group's debate.

Practically, each focus group involved a group of 8 to 12 individuals who were selected by key informants or contacts in the area, who by this stage I knew I could trust. Ideally, each group was carried out with the help of three assistants, one to translate and lead the discussion, another to make notes, and the third to note body language and more general occurrences during the discussion. However if lack of space, or individuals feeling shy hampered some of the discussions, we would run focus groups with less assistants. Focus groups were recorded using digital Dictaphones with the permission of the group, usually using two per focus group for reliability and in order to capture some conversations of larger groups. The recordings were then transcribed by a Ugandan, a resident of one of the slums in the city. She had previously worked for a PhD colleague and worked to an excellent standard. This was confirmed through field assistants who were present checking the transcriptions, and parts of the discussion that I could understand.

3.4.6 Fieldwork Management

Phase I of the research was carried out with the help of a large number of different contacts, as I scoped different slums and areas of the city. Phase II however was mostly carried out with a team of three Ugandan field assistants, although these changed in some of the study areas. My research assistants were three graduates from Makerere University, an older ex-local leader in Kisenyi, and two young men who worked with one of the local slum NGOs. The older lady helped start off the fieldwork in Kisenyi where most of the piloting took place. After that, two trained field assistants continued with me for the duration of the research, and two others joined when we moved to Mulago II. In this way, a good team bond developed and we worked well together. The field assistants were invaluable for the local language and being residents of Kisenyi and Mulago slum areas themselves, had in-depth knowledge of the local areas, which made planning and

implementing fieldwork safely so much easier. As well as carrying out training in research methods, my field assistants benefited from future contacts with other international researchers and academics in the university, so there was a useful two-way partnership.

Before starting the questionnaire fieldwork, I had been resident in the city for a total of five months, living in a poor urban neighbourhood in the near vicinity of my study areas (particularly close to Bwaise). During this time I had socialised and worked closely with the local NGO that I was staying with, and had travelled extensively around the city. As mentioned, I had also taken many visits with staff of the local organisation I stayed with, or other slum organisations to visit particular slum areas or projects. Hence by the start of my research I had a good understanding of the dynamics of the slums I was working in, and the dangers therein. I also spent a month in Kisenyi piloting and scoping the whole area and the different zones of the slum, so I knew it well by the time the interviews started properly. Thus I was able to work effectively and move with purpose when I was there. During this period I would also take time to interact and relax in the area, which helped to become acclimatised and to build trust with local residents.

As a team we also always ate locally in a central food area of each slum, so became known in the area that way too. Whenever I moved to a new slum area I would spend at least a week or two liaising with the local authorities and scoping the area. Only in two particularly dangerous zones of Bwaise II did I have to have security (a young representative of the LC who was very alert to the dangers of the area), under the recommendation of the Local Councillor. On the whole however, Ugandan slum areas are fortunate in being safer than most other African slum areas, and no serious problems were encountered although, of course, I never remained in the slum areas after dark.

During the course of the fieldwork I also kept field notes, a journal of weekly activities, and extra notes from particular interviews or study sites. This helped in later interpretation of some of the data.

In terms of ethics, the research was carried out under the stringent guidelines and review of the University of East Anglia's International Development Research Ethics Committee. For data collection methods such as interviews and focus groups, I followed the direction of good practice (Smith 1995; Bryman 2012). The aims and benefits of the findings were clearly communicated at the start of all questionnaires. Consent was asked from each respondent before the questionnaire started, and due to the use of local field assistants and clear explanation of the study in Luganda, there were very few questionnaires declined. The questionnaires were anonymised by writing the full names of respondents for consent in a separate notepad and were kept separate/out of the main analysis documents. Individuals were randomly selected within the slums, and not obliged to answer the questions in any way. A research permit was granted from Uganda National Council of Science and Technology, through whom ethical permission was also applied. Finally an attempt was made to report the findings of the study back to the local area. In November 2012 I made a return visit and arranged a workshop in partnership with other Makerere researchers and lecturers, also inviting local NGO workers that I had partnered with. The turnout was not high but the workshop did provide an opportunity to share my research with local slum NGO staff, as well as to receive comments and check the validity of my findings with their local knowledge.

3.5 Data Analyses

3.5.1 Quantitative Analysis of Questionnaire Information

The methods described above yielded quantitative data on 720 slum dwellers, roughly 240 from each area. It generated information on individuals' use of ecosystem services, scores for various adaptive capacity

factors, and detailed information on each of their personal networks of social support. In each results chapter, a summary is given for how the data was handled in order to answer the research questions. This section describes the initial analysis of the data in order that those analyses could be carried out.

3.5.1.1 Ecosystem Service Data

All of the data first had to be checked for reliability and 'cleaned', given some errors in recording the data. The data were entered from paper questionnaire sheets into Microsoft Excel® (2008 for Mac). Much of the data were then coded for analysis, for example assigning numerical categories to the amount of food grown, or standardising the duration of residence. With regard to data on the demand for ecosystem services in particular, there were two main data sources: quantitative data from each individual on the amount of food grown, livestock kept, or categorical data on water or fuel sources; and second the answers to the open question about anything natural that they enjoyed in the area. These open responses were turned into categorical data by forming a number of categories and assigning each response into one of these. In general many of the responses were the same so this was not a complicated process. More detail on this process and the categorisation used is given in Chapter 4, Section 4.2. Both types of data for the use of ESS could then be assessed overall, in terms of percentages and totals by area. The way in which these data was specifically used is explained in Chapter 4.

3.5.1.2 Analysis of Adaptive Capacity Assessment

From the results of the adaptive capacity assessment, statements had to be sorted and checked for validity, i.e. that they were measuring the representative determinant. As already mentioned, multiple statements were used for each factor, some of which were negative, and all were randomised.

Initially, statements were a priori grouped into categories or factors as per the list above (Section 3.4.4.4). However it was necessary to check whether the statements were measuring the same dimension or determinant of adaptive capacity. Naturally, some statements were interpreted more clearly than others. The first stage of filtering and regrouping the statements was based on observations of their success in the field (e.g. statements making sense to respondents). After this first regrouping, scores for the statements were transported into SPSS® (Version 19.0) for further analysis. The statements were checked for internal reliability using Cronbach's Alpha test (non-standardised scores so not assuming equal variances). This tests whether statements are measuring the same dimension and can therefore be used together in a composite score. An alpha score of 0.7 is deemed internally reliable (Nunnally, 1968; from Marshall et al., 2007). The second filtering and regrouping used this statistic. Groups were refined until they either contained a reasonably reliable group of statements, or one appropriate statement was chosen to represent that component of adaptive capacity.

Following the second filtering of statements a factor analysis was used to generate composite scores for sub-sections (determinants). Some determinants were now represented by single statements. The statements were weighted using a regression test with pairwise deletions (DiStefano et al. 2009). Prior to the Cronbach analysis, a Kaiser-Meyer-Olkin (KMO) test for sampling adequacy, and Bartlett's test of sphericity, were used to test the appropriateness of using the tool (values of 0.6 and $p < 0.05$ are suggested to represent valid responses). The final list of statements, with Cronbach alpha scores, can be found in Appendix 2.

This process of testing for reliability and regrouping led to each determinant of adaptive capacity in the list in Section 3.4.4.4 having a composite score (or score for a single statement) for each individual in the survey. From these data, analyses could be carried out on the determinants. For instance in Chapter 5, multiple correlations were carried out to test relationships

between determinants and strategies. Bonferroni corrections were applied given the large number of potential hypotheses, using the formula $\beta = \alpha / \eta$, where α is the original alpha score (5% significance level), n is the number of hypotheses, and β is the new p-value that is used to test significance. This offsets the chance of false rejection of the null hypothesis.

It should be acknowledged that the correlations may imply strong relationships, but cannot infer causation. The tests here were carried out under the assumption that Likert scales can be treated as normally distributed. This is a contended issue within statistics, but it was decided that as there was variability across the scales and the statements that were used had relatively good distribution across each score, the assumption held. Normality was checked visually using histograms and descriptive statistics for each of the variables. These methods follow the protocol of Marshall (2008). The validity of interpretations was also tested using other data such as additional survey information, focus group transcripts, and in-depth interviews.

3.5.1.3 Analysis of Ego-Network Analysis

All of the ego-network data as described in Section 3.4.4.5 were recorded on the datasheet at the end of the questionnaire in Appendix 1. The information was entered using 'Egonet' software (Egonet 2012), which worked effectively and quickly as the tool was designed specifically for datasets like this. Egonet was then used to generate an output that had variables for each respondent (or 'Ego ID'). These were matched with the adaptive capacity statement data in SPSS, and analyses could be carried out using the social network data.

3.5.2 Analysis of Focus Group Information

As focus group information were not a central part of the analysis for any of the research questions, these data were only used in a supplementary way (as opposed to as a separate analysis). The focus groups were recorded and

transcribed. Those transcripts were then scoured for opinions and viewpoints on certain key points of interest. For example, in order to understand why slum residents viewed urban ecology the way they did, those aspects of the discussions were grouped together and analysed. In a similar way, discussions from across the focus groups on adaptive strategies, or social cohesion in different areas were grouped together and analysed. As in the analysis of ecosystem services in Chapter 4, Section 4.3.1.3, some of these comments and discussions were then used as part of the analyses. In this way, the focus groups were used to triangulate the questionnaire data analysis, and to gain deeper insight on certain particular questions.

The combination of these quantitative analyses (of ESS data, adaptive capacity statements, and ego-network data), as well as the qualitative focus group information is combined and utilised in the following results chapters, Chapters 4, 5, and 6.

3.5.3 Robustness of Findings

The way in which data were captured and analysed is presented in the sections above. However it is also important to consider the validity and robustness of these data, on which the study's conclusions are being made. In terms of the research approach overall, one limitation of applying a multi-method approach is that each method should be considered for the different biases and uncertainties that might occur (Brewer & Hunter 2005). This is done for each method briefly now.

With regard to the questionnaire, it employed a broad scope of methods that have been previously tried and tested (e.g. the adaptive capacity assessment in Marshall 2007, 2010 and the ego-network analysis in Berrou & Combarous 2011). Questions were kept relatively simple and the repeated trainings helped to ensure all field assistants were asking the questions the same way. There were some challenges around language, for example "the

local place” was confusing so I opted for “about here where you live”. Certain adaptive capacity statements, such as those around ‘planning’ also did not work so other statements had to be used. Given the amount of time spent refining and testing the questionnaire, it was felt that those challenges pertaining to wording and administration of the questionnaire were generally overcome. More generally, some respondents were particularly shy (e.g. some prostitutes), in both starting a questionnaire and answering certain questions, which could have led to significant biases in these groups of people. However, the time that was allowed to first talk informally with such respondents meant that this barrier was usually overcome.

The adaptive capacity assessment, in particular, faced a number of challenges or potential biases. Individuals may not have revealed certain information on threats, and it was felt that people often did not mention the main threats in their lives. At the same time, others seemed to not consider day-to-day problems when mentioning threats. However what is important with this assessment is that on the whole respondents were considering shocks that they perceived to have affected them, and the ways in which they actually responded to them. There is another challenge in measuring adaptive capacity in that adaptive capacity is latent in nature and so it is only possible to measure it after it has been realised (Engle & Lemos 2010). However empirical knowledge from past experiences dealing with shocks does tell us something about current adaptive capacity (Adger et al. 2007), especially when those shocks are relatively frequently occurring, as is the case in slums. Another issue relating to timeframes was that when enquiring about previous shocks that respondents dealt with, the phrase “last year” could be interpreted/understood to be as much as five years ago. In response, careful attention was given to phrasing in the interviews and the phrase “this last year” used. By tightening aspects such as this in the adaptive capacity assessment, findings were made more consistent (as individuals considering the same time scale) and the robustness of conclusions was increased.

For the social network analysis, each ego may well have had different opinions of some of the relative measures, such as what “some” or “a lot” of help might have consisted of. However the ambition was not to elicit ‘objective’ amounts of help received, rather to capture the views of respondents and their perceptions of how much the help was to them. An ego-network approach (as opposed to full social network analysis) is limited in that we cannot see whom egos choose *not* to connect with for instance, however for the sake of the research questions here these weaknesses did not affect the intended results.

Finally, focus groups have the potential of being highly biased by the types of participants who are involved, dominance of certain individuals, or interpretation of discussions. Biases may exist whereby participants exaggerate for the purpose of gaining some benefit, for example (Morgan 1996). However the focus groups were made effective by already knowing at this stage the types of people who I wanted to include and in which area, knowing certain key individuals whom I could trust to help facilitate the group and maintain honesty, and working well with a number of field assistants in the implementation of the group who I also knew well. Having an established transcriber, and being able to check certain parts of the translation/transcription, also increased trust in the findings. Furthermore, having the opinions of different stakeholders was the purpose of these groups. And as noted above, the focus group data were primarily used to add richness and explanation to analyses rather than to stand alone as comparative analyses themselves. For this purpose, the data are certainly robust enough.

Using multiple methods and being able to test results against different methods also greatly increased the robustness of findings. For instance, conclusions on social networks in different groups could be compared via the adaptive capacity assessment, the ego-network analysis, and some of the focus group comments. Across all the methods, the field assistants and I tried to build trusting relationships and explain the purpose of the study

clearly (often by myself in Luganda which greatly helped to build trust). It appeared that this significantly helped to gain honest, in-depth information (most slum dwellers were keen to 'help' a student) and reduced respondent bias. All in all, there were significant challenges but given the time that I was able to take refining and smoothing these out, it is felt that the findings are robust.

3.6 Reflections on the Research Process

This study actually started with a primarily ecological focus, given my natural science background. However during the course of the preliminary literature review, preparatory study, and discussions with urban Africa researchers especially during an early visit to the African Centre for Cities in 2010, I became fascinated by more of the social dynamics of the poor urban environment. Moreover, I realised that in order to assess both ecological and social components of resilience, I needed to understand social science tools better. Hence I learned social science methods, undertook a course on social network analysis, and became fully engrossed in resilience debates. As such, the outcome of the thesis retains the focus on the role of ecosystem services, but actually contains relatively more of a focus on the social components of individual resilience.

I found the mixture of methods particularly interesting and rewarding, given the different range of information that they gathered. The two quantitative social assessments (adaptive capacity statements and ego-network analysis) revealed significant findings and once assistants were trained, were relatively straightforward to carry out. Perhaps the most satisfying and revealing findings, however, were the differences between migrant groups in Chapter 6, where both statistically significant differences were found between the quantitative analyses, and pertinent qualitative differences in adaptive strategies emerged from the focus groups. In future therefore, I would certainly refine and improve the quantitative methods, perhaps even rolling these out with the help of a study team. However I would carry out

more qualitative and ethnographic fieldwork alongside. As per the work of Lindell, Simone and others, this would yield rich descriptions of these slum spaces.

During the fieldwork, there were challenges dealing with the expectations on myself as the researcher. Many respondents initially had the attitude of wanting to know what I was going to give or deliver to them, understandably as a white person walking through the slum with relatively well-educated Ugandans. Knowing a moderate amount of Luganda was a great asset for this, and I even learned specifically how to explain and respond to the question of what I was 'providing', saying that I was a student and how I hoped the information from my research would improve the work of local NGOs, and how they would be helping me with my studies. This honesty helped win me trust with the vast majority of respondents.

Slum fieldwork required the need to balance maintaining ethical procedures and behaviour, while being flexible and pragmatic about obtaining the information required. I was always considerate towards slum residents, not pushing for an interview but also being enthusiastic about wanting to 'hear their opinion'. Of course where individuals declined I accepted this. I also used my team of field assistants sensitively, so that if there was an older woman who obviously preferred talking to a lady, then the female field assistant would carry out the questionnaire. Likewise there were times when young groups of guys were best approached by men, so the male assistants or I would do this. Interviews were never 'paid' for, but when people's time was taken for a focus group, refreshments were provided as much as part of the custom as out of gratitude for their help. There were some notably challenging and potentially compromising situations too, just by the nature of carrying out a random sample of a slum. When trying to talk to a number of prostitutes, for example, sitting down over tea and 'mandazi' (local cake) that I provided meant those questionnaires became possible. Slum bars (surprisingly common even informally in people's houses) were also highly challenging. However by maintaining strict boundaries (not

drinking etc), but also open to sober individuals who might want to share experiences, an ethical, 'radically pragmatic' approach was taken. Therefore, I feel my sample is truly representative of slums in the city, and the wide range of individuals that live and work there.

Chapter 4: The Usage and Distribution of Ecosystem Services in Poor Urban Areas, and Characteristics of Ecosystem Service Users

4.1 Background to the Chapter

Having outlined both the background to this research and the way in which it was carried out in Chapters 2 and 3, this chapter presents the first of three areas of results. Chapter 5 and 6 present the adaptive capacity and social network findings, whilst here the results of the ecosystem services investigation are presented. The chapter presents three key findings: first, that local ecosystem services are used very little in the three slums but where there are some green spaces or trees, regulating and cultural services are valued; second that the distribution of these levels of usage and values matches the physical characteristics of the areas and the amount of green space that is there; and third that poorer individuals tend to use provisioning services more while only relatively higher-income individuals value cultural services.

As reviewed in Chapter 2, the level of understanding of the role of ecosystem services in poor urban or urbanising areas is minimal. The field of urban ecology has outlined in some depth the functioning of ecological services in urban areas (Pickett et al. 2011), and how various disturbances may hamper these functions (Alberti & Marzluff 2004; Alberti 2005). Likewise, there are increasing studies of ecosystem services in urban areas, highlighting their importance for human well-being (Bolund & Hunhammar 1999; Desakota Study Team 2008; Cilliers et al. 2012). However virtually all of these studies are in cities in developed country contexts where the challenges and urban landscapes are notably different from the context of slums and informal settlements. The predictions of continued increase in urbanisation and the size of urban areas in Africa means there is an urgent need to understand the role of ecosystem services in these urban contexts (Cilliers et al. 2012).

Ecosystem services are here defined as direct and indirect contributions from ecosystems to human well-being (TEEB 2010). The ecosystem services framework developed by many authors and recently summarised in the TEEB Manual for Cities is used for the analysis in this chapter. This report by TEEB outlines a method to assess and measure ESS in cities, using the example of Cape Town. However as Ernstson and Sörlin comment (2012), their claim of being a transportable method is flawed (see Chapter 2 for details). Furthermore, given the paucity of data in less developed countries than South Africa, such as the case here, this study focuses on a few simple provisioning ecosystem services. It then enquires more widely about other natural benefits that slum residents value. The research question that frames this chapter is:

Question 1: What is the level of ecosystem service use in poor urban areas and how does that change across a city?

This question is broken down into three sub-questions for investigation and analysis in this chapter:

- 1) *What is the level of ESS use in the slum areas?*
- 2) *What is the distribution of ESS use across the city?*
- 3) *Who in particular in these areas uses the ecosystem services?*

4.2 Methods & Data

These three questions are answered using a number of methods and data sources. The questionnaires described in Chapter 3 were used to gather information on ecosystem service usage, primarily focusing on provisioning services. These include sources of food, water, and energy (lighting and cooking). The results of a quantitative analysis of these data are presented in Section 4.3.1.1. In addition, the questionnaire contained an open-ended question regarding 'anything natural' that individuals appreciated about

their local place. Whereas Section 4.3.1.1 analysed levels of *usage*, the results of this open-ended question presented in Section 4.3.1.2 analysed benefits that individuals mentioned, or '*values*'.

Using the TEEB classification, these open responses were coded and analysed according to the numbers of each response. However the framework was used flexibly, adjusting certain sub-categories to fit the context. For instance under provisioning services, raw materials did not come up as a relevant benefit so this category received no coded responses, however there were multiple different sources of food, so these were given different sub-codes (e.g. P1a, P1b etc). Similarly, only local climate and air quality regulation were mentioned from the regulating services, so this category was divided according to the different values people ascribed to trees (e.g. shade, and clean air). The same was true for cultural services, where services such as tourism and spiritual experience were not locally relevant, but different aspects of recreation and mental and physical health were coded. Ecosystem disservices were also considered, which were not mentioned explicitly in TEEB.

In addition to the quantitative data that came through the questionnaire, the focus group discussions were examined for any qualitative information or views on why residents held certain values, or used ecosystem services in a certain way. For the comparative analysis of the three areas in Section 4.3.2, the data above was simply compared across the three areas in conjunction with secondary information and fieldwork observations on the physical characteristics of the areas; finally for the descriptors of ESS users, different groups of ESS users were disaggregated from the main sample and their background information was compared.

4.3 RESULTS

4.3.1 Ecosystem Service Usage

Of the three data sources (closed questions, open questions, and focus groups), the quantitative analysis reveals that a very small proportion of the population use local ESS to meet their basic needs. Provisioning services are the most often mentioned of the ESS categories, with regulating and cultural services mentioned even less. As well as this important 'negative result', there are a few key positive findings such as the use of natural sources of water. The open-ended question reveals that some people value benefits from regulating and cultural services, such as the importance of trees in providing shelter and shade, and the aesthetic benefits of what nature still existed. Finally the focus groups give insight into how the value of certain green spaces is seen as something for the wealthy, and not the urban poor. In summary, this section comprises information on levels of ecosystem services *usage* (Section 4.3.1.1), levels of *values* that residents have for a wider range of ecosystem benefits (4.3.1.2), and reasons for some of these patterns and values for ESS (4.3.1.3).

4.3.1.1 Usage of Provisioning Services

This section presents the analysis of the closed questions from the questionnaire, covering the basics of food, water, and energy sources. The numbers of people across the survey who use different sources are summarised, and presented as the percentage across the sample population. This information is shown in Table 1.

Table 1: The percentage of the sampled population who used various forms of natural resources, as well as other sources, for their basic needs.

Food source		Food Grown		Livestock		Food from village		Water Source	Drinking	Bathing	ENERGY	Lighting	Cooking
Local market	77.1%	A little	2.1%	To keep	5.2%	None	83.8%	Private	4.7%	4.8%	Electricity	64.2%	0.4%
Shops & Market	7.4%	Some	0.3%	To sell	3.1%	A little	9.8%	Public taps	83.6%	85.4%	Generator	6.3%	0.4%
Eat from kiosks	10.7%	A lot	0.4%			Some	4.6%	Borehole	0.7%	0.7%	Paraffin	11.5%	0.9%
Scraps	0.8%	All	0.1%			A lot	1.3%	Well	5.5%	6.5%	Tadooba	6.4%	
Markets & Kiosks	3.8%					All	0.1%	River	0.7%	0.7%	Firewood	0.3%	4.5%
								Shop	3.2%	-	Candle	10.9%	
											Charcoal		89.9%
											Gas		0.4%

Key:

	FOOD SOURCE
	WATER SOURCE
	ENERGY SOURCE

Table 1 shows how few of the basic needs of the Kampala slums are met directly by ecosystem services. As discussed later, this is of course not to say that these are not met *indirectly* by ESS, but that in terms of the *local* ability to meet the needs, this rarely occurred.

The vast majority of residents' food is obtained from the local market, with 80% of people getting it from there alone; others go to kiosks for prepared food whilst a minority 7% use shops. A fraction who represent the poorest of the poor, mainly residing in inner-city Kisenyi, resort to subsisting off scraps, that others threw away or were off-cuts from the market etc. In terms of ecosystem services, the market food source involves the production of ESS in the rural areas (where the food is grown), being transported into the city first thing in the morning. However the examination of this process was outside the scope of this analysis. While the majority use the local markets, it was also found that a small number personally received food from the village. Roughly 10% receive "a little" and only 5% receive more than that. Of this, two thirds go back to collect the food themselves, while about half own the land they received the food from.

Regarding the local provision of ESS, there are very few people who grow their own food. Just 15 people of the whole 730-person survey reported to grow anything, and only 5 of those grew more than "a little". A few more keep livestock, with 8% doing so. Of this, most keep livestock for their own consumption (5% - e.g. chickens within their house area), while 3% kept them to sell. This is mainly due to lack of space, although keeping chickens requires little space, hence a significant number of people did this. Likewise, only 5% report to sell any natural produce. Those who do, sell things like tomatoes, onions, sweet potatoes, cabbages and 'greens', mangoes and coffee. Considering both the sources of food and 'production' together, it is clear that the vast majority of food is brought into the city from rural areas, to markets rather than specific individuals, where a small percentage of people earn a living from selling in the markets.

Slum residents' sources of drinking water are more often from local natural provision. The vast majority use public taps (83%) but a significant number (8%) use either a natural well or river (this number includes people who use mixed sources not included in the table above). The small fraction that have their own private water supply (5%) indicates the low levels of wealth in these areas, while another 3% most commonly buy water from shops, as they likely have neither access to private or public taps. The same patterns are found for water used for bathing rather than drinking.

Lastly, a large number of slum residents have some access to electricity for lighting their homes (64%), however there remains a significant proportion of people who have to rely on paraffin (11%), candles (11%) or a tadooba (smoky kerosene candle – 6%). Unfortunately any more information on the origin of these fuels was not gathered during this study. However, for cooking the vast majority of residents use charcoal (nearly 90%) with another 4.5% using firewood.

Evidently these questions only allow investigation of a narrow set of goods and services and so the open-ended question was next analysed in order to give added information.

4.3.1.2 Wider Appreciation of Ecosystem Services

Table 2 below shows the responses to the open-ended question, coded according to the TEEB Manual for Cities, with flexible adjustments of the categories thereof. In addition to the three broad categories of provisioning, regulating and cultural services, a category of 'natural traits' was included, that contained responses where people simply identified aspects of the environment that they appreciated, although these were not necessarily 'ecosystem services'.

Table 2: The percentage of the population who named various ESS (as coded here) when asked if there was anything natural they enjoyed in the place.

<u>ECOSYSTEM SERVICE</u>	<u>% of Population who Valued the Service</u>
Nothing	41.8%
<u>NATURAL TRAITS</u>	
Friends	3.3%
The sky	1.1%
The wetland	0.4%
The hills - flood protection	0.5%
<u>PROVISIONING SERVICES</u>	10.6%
Fruit from trees	2.7%
Vegetables grown	0.7%
Animals	2.1%
Raw materials	0.1%
Water from the well	3.7%
Medicinal plants	1.1%
<u>REGULATING SERVICES</u>	5.2%
Trees	2.3%
Trees-shade	2.2%
Trees-clean air	0.7%
<u>CULTURAL SERVICES</u>	3.7%
Aesthetic: Flowers/trees/birds	3.4%
Recreation (football)	0.3%
<u>DISSERVICES (wetland, mosquitoes, waste leaves)</u>	0.3%

The section above found that the majority of residents of these slums have little direct use of local ecosystem services. This section adds to that result by showing that residents also report very little ‘appreciation’ of anything natural in the area. By giving the opportunity to answer to an open-ended question exactly as they felt, this strongly suggests the validity of this negative result. A large number (42%) actually commented specifically that there was nothing natural in the area.

Of the responses given, most relate to provisioning services of some sort (11%). In the first instance, this confirms the low levels of ESS usage by slum residents, as the closed questions were asking solely about provisioning services and still found low levels of usage. The percentages in this section are perhaps not as accurate an indicator of usage as in the previous section, as they do not directly ask about certain services but the results do show which ecosystem benefits are valued.

The provisioning services include fruit that individuals get from trees in the area, as well as animals and the benefits from them (mostly referring to livestock). The importance of wells for drinking water is confirmed too. This question also shows that individuals are using trees and plants for medicinal purposes, although the numbers who report this is very low (only 1%).

The benefits people ascribe to trees fall under both regulating and cultural services, with undoubted overlap between the two. The regulating services that people mention (often in simple terms such as “the tree provides shade”) revolves around trees, and the clean air, shade, and shelter that they provide. Residents also mention the aesthetic value of trees, flowers and even an appreciation of birds. Lastly a very small number of respondents mention the ability to play football on small clearings of areas of grass. Given their being valued by the community, it is important to mention how few trees there actually are. However, benefits such as appreciating their aesthetic value are reported even when residents could just see the top of the tree. In fact, when these regulating and cultural benefits are combined together, as often they are described, almost 10% of residents mention some form of their benefits.

The last area to mention is ecosystem disservices. As described in Chapter 2, these are things people mentioned that originate from the natural system, which negatively affect them/their livelihoods. It is particularly notable that these are mentioned given that the question was framed in a positive angle ‘anything that you value/appreciate’. Very few mention such disservices but

it is important to note those that are. For instance, the wetland on the edge of the city (near Bwaise) provides provisioning services in terms of papyrus to some people, and aesthetic benefits to others, but it was also mentioned as a significant source of disservice as a mediator of vector-borne diseases. (While obviously not showing a complex understanding of the wetland water regulation functions, it shows the perception that with the extra water around because of the wetland, it brings mosquitoes and the diseases that come with that, even if there are other factors at play.) The large trees that are often valued for their shade or shelter are mentioned by others as causing problems due to the leaves that created a waste nuisance and had to be cleared up from people's compounds, or water channels.

4.3.1.3 Explanations for Ecosystem Service Values

While the closed questions find levels of usage of specific ESS, and the open question finds other ecosystem benefits that respondents value, the focus groups are able to provide qualitative evidence of the reasons why respondents have some of these values, or use ESS in a certain way. They provide explanations for the lack of value, and how slum residents articulate their perceptions on this subject. The amount of information gathered on this topic is not huge, but allows a number of useful insights presented below.

Firstly, the focus groups confirm that natural goods and benefits really are of little interest to the slum dwellers. None of the focus groups responded in much depth on the topic even when prompted, and they generally responded with short responses that there were very few natural benefits in the area. The comments also reveal some of the reasons why they do not grow food etc, such as lack of space:

[Is there anything natural that you enjoy in this place?]

"Nothing but whatever there is they keep destroying it."

(Participant, Kisenyi Focus Group, #4)

“Where will you dig in the city?”

[On keeping chickens:] “there is nowhere here to keep and look after them well; there is no space here for rearing them.”

(Participant, Karamajong Focus Group, #1)

These comments, and others that were similar, reveal respondents’ viewpoint that there is just not enough room for there to be anything of natural value, or to have enough space for urban agriculture for instance; and anything of natural value is destroyed. Especially for residents who have been there a long time and have seen large areas of natural space destroyed for development, with little or no planning, this perception is understandable.

Amidst this backdrop of low value for ESS, the services that are mentioned are particularly notable. The one provisioning service that a small proportion of residents obtain locally was water from wells, and in Kisenyi, where this occurs, residents are proud to have this:

“One thing we are proud of in Kisenyi, is that when the tap goes, there is a spring well. We can go there and fetch water.”

(Participant, Kisenyi Focus Group, #4)

It appears therefore that although the slum residents have little value for ecosystem services and lack the space to create any meaningful urban agriculture etc, where there are some natural benefits such as a well, local residents are proud to be able to be able to use this.

In addition to the barrier of not having enough space, the discussions reveal the importance of the topography and landscape of the surrounds of individuals’ homes.

“This area is located on a hill; we don’t face floods like those living in valleys; we also have a good view of the city centre, the university, these adjacent hills. The hospital nearby is an added advantage.”

(Participant, Mulago Focus Group, #4)

This quote highlights that the topography (and likely the amount of vegetation too) does not just affect the aesthetic features of the area, but also the exposure to shocks such as floods. Although residents may not see it as such, this shows how important regulating services may be, such as filtration of water, or regulation of water runoff in an area. Specifically, these services likely manifest as a *lack* of regulating services, and therefore the hazard from flooding that comes when slum hillsides are degraded and water runs rapidly to low-lying settlements.

In addition to the limitations of space and topography of the areas, the focus group discussions reveal an important cognitive barrier to ESS use, in terms of the perceptions that slum dwellers have towards green space:

“There are some developed places; we have the trees, golf course, garden city the resting place and the rich people think that the only way of being in the city is to cut down the natural trees and plant flowers.”

“I think that in developed countries, if they build like Nakumatt [a large supermarket], still there had to be trees, and we also need such places, where you can go and rest from, even me such places like a park if you are oppressed you can go and rest from there. Places like city square there are trees but the police no longer need people there.”

(Participant, Kisenyi Focus Group, #4)

These statements show how, perhaps due to the destruction of green spaces in poor areas mentioned in the earlier comment, the slum dwellers no longer see green space or areas for recreation as something for poor urban areas, rather a luxury of the rich.

Overall, the focus groups endorse the finding that slum dwellers have very little value for ecosystem services however where services exist they can be proud of this; they suggest that regulating services are of great importance even if slum dwellers are not aware of this; and they find that barriers include lack of space and degradation of the area, as well as perceptions of who green space is for.

In summary, slum residents do not use local ecosystem services to a great extent to meet their basic needs. Food tends to come from local markets with food brought in from rural areas, and water is sourced from public taps. However there are a significant few who still used wells or streams. Trees provide significant benefits for slum residents too, both in terms of regulating services such as providing shade and shelter, and also as aesthetic value. Focus groups that enquire specifically on this topic reveal some reasons why ESS are used and valued so little (by so few people), given the small amount of space, the amount that is destroyed, and the perception that green space in urban areas is only something for the rich.

4.3.2 Distribution of Ecosystem Services

Having ascertained the level of ecosystem service use across the whole sample, and exactly which services are valued, this section describes the distribution of ecosystem service usage across the city. Using the three study areas as comparisons, both the closed and coded open questions are compared. To keep the analysis clear, only the key results of the provisioning service closed questions (4.3.1.1), and the sum of categories from the open question responses (4.3.1.2) are used. The average results of the three areas are presented in 4.3.2.1, followed by actual descriptions of

the physical and ecological characteristics of the three areas in 4.3.2.2. The results show that physical characteristics of the areas match up with appreciation and demand for ESS.

4.3.2.1 Levels of ESS Demand in the Three Areas

The results of both closed and open question responses for the three areas are shown in Table 3 below:

Table 3: Table showing combination of quantitative data on ESS use from Sections 4.3.1.1 and 4.3.1.2, split according to the three slum areas. Key differences are shown in bold.

	Kisenyi	Mulago	Bwaise
<i>CLOSED QUESTIONS</i>			
FOOD SOURCE - % from just markets	73.1% (N=177)	88.6% (N=217)	66.5% (N=161)
FOOD GROWN - % grown	2.9% (N=7)	3.3% (N=8)	2.5% (N=6)
LIVESTOCK (% who keep)	2.1% (N=15)	2.5% (N=18)	3.7% (N=26)
FOOD FROM VILLAGE - % who receive	21.9% (N=53)	12.2% (N=30)	12.4% (N=30)
DRINKING WATER - % from natural sources (well & river)	10.5% (N=25)	6.6% (N=16)	1.7% (N=4)
BATHING - % from natural sources	11.3% (N=27)	8.6% (N=21)	1.7% (N=4)
<i>OPEN RESPONSES</i>			
Nothing	85	86	134
PROVISIONING SERVICES	22	26	29
REGULATING SERVICES	14	20	4
CULTURAL SERVICES	3	12	12

The results above are then compared using the count data (rather than percentage as shown in some of the fields), and Chi-square tests for

homogeneity. The null hypothesis in this case was that there would be no difference in the distribution of the values between the three study areas.

Starting with food sources, more people in Mulago use the market alone ($p=0.011$). This is a complicated result to interpret as many people use mixed sources for their food, however Bwaise residents obtain less food from the market alone, and more from mixed sources including shops and kiosks. There are a similarly small number of people growing their own food. More people in Kisenyi receive food from the village however (53 compared to 30 in the other two places; $p=0.0039$). Kisenyi also has more residents (although still a very small number) relying on this food from the village – the other two locations only have people getting “a little” from the village. Pertaining to this, a higher proportion of the residents who receive food in Kisenyi go back themselves, and own the land themselves ($p=0.037$, $p<0.001$ respectively; data not shown here).

In Bwaise, more people have livestock (26 as opposed to 18 and 15), although this was not statistically significant. By contrast, many more Kisenyi residents use natural sources of water, with the least in Bwaise.

The open-ended question analysis perhaps reveals more here however, showing how many more in Bwaise reported that the natural environment bore no benefits at all ($p<0.001$), even having a negative view of the services it provides. Provisioning services show no difference in their value, except there being more animals in Bwaise as reported above. However there is a significant difference in both regulating and cultural services ($p=0.006$). Bwaise showed markedly less individuals valuing regulating services, with Mulago the most, where people were grateful for the trees around. For cultural services it was Kisenyi that showed the lowest values.

To summarise, the main differences are in the higher amounts of food being imported to inner-city Kisenyi and the use of wells there, more livestock being kept on the outskirts in Bwaise, and higher values of regulating and

cultural services (namely valuing trees) in Mulago. Given the overlap in cultural and regulating benefits mentioned earlier, it makes sense to combine these two categories and by doing so, Mulago showed double the score of the others ($p < 0.0001$). In the next section these results are compared with the actual physical description of those three areas.

4.3.2.2 Physical (Ecological) Descriptions of the Three Areas

With these observed results in mind, it is possible to consider how the physical space corresponds to the ESS values of residents there, by describing what the three areas are like in terms of space and provision of green space. While it was not within the scope of the study to make actual ecological measurements, the following composition of observations and descriptions from the literature, satellite imagery with GPS locations of the interviews, and photographs of each study area are able to give a rich understanding of the layout and physical geography of the three slums.

Generally, as described in Chapter 3, green space in Kampala has suffered as what was allocated for this has been given over to other purposes. Due to both corruption and the lack of prime land, key green spaces have been allocated to private investors for development (Uganda Ministry of Local Government 2010). This demand for land, especially near the urban centre, helps to explain some of the differences observed in the three study areas. Furthermore, wetlands have been encroached as areas of informal settlement occupation, and have been destroyed by the large populations that have settled there. Local Councillors (LCs) who are supposed to help protect the wetlands instead have endorsed the papers of the encroachers.

What this informal pattern of development has led to is slums with varying physical geographies and layouts, generally determined by the way in which they were settled as a result of the various attracting features of the area.

Kisenyi, for instance, being in the inner city is attractive for migrants to slum areas in that there is no need for transport costs to work in the city centre,

as people are able to walk to work (see location in Figure 3). The slum has a lively economy with a variety of businesses including food vendors and metalworking. It is highly congested with high population density (see clearing amongst dwellings in Figure 10). Despite originally being a swamp area, almost all green space has disappeared as all available land has been used, developing in a haphazard way with no formal planning. The pressure for land is now to the extent that many residents live with the constant threat of eviction. Meanwhile the benefit of being a relatively well-established area of informal settlement is that some services have been provided by the government such as roads and public taps, albeit still sub-standard. However the majority of people have no access to dumping grounds so use streets and drains for waste disposal. Furthermore, there is little or no green space or trees left existing in most of Kisenyi II. Figure 7 shows the five zones surveyed in Kisenyi II. Industrial areas can be seen in the top-right of the picture, and high-density housing in the zones surveyed.

Mulago, on the other hand, is still relatively central but would cost some people transport money to get to the city centre (see Figure 8 for location). While suffering from many of the same development issues as Kisenyi, it crucially has more open space (see Figures 11-13), and a few remaining patches of green and large trees (Figures 12 & 13). Some of the slum is on a hill, which makes settlement of homes difficult, and this area has remained a recreation area/open space (Figure 13). Being on a hillside, this also helps much of the slum not suffer from floods. The map in Figure 8 shows high-density informal settlements, but also the moderately sized areas of green space, and occasional large trees.

Bwaise is exactly double the transport cost to the city centre of Mulago (1000 Ugandan shillings as opposed to 500 at the time of research). It is located either side of the 'Northern Bypass', a road which bounds the northern edge of most of Kampala city (see Figure 9). It is a low-lying swampy location and is subject to seasonal flooding whenever it rains heavily (see Figure 14 showing impact of moderate rains). Being further

from the city centre and highly vulnerable to flooding, there is some of the cheapest housing in the city here, especially in the seasonally flooded areas (see poor housing in Figure 15). There are also the same issues of low service provision, with some areas suffering severely from solid waste issues and very poor sanitation and toilet provision. Bwaise has a high population density in parts but by contrast also has larger areas of green space and some main roads intersecting the slum. However, much of this green space is wetland, which becomes deeply flooded whenever heavy rains come (some seen in Figure 14), and is associated by the residents with these floods. Hence one can see why values of green space are different in this area. The map of the area in Figure 9 shows the wetland at the bottom of the picture, on either side of the Northern Bypass, and small open areas and green space amongst the informal settlements.

In addition to this descriptive evidence, the three maps below give visual evidence of the different characteristics of the areas. They show how in Kisenyi there are very few green areas or trees, in Mulago there are more small patches of green and quite a few trees interspersing certain slum areas, and how in Bwaise there are large areas of green space including the wetland. However the settlements of Bwaise are high density and again have little green space within them.



Figure 7: Map of Kisenyi II study area from Google Earth (2013). The pinpoints show the five zones that were covered.



Figure 8: Map of Mulago II study area from Google Earth (2013).

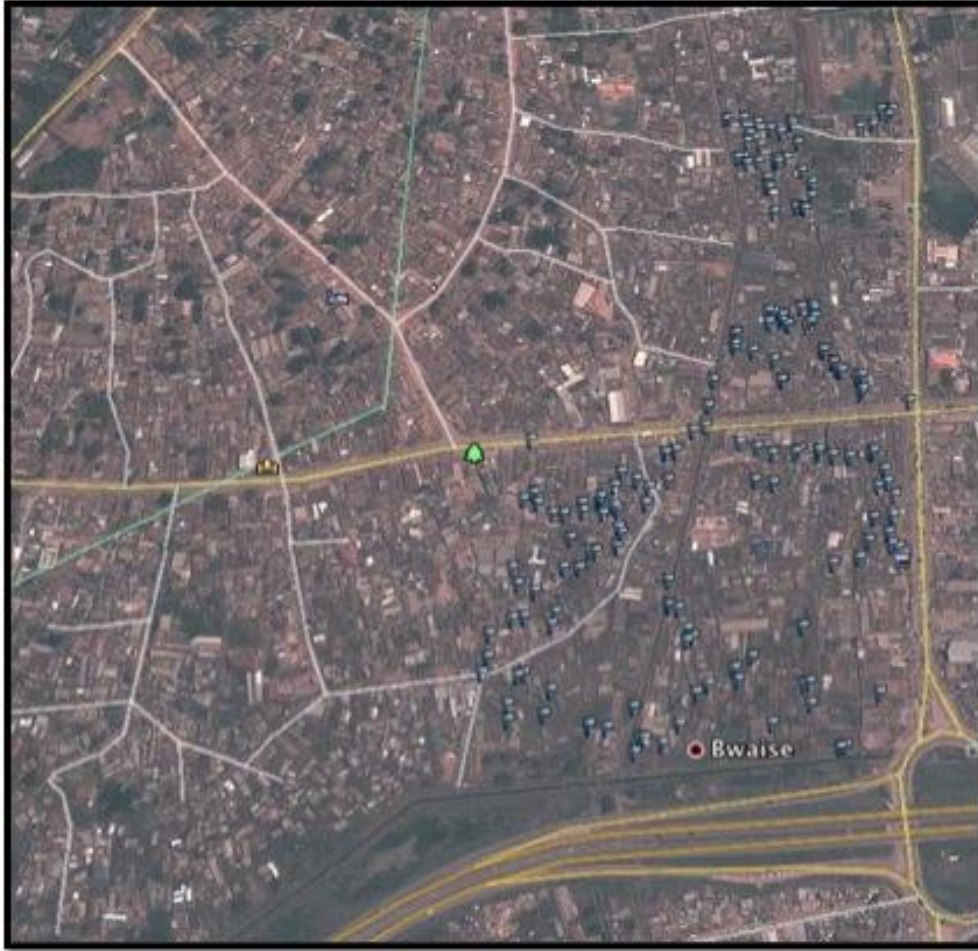


Figure 9: Map of Bwaise II study area from Google Earth (2013).

The following photographs also give an indication of the different physical appearances of the three places:



Figure 10: Photo of the heart of Kisenyi II, showing a total lack of green space, the proximity to the central business district (in the background), and people going to collect water from public taps.



Figure 11: Photo of the centre of Mulago II, showing a one of few areas of open space and lone, large trees.



Figure 12: Photo of open area in Mulago II (same as Fig 11), showing more large trees amongst the slum in the background.



Figure 13: Photo of an open area near the bottom of Mulago II slum, where young people play football.



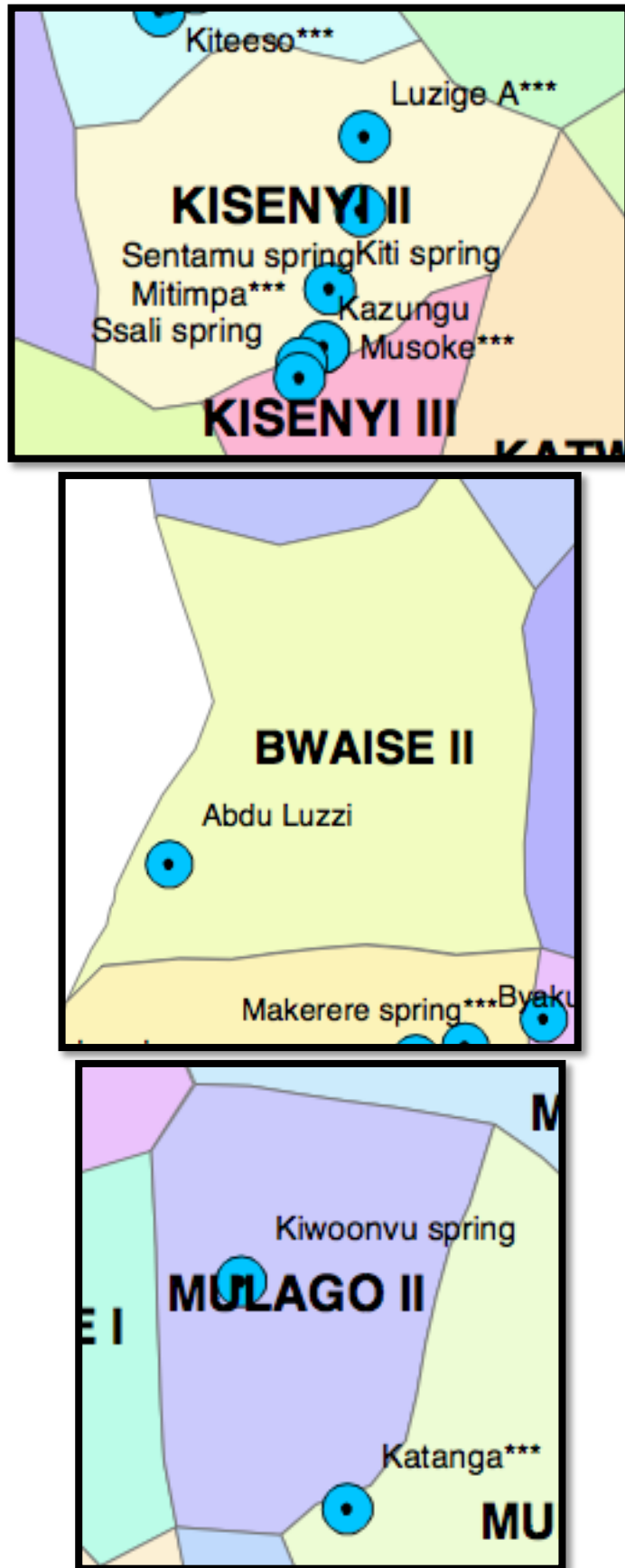
Figure 14: Photo of Bwaise II slum from the edge at the bypass, taken some time after a moderate flood. This shows the green space, and the impact of floodwater.



Figure 15: Photo of one of the older permanent dwellings in Bwaise II, with surrounding stagnant floodwater.

Lastly the following zoomed in sections of a map show the location of freshwater springs in Kampala. It is easy to see how in Kisenyi there are many more than in the other two locations.

Figure 16: Zoomed in maps of Kisenyi, Bwaise and Mulago study areas with spring locations, courtesy of Kampala KCC GIS Department..



To summarise the physical/ecological description of the city from the four sources of evidence (observational descriptions, satellite maps, photographs, and location of springs), a haphazard pattern of development and demands for land have resulted in the inner city slum having virtually no land that is not developed, and much being developed in a highly concentrated way. Meanwhile, there is a little more space in Mulago and Bwaise, however much of that in Bwaise is highly flood-prone. Slightly larger areas of green space and trees could be identified on the satellite images of Mulago and Bwaise, and the photographs really exemplify this. Finally the map of the location of springs shows how Kisenyi II has six within or just neighbouring its borders, while the other two only have one each in those zones.

The characterisation of the physical nature of the three areas described corresponds strongly to many of the results of differences observed. For instance the larger amounts of food imported into Kisenyi is understandable given the fact that being an inner-city slum, Kisenyi has a higher proportion of immigrants and recent arrivals, who are more likely therefore to have stronger links to the village, be less established and therefore require rural help and so receive greater support in terms of food brought in from rural areas. The peripheral nature of Bwaise slum means that livestock may be kept here, where there is simply no space in the other areas. As for water, there is a clear and direct relationship between the number of wells (many more in Kisenyi), and the number of residents who value that provisioning service.

Moreover, the broader patterns of residents' values for various ecological benefits correspond to the physical characteristics of the areas. The lower values of Bwaise residents, and even negative values, correspond to the fact that the green space in Bwaise (wetland and marsh areas) is associated with flooding (even though it is the ecosystem being degraded/settled upon and not functioning properly rather than the ecosystem providing a true

'disservice' per se). This explains why, despite the relatively significant amount of green space, Bwaise residents do not report many regulating or cultural services. Perhaps the single most striking result however is Mulago residents reporting significantly higher values for combined regulating and cultural services, primarily around the values of trees. This result corresponds powerfully to the evidence of more open spaces, and many more lone trees in Mulago (even though the area is on the whole of a similar standard of living and service provision). This suggests that even these small areas of open/green space, and occasional trees, make a significant impact to residents' value of the area.

4.3.3 Descriptors of Ecosystem System Service Users

Having found that ESS values and levels of usage differ according to place and correspond to the physical characteristics of those areas, the following analysis shows exactly who uses those ESS, and if there are 'descriptors' of ecosystem services users. Section 4.3.1 identifies certain key ESS that are used in the three slums. These include water sourced from local wells, fruit from local trees, charcoal and food imported from elsewhere, and cultural and regulating services of local green space and trees. Though complex, the indication is that poorer residents use provisioning services more, while only higher-income slum residents value regulating and cultural services.

For clarity of the analysis, only a handful of services are investigated, so that these categories are represented by a meaningful number of respondents (30-40). Three provisioning benefits are included: water from the wells, fruit from trees, and the use of medicinal plants. In addition the regulating services of trees, and the cultural services of various aspects of nature are investigated. They are compared against the average scores for various background and socio-economic measures such as individuals' age, cost of rent per month, and the youth dependency ratio in the household. The percentage of people who were from specific migrant groups (see Chapter 6 for this analysis) was also included.

In the process of carrying out the analysis, the first key finding is that individuals who said that they obtained their water from wells are not the same individuals who respond that they value the presence of wells in the area. Vice versa, many individuals who respond that they appreciate wells in the area actually obtain their water from public taps. The significance of this finding is that it shows that what people say they value is not necessarily what they personally use. For investigating 'well water-users' therefore, the actual use (closed question) results are used. For other categories of values, such as from regulating and cultural services, the open-ended question is used. The socio-economic/background statistics for each of these groups of ESS users, as well as the average for the whole sample, are shown in Table 4 below:

Table 4: Socio-economic and background data for various ESS users, compared with average for whole sample. Key differences are shown in bold.

	Average	Well water	Fruit from Trees	Medicinal Plants	Trees (RS)	Cultural Services
% Male	66.7%	73.2%	77.5%	50.0%	77.1%	67.7%
Age	31.4	35.7	31.9	35.6	29.1	32.4
Youth Dependency Ratio	0.72	0.97	0.75	1.25	0.88	0.63
No. in household who work	1.54	1.48	1.38	1.75	1.42	1.40
Duration of Residence (days)	3415.11	3267.22	3865.17	4703.69	2953.21	4375.02
Rent per month	68.7	59.8	67.5	40.3	70.4	65.9
% in Formal Work	4.0%	3.6%	0.0%	0.0%	11.4%	6.7%
% in Any Work	70.0%	69.6%	80.0%	75.0%	74.3%	63.3%
% Migrant group users	9.60%	12.50%	10.00%	0.00%	8.57%	9.68%

The evidence here suggests that lower-income slum residents use provisioning services, while relatively higher-income individuals appreciate regulating and cultural services more. For provisioning services, there are some key differences between users of well water and medicinal plants, and the average population (although no difference with those appreciating fruit from trees). Firstly, youth dependency ratios are higher for both users of the well and medicinal plants. Youth dependency ratios show the relative proportion of dependents (those under 16) and typically, high dependency ratios indicate lower levels of income (Bloom et al. 2007). Second, the amount of rent paid by these individuals on their rent each month is considerably less for the provisioning service users, by over 10% in the case of well water, and over 40% for medicinal plants. This suggests that individuals who use provisioning services in this context live in poorer dwellings, and have lower incomes. There are also relatively more migrants who use the water from the well. Lastly users of medicinal plants have been in the area longer, possibly suggesting it may take time to become aware of the location of these plants.

Users of regulating and cultural services do not differ from the average population for most measures in Table 4, however the percentage who are in formal work is higher. Overall, there are very few respondents from the three slums who are in 'formal work' (4%), meaning formal employed labour as opposed to less formal manual work or running their own small enterprises such as selling produce. The higher numbers in formal employment and appreciating cultural and regulating services suggest higher-income individuals (as formal labour will pay better) have more of an appreciation of these services, although the levels of rent do not reflect this. In addition, people who appreciate cultural services were on average resident in the slum much longer. Though perhaps a weaker result than the finding for provisioning services, it suggests that higher-income residents who are more established in the slum have a greater appreciation of cultural and regulating services, namely the presence of trees and green space in the area. This may be a feature of individuals having both come to enjoy these

benefits with time, or that they live in greater proximity to trees or green space.

The conclusion to the investigation of who in particular uses these ecosystem services is that lower-income individuals tend to use provisioning services, while higher-income ones have a greater appreciation of cultural and regulating services. This makes intuitive sense given that poorer individuals are likely to source their food and water from anywhere that is free. Likewise it will be the relatively wealthier individuals in the slums who have dwellings with more access to open space and therefore are likely to appreciate green space, flowers, and trees more. The following section discusses this result in more depth.

4.4 Discussion of Results

4.4.1 Use of Ecosystem Services in Poor Urban Areas

The foremost result of this chapter is that in poor urban areas, local ecosystem services are hardly used or valued by residents. Instead, provisioning services are essentially brought in from rural areas and provided via local markets. This is not rare for cities in general, where most ESS consumed within the city are generated by ecosystems located outside of the city (Jansson 2013). This study is designed around the “ecology *in* cities”, rather than the “ecology *of* cities” (as Jansson 2013 puts it), and so does not measure that dependence on the surrounding landscape. However, it is important to note the results here which contrast the traditional focus of ‘ecology in cities’ studies elsewhere that often consider energy efficient buildings etc (Jansson 2013). Likewise the reasons for residents not using local ESS also differ from other contexts.

Some of the reasons for the lack of local provision of ESS became evident in the focus groups. It is primarily due to the lack of space in the slums overall, and amongst their dwellings, as found in other African slums (Gallaher et al. 2013). This is the same major constraint that was found in Kampala in a

study of urban agriculture in 1995 (Maxwell 1995). The other key issue is a perception that green spaces are for “developed countries” or the “rich people in town”. This may have evolved from the lack of space that individuals experience in their slums, in combination with limited planning and constant development of open spaces, and lack of government provision of services to the slums. This is an important contribution as other studies highlight barriers such as solar radiation, air pollution, soil degradation or water availability (Eriksen-Hamel & Danso 2010) but in poor urban areas, the barrier to local production may more simply be lack of space.

In addition to a different set of drivers of ESS provision, the level of usage of certain services is also different to what is purported elsewhere, even in comparable poor urban contexts. One of the main provisioning services that is investigated here is the provision of food. Very few respondents at all report to growing any food (only 3% of all surveyed, and an additional 5% keeping livestock), or receiving food from rural areas. However many studies argue that urban agriculture is of great value to poor urban residents and that a significant proportion of the urban population grow some of their own food.

Reviews of urban agriculture find totally different findings to the current study, with between 30 and 85% of vegetable requirements found to be met by urban agriculture in Asia, and up to 80% in cities in Africa (Eriksen-Hamel & Danso 2010 for review). Even for the region in context, it has been reported that 40% of staple crops are produced within the city limits of Kampala, Nairobi and Dar es Salaam, although all of these studies were before 1995 (Eriksen & Danso, *ibid.*). While this data is about the amount of food being produced within urban areas, recent reviews also contrast the findings of the current study regarding the number of urban dwellers involved in urban agriculture: a Foresight project on 'Global Food and Farming Futures' states that the percentage involved in urban and peri-urban agriculture (or related activities) is 13% in Accra (Sonou 2001), 15-20% in Dar es Salaam (Sawio 1998), 20% in Lima (IPCC 2007), and 45% in

Governador Valadares (De Zeeuw et al. 2011). The reasons for the discrepancy with the low levels of urban agriculture found in the current study are followed up in Chapter 7, but in brief it is key to note that the figures in the Foresight paper are from a review that includes peri-urban as well as urban, and also includes "other activities". In addition, the African examples are over ten years old.

Moreover, even studies focusing on Kampala in particular find contrasting findings to what is discovered here in terms of levels of urban agriculture. Maxwell (1994) estimated that 30% of the population was involved in urban farming (crops and livestock) based on 1991 data, and later studies also found similarly high levels averaging at 26.5% based on studies in 2003 (see Lee-Smith 2010 for review). However, as Lee-Smith comments, these figures "beg many questions, not least the need for validation". Again, other studies have found that food from the village has an important role in reducing hunger vulnerability (Frayne 2004), and significant amounts are brought back and play a key role for poor urban households (Owuor 2007), but this is not found here. The discrepancies with both of these results (levels of local food production, and amount of food imported from rural areas) are discussed in Chapter 7.

Of those services that are used in the three slums, provisioning services are most valued by slum dwellers. When given an opportunity to mention any natural benefits, provisioning services were mentioned as much as all other benefits combined (Table 2). This preference for provisioning services is not surprising given that the benefits from these services help individuals meet their basic needs, while the other types of ecosystem service do not (directly at least). In the context of urban poverty where such basic needs are a critical priority, this will mean such services are valued more.

However, a reasonable proportion of the respondents also value regulating and cultural services (around 10% combined). This is important as it means that even the small patches of green space, or lone trees, generate value for

individuals' appreciation of their local environment. It appears that green spaces are less valued in developing countries (Cilliers 2009) and in fact most studies in the urban context focus on distinct areas of green space such as urban gardens (Barthel et al. 2010; Barthel & Isendahl 2013) rather than the small patches or scattered trees as is the case here. But this result suggests that planning for green space or trees in slums could have similar benefits for the well-being of local residents.

4.4.2 Distribution of Ecosystem Services in Poor Urban Areas

The distribution of these provisioning, regulating and cultural services is not uniform across the slum areas of Kampala. Instead, the locations where residents value certain services match up with where there are more green spaces or trees. In other words, the availability of ESS corresponds to local demand and value for those benefits provided.

This is important because as McDonald and Marcotullio (2011) point out, the 'value' of an ecosystem service is a combination of both the supply by an ecosystem of that service, as well as individuals who want that service (the demand). Furthermore, while many studies have focused on the provision of ESS, few have studied the demand and how this changes spatially when urban residents have specific needs (McDonald 2009, in Cilliers et al. 2012). This result is important therefore, as it demonstrates that where slum areas have green space and the provision of ESS, such as aesthetic benefits from trees, there is a concomitant demand and therefore value for them. In other words, it is further evidence that building green space into slum areas will increase the well-being of those areas.

4.4.3 Characteristics of Ecosystem Service Users in Poor Urban Areas

While the levels of usage and value for ecosystem services differs geographically across the three slum areas, demand for ESS also differs according to some individual attributes. In fact, ESS demand appears to differ according to the relative income of slum dwellers – poorer residents

use provisioning services more, while relatively higher-income residents have more value for cultural services.

This relationship between income and demand for ecosystem services is repeated elsewhere, in a study of domestic gardens in South Africa (Cilliers et al. 2012). Again, poorer residents used more provisioning services while more affluent individuals valued regulating services to a greater extent. This survey was based in South Africa and only in more affluent areas so not entirely comparable, but there are few other studies against which to compare this result.

As for the preference for provisioning services mentioned above (in Section 4.4.1), it is an apparently obvious result, given the context of poor urban households and the principal needs (e.g. food, water) that must be met by individuals. In the framing of needs and satisfiers (Max-Neef et al. 1992), this makes sense as aspects of the local environment such as cultural services and a consideration of aesthetic benefits for instance cannot come into play until subsistence needs are satisfied (also see Cruz et al. 2009). This also helps to explain the comments made by residents that ‘green space is only something for the rich’.

4.5 Limitations and Improvements

While ecosystem services are not highly utilised or valued in these areas, the two findings that a) there are still certain benefits such as aesthetic values of trees/green space, and b) that where ESS are available they are valued, suggests that a closer inspection of what natural goods are really valued by local residents is necessary. It also appears that the research design used here, broadly based on the TEEB classification system, did not yield a particularly rich understanding. Instead, much as the work of Myers and Simone and others has demonstrated (see Myers 2011), the use of critical ethnographies is likely to yield far richer understandings of the way in

which urban nature is created, valued, and influences individual well-being in these places.

The evidence here suggests that only a small amount of open space for recreation, or the provision of trees to gather or sit around for shade and communal activity can be such a positive influence on community. An approach comprising critical ethnographies would be more capable of generating an understanding of the contested nature of these spaces, and the real values that might exist. This approach would also make it easier to disentangle people's perceptions and demands for specific natural benefits, as opposed to the objective measurement of what is available.

Lastly the relationship of income with demand for ESS deserves further investigation. This, and the potential future research avenues mentioned above, are followed up in more detail in Chapter 8.

4.6 Summary of Chapter 4

This chapter has found that local ecosystem services are barely used or valued by poor urban residents; that the distribution of demand or usage of ESS is uneven and in fact matches the ecology of the area; and that poorer individuals use provisioning services more while only higher-income residents value regulating or cultural services. The chapter also provides evidence to challenge contemporary studies that argues the importance of urban agriculture. While provisioning services are used most by slum-dwellers, there are a significant number of residents who value cultural and regulating services combined, which generally are aesthetic or cultural benefits around the presence of green space or large trees amongst the slum. The provision of such ecology appears to positively affect well-being therefore, but the chapter also reveals challenging findings around ecosystem disservices, and how slum-dwellers see green space as something only for the urban rich. The fact that certain services (e.g. cultural) are not valued is unsurprising however when we consider that poorer residents are

focusing on their basic needs. Some of the debates around the importance of urban agriculture are followed in Chapter 7, where insights to improve ESS frameworks are also discussed. Chapter 8 considers how these valuable green spaces may be incorporated into slum development.

Chapter 5: Aspects of Adaptive capacity and Social Networks in Poor Urban Areas

5.1 Background to the Chapter

Chapter 4 described the relative importance of ecosystem services for residents of poor urban areas, as well as the distribution of ESS spatially and in relation to individuals' characteristics. This current chapter moves on to examine the social features of slum-dwellers' resilience, focusing on their adaptive capacity, and a specific focus on individuals' social networks. The chapter presents five main findings: first that individuals tend to deal with problems with the help of others; second that certain key capacities correlate significantly with adaptive responses, which include feelings of control, belief in change, and innovation; third that social sensitivities also correlate with adaptive responses and include attachment to place, the presence of networks, and an appreciation of the local environment; fourth that two types of social support network exist; and fifth that the large majority of social support comes from within the city rather than from outside.

As reviewed in Chapter 2, there are many possible ways to examine adaptive capacity and aspects to consider. The working definition of adaptive capacity that is used here is as outlined in Chapter 2, Section 2.5.1, as the preconditions necessary to enable adaptation (to maintain or increase quality of life), including social and physical elements, and the ability to mobilise these elements. As Chapter 3 describes, the study attempts to measure adaptive capacity at the level of the individual, in three poor urban areas (slums). The aim of the research is not just to explore capacities in some theoretical sense (assuming that they will lead to good adaptation), but to examine both adaptive characteristics, individuals' ways of approaching problems, and the actual strategies employed when problems come. These are dealt with in three sections – 'strategies' (I), 'capacities' (II), and 'social sensitivities' (III).

The three sections relate to the following aspects of adaptation and adaptive capacity: social sensitivities affect to what extent the system (individuals) is affected by a problem (e.g. flooding); adaptive capacities describe the varied abilities of an individual to respond to a shock and take advantage of opportunities. A “crisis” here refers to a significant event that a respondent has referred to that has challenged or disrupted their livelihoods, such as loss of income, sickness, or flooding. Lastly, as justified in Chapter 3, the focus here is on general resilience, i.e. the resilience of individuals in the slums to a range of shocks and challenges.

The specific features that are measured here are derived from a large number of potential determinants of adaptive capacity, as reviewed in Chapter 2. These determinants include factors relating to resources, structure, and agency; both subjective and relational factors, as well as objective ones. By considering the relevant context and through a process outlined in Chapter 3, a manageable number of factors are assessed for each category of adaptive strategies; adaptive capacities; and social sensitivities. The strategies considered here are adaptive mobility, getting help from others, self-efficacy (individuals’ ability to deal with situations on their own), and learning from others. These cover four different ways in which slum residents cope with problems. The adaptive capacities include: feelings of control (over their own circumstances), belief in local change (i.e. that the area will improve), readiness to move out of the area, innovation, job flexibility, options to change (other ways to earn money), and planning and preparedness (being ready for when problems come). Finally the social sensitivities include: an appreciation of nature, attachment to place, feelings for the village, attachment to occupation, the existence of networks (friendships etc), and employability (the abilities to do another job). A full list of these features, including the exact statements that are used to represent them is found in Appendix 2.

Using this set of adaptive capacity components and the methods outlined in Chapter 3, each aspect is measured using representative statements. This is in order to answer Question 2 which frames this chapter:

Question 2: For residents of poor urban areas, what are the most important aspects of adaptive capacity?

This is broken down into the following sub-questions for investigation and analysis in this chapter:

- 1) *What are the most important aspects of adaptive capacities, and how do they affect adaptive strategies?*
 - i) *What strategies do slum residents employ and in what combinations?*
 - ii) *How do adaptive capacities affect the strategies employed?*
 - iii) *How do social sensitivities affect strategies employed?*

- 2) *How important are social networks for adaptability?*
 - i) *What characteristics of social networks influence adaptive capacity?*
 - ii) *Where does that social support come from?*

5.2 Methods & Data

These research questions required specific methods that are reviewed in Chapter 3, but a brief recap and few more specific details are provided here. In order to measure the features of adaptive capacity (Question 1), a social survey was used to gather categorical data on each determinant of adaptive capacity. Statements that represented each determinant were presented, and respondents replied whether they agreed or disagreed on a four-point scale. Respondents were first asked about what challenges they felt “this last year”, in order to make sure responses were referring to strategies actually employed.

The statements were presented in the order of adaptive strategies (I), followed by adaptive capacities (II), and finally social sensitivities (III). Chapter 3 describes how statements were grouped, tested for validity, and randomised. With statements sorted into reliable groupings, the data could be analysed in order to answer the sub-questions of Question 1 shown above pertaining to strategies, the effect of adaptive capacities, and the effect of social sensitivities.

The second of the key methods used in this chapter is the ego-network analysis. The tool enabled analysis of the amount and type of social support each individual was receiving, as well as detailed information on each ego-network, the composition of that network, and its structure (from the alter-alter ties). Only some of this data is used in the analysis presented here. The outputs of the ego-network analysis (ego-network measures) are used in correlation analyses with the adaptive capacity assessment results from the statement responses analysis above (Question 1).

The results are presented in the order of the research questions noted at the start of the chapter. The first main question is answered using the adaptive capacity statements data, and the second uses data from the ego-network analysis and the relationship to strategy responses.

5.3 RESULTS

5.3.1 The Most Important Aspects of Adaptive Capacity for Poor Urban Residents

In overview, the analysis of adaptive capacity statements reveals that there are indeed certain determinants that correlate significantly with positive adaptive strategies. As anticipated, there are a range of shocks that slum residents face and they differ according to each area. It is also found that respondents tend to deal with problems best with the help of others. Finally, the capacities that most correlate with positive responses are feelings of control, belief in change, and innovation, while the sensitivities are

attachment to place, the existence of networks, and an appreciation of the local environment.

Before assessing the patterns and relations between determinants and strategies (Sections 5.3.3.1 to 5.3.3.3), the first analysis is of the types of shocks slum dwellers face, and differences between each area are clearly seen. For example (and by no means describing the full complexity of the situations) Bwaise, located on or adjacent to a wetland, faces severe flood impacts; in Mulago severe crime is often mentioned; while in Kisenyi in the middle of the city eviction is a pressing threat. Hence the flexible approach of measuring 'general resilience' appears to have been appropriate.

Next, the analysis of statements generated some robust findings. The reliability tests generate Alpha scores over 0.7 for the remaining groups (after sorting), except in some instances when close at 0.62 to 0.65. Encouragingly, all the changes made by initial 'observation' were later justified by reliability analysis. The Bartlett/KMO scores are also satisfactory except in a few groups with KMO=0.5 (rather than 0.6 which is desirable) but this is because these groups are made up of only two statements. The positive Bartlett scores, and eigenvalues over 1 for all F-scores, suggest that all the composite indices are valid.

The Pearson correlation coefficients (r), and Spearman rank correlation coefficients (r_s), are presented with p-values (p) for every correlation mentioned in the text below. In the description of "significant" results, Bonferroni corrections are applied such that appropriate cut-off p-values are used. When an analysis comprises multiple possible correlations, the alpha significance level is adjusted. For example, if there are 8 possible correlations for a test then the p-value used for the significance cut-off is $0.05/8$, so $p \leq 0.006$. After this adjustment, the following terms are used according to different significance levels:

- At the equivalent of a 5% significance level: "strongly significant";

- Marginally higher p-values (often still less than 0.005): “moderately significant”.

Having checked the data for reliability and consistency, the analysis of the statements could be carried out.

5.3.1.1 The Patterns of Adaptive Responses to Shocks

The first analysis of statements focuses on patterns of adaptive responses, i.e. the ways in which individuals respond to shocks. The key finding of the analysis is that dealing with problems well is associated with responding *with* the help of others, rather than in isolation. The statistics indicate that individual factors may not be strongly *related* to each other, but there are strongly *significant* correlations. In other words, even if some of the relations between response variables are moderate or weak, they are statistically significant. This finding is unpacked further below.

The analysis of responses occurred through multiple correlations between individual response strategies in Section I, using Pearson correlations. Statements in this section are not grouped together because each statement represents a different response strategy, even under the same ‘category’, e.g. shifting elsewhere in the city versus shifting back to the village versus staying in the slum. The analysis reveals, for example, if people who never leave the city during a crisis get more help from those living around them than those individuals who leave. The full list of statements relating to these adaptive strategies are found in Appendix 2.

To start, relatively few people leave the area entirely during times of crisis, with only 12% returning to the village and only slightly more moving elsewhere within the city. Significantly, individuals who ‘shift elsewhere’ correlate with not receiving help from their neighbours ($r[714] = -.115$, $p = 0.002$), and not ‘just praying to God’ ($r[712] = -.134$, $p \leq 0.001$) (i.e. negative correlations). There is also a moderately significant, if weak, correlation between shifting back to the village and not learning from others ($r[717] = -.102$, $p = 0.006$). This suggests that most individuals stick around and learn

from others how to adapt, but those who do not, choose to leave. The finding that individuals who leave are those who are not getting help from their local area makes intuitive sense but is nevertheless a useful finding.

Regarding adaptive responses while staying in the local area, positive responses correlate with doing things with the help of others. For instance self-efficacy correlates with 'getting help' in general ($r[718]=.127, p=0.001$). Meanwhile 'just staying here and dealing with it' strongly significantly correlates with taking care of problems on one's own (negative relation with 'not staying': $r[715]=-0.156, p\leq 0.001$). Lastly the most useful statement for assessing self-efficacy, the inverse of "I just gave up", strongly significantly correlates with getting help, and learning from others ($r[718]=.127, p=0.001$; $r[718]=.191, p\leq 0.001$). This last correlation between self-efficacy and learning from others also shows a stronger relation. All of these correlations show that in this context self-efficacy, or dealing with problems well, correlates with getting help and learning from others; and not just dealing with problems on your own, just staying put, or just praying to God. Put another way, there is an intrinsic notion that problems are best dealt with using the help of others.

To conclude, individuals who leave the area during times of crisis are more likely to be those who are not gaining local benefits either from neighbourly help, or local learning. By contrast, individuals who stay and cope with challenges well gain help and lessons from others and try to do something in the face of the challenges. In the following sections, 'positive responses' as discussed here are also described as individuals being 'adaptable' or having high adaptability.

5.3.1.2 The Effect of Adaptive Capacities on Adaptive Responses

In general, slum residents report that their level of capacities, rather than their level of exposure to shocks, is the foremost determinant of how well they are able to cope with daily challenges. Additional comments during the questionnaire, and the focus group discussions reveal this to be the case:

“The flooding here [in Bwaise] is not the main problem, it’s the fact that the indigenous people have absolutely no capacity to deal with it.”

This highlights how important it is to understand the capacities that may limit or enable slum-dwellers to adapt to various shocks and stresses. The statements that represent adaptive capacities and social sensitivities (Sections II and III) are correlated against adaptive strategies (Section I), and the results are shown in Appendix 3.

In overview of the results, adaptive mobility does not significantly correlate with capacities, but all other adaptive strategies do. The main capacities that correlate with these strategies are innovation, feelings of control, and belief in change. As in the section above, the correlations do not necessarily imply causation but many are strongly significant. These relationships are now explained in more detail.

Adaptive mobility responses do not significantly correlate with any capacities. This suggests that decisions regarding moving or not are made with reference to other factors. For getting help however, there are strongly significant correlations with adaptive capacities, and different capacities correlate with different ways of getting help. For example, getting help from friends or relatives correlates with belief in change and innovation ($r[659]=.147$, $p\leq 0.001$; $r[714]=.161$, $p\leq 0.001$), while getting help from neighbours correlates with having options – ‘other things to earn money’ ($r[712]=.153$, $p\leq 0.001$). There is a surprising result in that ‘job flexibility’ is moderately *negatively* correlated with some help statements. This negative correlation can be understood given the full statement “I am ready to try a new job”, as individuals who are ready to move on are not likely to be supported by those around them. The other important capacity for getting help as a response to crises is ‘feelings of control’ (over individuals’ circumstances, see row in table in Appendix 3 for many significant correlations). From the pattern of correlations observed (many of which are

highly significant), one can conclude that individuals most likely to receive help are those who believe that their local area can change, think of new ideas to survive, and feel control over their lives/circumstances.

Having covered the capacities that affect whether an individual receives help, the other two responses, self-efficacy and learning from others, also both show strongly significant correlations with capacities (see rows for “Did not give up” and “Learned from others”). Significant correlations exist between self-efficacy and, feelings of control ($r[708]=.258$, $p\leq 0.001$) and innovation ($r[714]=.191$, $p\leq 0.001$); and likewise between learning from others and those two capacities ($r[709]=.164$, $p\leq 0.001$; $r[715]=.249$, $p\leq 0.001$, respectively). Feelings of control and innovation are also two of the more strongly related determinants in the analysis overall. In addition, self-efficacy and learning from others are negatively correlated with certain capacities: ‘options to change’ (with both learning and self-efficacy, $r[714]=- .128$, $p=0.001$; $r[713]=- .126$, $p=0.001$ respectively) and ‘planning and reorganisation’ (just learning, $r[712]=- .195$, $p=0.002$). These negative correlations suggest that *not* focusing on the other things one could be doing helps individuals to deal with the problem in hand, and go to learn from others around them.

In summary, individuals with feelings of control over their own lives, belief in change locally, and the potential for innovation are most likely to respond well to shocks.

5.3.1.3 Effect of Social Sensitivities on Adaptive Responses

Having highlighted the key capacities, the effect of social sensitivities on adaptive responses is explored. The table of results in Appendix 4 shows the multiple correlations between social sensitivities (Section III) and adaptive strategies (Section I). The key findings are that adaptive mobility, as with capacities, does not significantly correlate with any social sensitivity factors. The presence of social networks and a strong attachment to place significantly correlate with individuals getting help. However only an

'appreciation of the local environment' correlates with self-efficacy and learning from others, the other two responses.

Adaptive mobility does not significantly correlate with any social sensitivities, as is the case with adaptive capacities. However there are moderately significant negative correlations between adaptive mobility statements and an appreciation of nature ("Not stay here": $r[704]=-0.106$, $p=0.005$), and feelings for the village ($r[709]=-0.105$, $p=0.005$). The correlation with feelings for the village just shows that individuals who do not like the village do not move back there (which is inherently obvious). But the correlation with an appreciation of local environment is the only factor to do so, and shows how important this factor is. (Although 'local environment' correlates with the ambiguous statement about (not) leaving generally, there are also correlations with the other two mobility statements of shifting elsewhere ($p=0.013$) and to the village ($p=0.056$.)

For 'getting help', attachment to place and the existence of networks are the two factors that correlate significantly, with correlations with all three types of help (neighbours and friends/relatives for attachment to place: $r[710]=0.142$, $p\leq 0.001$; $r[711]=0.100$, $p=0.008$; and general, neighbours and friends/relatives for networks strength: $r[715]=0.105$, $p=0.005$; $r[713]=0.296$, $p\leq 0.001$; $r[714]=0.126$, $p=0.001$). The relation between strength of networks and neighbourly help is strongest, out of the three types of help. While it appears obvious that the existence of networks would lead to individuals getting help, it is an encouraging corroboration of results. We also observe the importance of attachment to place. The other two remaining response categories, self-efficacy and learning from others, are only significantly correlated with an appreciation of nature ($r[706]=0.175$, $p\leq 0.001$; $r[707]=0.202$, $p\leq 0.001$) – as adaptive mobility (leaving the area) was. This reinforces how important an 'appreciation of the local environment' is as a factor of adaptive capacity. As an aside, it is important to note that the relationship between this factor (appreciation of local environment) and adaptive responses does not imply that large numbers of slum dwellers

have high values for local nature, as would contradict the findings of Chapter 4. Instead, it shows that where individuals do report an appreciation of nature, they are high likely to be adaptable also.

In summary, attachment to place appears to be a key characteristic that correlates with individuals getting help in times of crisis. As expected, the existence of both strong, and wide networks does correspond to people getting help from neighbours and contacts further afield. The striking correlations between an 'appreciation of local environment' and all three other adaptive responses is perhaps most intriguing and shows the significance of this factor, and is followed up in Section 5.4.3.

Finally a correlation analysis is carried out to test which of these capacities tend to go hand in hand with one another. Attachment to place, existence of both strong, and wide, networks, and attachment to occupation correlate with each other. Yet an appreciation of nature does not.

Bringing together the findings from above to answer the question of what are the most important determinants of adaptive capacity, there are three key adaptive capacities, and three social sensitivities that correlate significantly with positive response strategies of individuals. The three key capacities are innovation, feelings of control and belief in local change. The three key social sensitivities are attachment to place, the existence of networks and an appreciation of nature. These six factors correlate with positive responses in times of crisis, which suggests that it will be important to foster them in building social resilience. As an important factor, the next section moves on to look more in depth at the specific role of social networks in these contexts, and where individuals get their help.

5.3.2 The Importance of Social Networks in the Adaptive Capacity of Poor Urban Residents

The analysis in Section 5.3.1 reveals six key factors that determine individuals' adaptive capacity in poor urban areas. One of these factors is the presence of networks. In this section the role of social networks in the adaptive capacity of respondents is examined in more detail, using an ego-network analysis. First the correlation of social networks with adaptive strategies is explored, and then the source of that social support is investigated. Of a number of potential variables from the ego-network analysis, two main aspects are considered here: the amount of help, and the composition of individuals' ego-networks. The results reveal two key findings: first that there are two types of social support network that are both important for adaptive capacity, and second that the large majority of social support comes from 'helpers' living within the city.

5.3.2.1 The Effect of Social Network Characteristics on Adaptive Responses

First, correlations between network characteristics and adaptive strategies are carried out, to test the influence of social networks on response strategies. The following is a list of social network measures used:

- a) Amount & type of help:
 - i. Number of alters/amount of help
 - ii. Percentage help that is money
- b) Composition of network:
 - iii. Average time known
 - iv. Number Same origin helpers
 - v. Number Same place helpers

The amount of help was measured using self-reported information from egos (respondents) on how much they were helped by certain individuals during times of crisis. The two indicators for 'amount of help' are the number of helpers, and the aggregate amount of help from all of those

helpers. Non-parametric tests, i.e. Spearman rank correlations, are carried out between the social network variables and the adaptive response scores. This choice of correlation is because while normality was assumed for the Likert scale data, the social network variables do not conform to conditions of normal distribution.

The large number of strongly significant positive correlations seen in the table of results in Appendix 5 shows that social networks are highly correlated with adaptive responses. Unsurprisingly, social networks appear to be very important in how much help individuals receive (see three columns for 'Getting help'), but they also strongly correlate with self-efficacy and learning. Adaptive mobility responses once again do not significantly correlate. The variables that correlate most with adaptive responses are the simple indicators of the number of helpers and the amount of help (measure i) above), while more complex compositional variables show less association with the responses (iii-v)). The results for each adaptive strategy are explored in more detail below.

The only statement that represents adaptive mobility and which (negatively) correlates with network measures is regarding 'shifting elsewhere'. The correlation of this mobility statement with 'length of time known' ($r_{s[701]} = -.119, p = 0.002$), and 'number of helpers from the same place' ($r_{s[701]} = -.111, p = 0.003$) suggests that specifically strong, well-known, local networks are a deciding factor for people to stay rather than move out when problems come. This is unique as other responses correlate with the more general measures of network size, help etc.

By contrast there are somewhat obvious correlations between social network measures and individuals getting help (see table in Appendix 5). This triangulation of methods (presentation of statements, and ego-network analysis) validates the findings. While getting help from friends or relatives correlates with most social network measures, getting help from neighbours is uniquely correlated with the number of helpers living in the same place,

and time known. What this suggests is that neighbourly help is less associated with knowing lots of people, and more about networks of local people that take time to build. This result corresponds to the correlation in the section above, where strong networks had the strongest relation to getting help from *neighbours*, as opposed to general help, or from friends or relatives.

Self-efficacy is strongly correlated with just the simpler measures of amount of help (e.g. Number of helpers, $rs[703]=.137$, $p\leq 0.001$; Amount of help given, $rs[703]=.135$, $p\leq 0.001$). Learning also correlates just with these simpler measures, although is also strongly correlated with the number of helpers living in the same place ($rs[704]=.140$, $p\leq 0.001$). This suggests that learning from others during times of crisis comes through local, rather than wider networks of support.

From the correlations of the four response strategies, it is clear that social networks play an important role in shaping adaptive responses in times of crisis. While simple network measures (e.g. number of alters) tend to correlate in most instances, there also appears to be two slightly different types of network support: first broader social support networks that include material help and second the existence of strong, local networks of not necessarily providing material help that uniquely correlate with individuals not moving out of the area, receiving help from neighbours, and learning from others. Critically this latter type of support is associated with helpers who have been known for longer, i.e. these networks take time to build.

5.3.2.2 The Source of Social Support

While the findings in the section above reveal the type of social support networks that are necessary for adaptive capacity, it is still unclear exactly where that support comes from. The location of the 'helpers' for each ego is therefore now examined. For this analysis, data for individual alters are used (rather than aggregate data for each ego). This is ordinal data on the amount of help from each of those alters, either none (0), a little (1), some

(2), a lot (3), or essential help given (4). This is then disaggregated according to where each alter was currently living, either: the same place, (different area but) the same city, outside the city, or in a different country. Kruskal-Wallis tests are used to compare these categories. The results are shown in Figure 17 below:

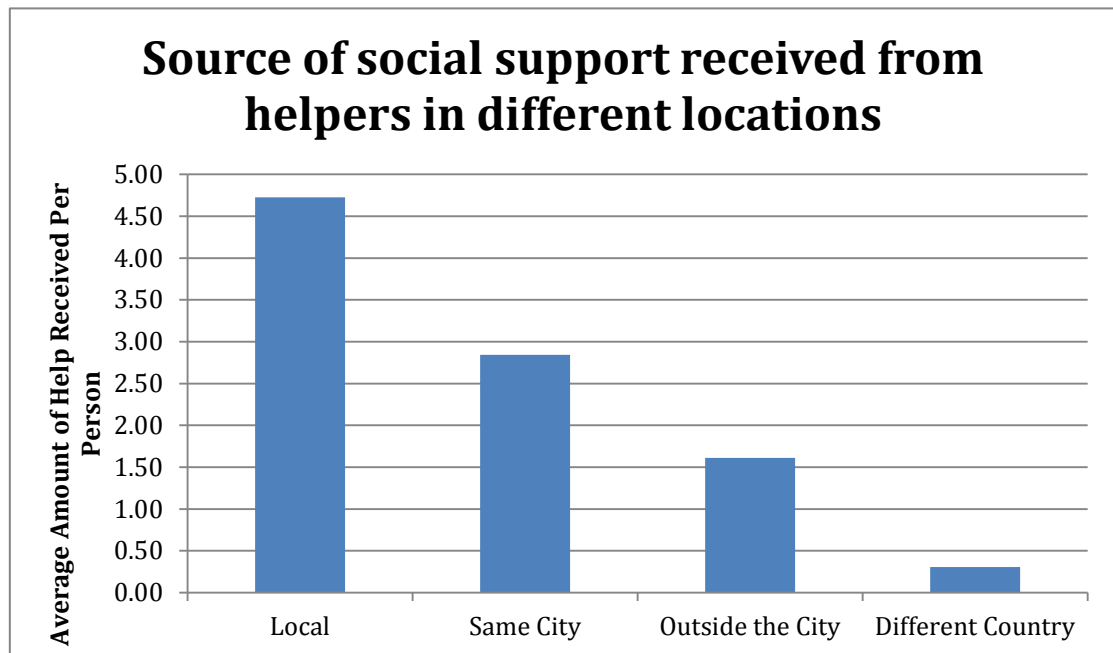


Figure 17: Graph showing average amount of help given to individuals (egos), according to location of alters; on a scale of 0-4 (None, A little, Some, A lot, Essential).

Figure 17 shows clearly how the majority of help comes from alters living in the same area (nearly 50% of average help). This means the same slum area or even the very same 'zone' (sub-area of that slum), but not necessarily their immediate neighbours (as per the statements analysis above). There is still a significant amount of help coming from within the same city (a further 30%), leaving only 20% from beyond the same city, and just a fraction (3.2%) internationally.

There is in fact a statistically significant difference in the amount of help coming from each of these four categories of where helpers lived ($H = 15.949$, $p=0.001$). These findings convey a striking result that adaptive support for individuals in times of crisis comes from helpers located in the

same area, if not the same city. However it should be remembered that this is referring to help received *during a time of crisis*, rather than more consistent help such as remittances. This dynamic is discussed in more detail in Section 6.3.1.4.

The investigation into the role of social networks in adaptive capacity reveals just how important social networks are for adaptive capacity, how there are two types of support, and just how much help comes 'from within' the community or city. Alongside the results of Question 1) above, we now understand what some of the key aspects of adaptive capacity are, and what type of networks help slum-dwellers to adapt to the shocks and stresses of daily life. Evidently these findings are specific to this case, and the question arises whether these results may be generalised to other poor urban areas. By comparing three different study areas, Chapter 6 begins to tackle this question. For now, some of these key findings are discussed.

5.4 Discussion of Findings

This chapter reveals the patterns of adaptive strategies in slum-dwellers in Kampala, Uganda. It then finds six key determinants of adaptive capacity, three 'capacities' and three 'sensitivities', shows how social networks are a key determinant and that two *types* of network are important, and finally investigates the source of that social support. In the next section, all of these results are explored in more detail, and put in the context of other supporting, or conflicting, findings in the literature.

5.4.1 Adaptive Response Strategies

It is important to first consider the actual strategies residents employ in times of crisis, because arguably future interventions should be based around these existing strategies (Kuruppu & Liverman, 2011). For one, residents rarely choose to leave the area during a crisis, rather adapting in whatever ways they can. Chatterjee (2010) found the same result, and that it was because individuals wanted to safeguard (and not leave) their

livelihoods. Instead of leaving therefore, residents often utilise networks of assistance, dealing with problems through getting help from others. The importance of this strategy of 'getting help' is confirmed by the finding that those who leave in times of crisis are not receiving help from others. Others have found that trust and cooperation may be high in slums (Carpenter et al. 2004), making such ways of coping possible. Moreover, the fact that severe problems such as flooding, loss of income, or the death of a relative are dealt with through the help of others is understandable given the limited resources and accrued financial capital that households in these areas have – meaning they have to rely on others to help in such times.

The analysis of strategies also reveals an important negative result regarding 'adaptive mobility'. Adaptive mobility is the only strategy that does not correlate with capacities, sensitivities, or network measures. It should be reminded that adaptive mobility refers to what people did when shocks came, rather than 'adaptive potential' as it is used in other notable publications (e.g. Foresight 2012). Whether moving in times of crisis is a 'positive' adaptive response is debatable; arguably well-adapted individuals will not need to move as they will have the preparations (e.g. household constructed flood defences) or capacities to deal with the problem whilst staying. However the point here is that unlike other responses, mobility does not seem to associate with any particular pattern of capacities or characteristics of the individual; it is hard to predict and presumably determined by other factors.

It is crucial then that we understand how slum adaptation for most individuals takes place, usually being 'in-place' and necessarily involving the help of others. Therefore it could be argued that resilience will best be built in these areas if social cooperation and networks of support are maintained and improved, in addition to building individuals' livelihoods or individual capacities. The way this might occur is followed up in Chapters 7 and 8.

5.4.2 Important Adaptive Capacities

The three capacities that correlate with the adaptive strategies are feelings of control, innovation, and belief in change. Other capacities show mixed or negative responses. These include job flexibility, options to change, and planning. As with the sensitivities discussed in the next section, these determinants do not explain a huge amount of the variation in each adaptive response, but all of them have a strong significant influence on the responses.

Innovation is found here to be a key determinant of adaptive capacity. Other assessments of adaptive capacity have come to similar findings, for instance the importance of the ability to improvise within “room for autonomous change” in institutions (Gupta et al. 2010). Household and community-level studies also stress the importance of innovation for adaptive capacity, for instance being included in ODI’s framework for local adaptive capacity after their review of key adaptive capacity components (Jones et al. 2010b). Previously adaptive capacity assessments have focused more on structural aspects, or the provision of new technology, and therefore not given innovation such consideration. But this misses out on where local innovations are happening and can be nurtured and capitalised on (Levine et al. 2011). Furthermore, the concentration of people in cities gives real potential for urban innovation to contribute towards local resilience, as Arbesman and colleagues (2008) argue. This paper argues that bigger cities generate more innovation because of the greater interactions between people that are “socially distant from each other” (i.e. not family or friends). While it is hard to comment from the evidence of this phenomenon from the one city studied here, the importance of these ‘weak ties’ is discussed below and these linkages interact with the important capacity for innovation.

Innovation has further benefits for individuals. Being innovative or ‘on the ball’ with regard to opportunities will encourage general resilience, as well as resilience to a particular shock. Nielsen and Vigh (2012) found that being alert to financial opportunities enables individuals to adapt to other shocks

such as climate change, as they put it, being “hyper-attentive to real and imagined possibilities”. Barriers to innovation do exist, such as culture or the inability to take financial risks, but both identifying the importance of this capacity as well as its potential barriers will be key for building local adaptive capacity in slums.

‘Belief in change’ and ‘feelings of control’ are the two other key capacities found to be determinants of adaptability (positive response strategies). These capacities touch on intangible, or ‘socio-cognitive’ facets of adaptive capacity that only recently have been given attention in the adaptive capacity literature (e.g. Grothmann & Patt 2005; Kuruppu & Liverman 2011). Many reviews do not include socio-cognitive factors (e.g. Gupta et al. 2010; Jones et al. 2010b; Arup 2011), albeit because they are focusing on a community or national scale where they are hard/inappropriate to consider. However empirical work shows that for individual resilience, they are key.

Other studies have also found that socio-cognitive factors such as belief in change and feelings of control are important in determining adaptive capacity. Kuruppu and Liverman (2011) found that individuals’ belief in their own abilities is a crucial factor for driving intentions to adapt. Petheram and colleagues (2010) found that community self-image and trust in the government helps communities to foster adaptive capacity. The current study separates ‘feelings of control’, which relate to the individual and are more akin to Kuruppu and Liverman (2011), as opposed to ‘belief in change’ (locally), which is more about their relation with the local context, more similar to Petheram and colleagues’ conceptualisation. Together, they both form a part of ‘perceived adaptive capacity’.

Perceived adaptive capacity therefore is of utmost importance for local resilience, and has shown can limit the actions that people take because they do not believe that their actions will change a situation (Patt & Gwata 2002). Despite being from entirely different contexts (e.g. farmers and climate-induced crop changes in Patt & Gwata) the findings here are consistent with

the empirical studies mentioned, and furthermore perceived adaptive capacity is an important factor in the slum context – where the existence of constant threats such as violent crime mean residents often report to have little hope of changing their situation. Perceived adaptive capacity will also be influenced by the nature of the shock, for example climate change being long-term and uncontrollable, as compared with impact on water resources being more tangible and therefore easier to consider adaptive options (Kuruppu & Liverman 2011). The complex nature of the socio-cognitive factors involved in perceived adaptive capacity require greater understanding, but the key message is that for strong adaptive capacity, individuals need to feel they can affect their situation and have a sense of control over their lives.

In addition to highlighting the most important capacities that determine adaptability, it is important to make the more general point shown here that these different ‘capacities’ really do influence the resilience of slum residents. This is important to note when perspectives in high or middle-income countries might focus on urban resilience in terms of ‘accumulated resilience’ – services and infrastructure mainly provided by the government. In the context of slums however, of course much of this is not provided, and so resilience comes from inbuilt assets, capabilities, and networks (Satterthwaite 2012). After all, there are profound differences in the vulnerability of cities in developed and developing countries (Gasper et al. 2011). It is important therefore to note that in the absence of some of these provided ‘safety nets’, the levels of certain capacities indeed make an impact on individuals’ adaptability.

5.4.3 Important Social Sensitivities

Social sensitivities are also highly correlated with adaptive responses. In this case, the three key determinants are attachment to place, the existence of social networks, and an appreciation of nature. Attachment to place and the existence of social networks strongly correlate with individuals getting

help, while having an appreciation of the local environment correlates with not giving up, not moving, and learning from others in times of crisis. These results again support the notion of building a 'sense of place' and how multiple factors contribute towards this important quality. Each of the three factors are discussed below.

Attachment to place (or 'place'), like other socio-cognitive capacities and perception factors, has been under-represented in its importance in determining social resilience (Adger et al. 2011). There has not been a large degree of overlap between place research and that of social capital or social resilience, but there is plenty of evidence to show that 'place-attached persons' are generally more satisfied with life overall, have stronger bonding social capital as well as local ties, trust people more, and are less "egocentric" (Lewicka 2011 for review). Given the links between social capital and adaptability (e.g. Adger 2003; Yohe & Tol 2002), it makes sense that 'attachment to place' is such a strong correlating factor with adaptive responses in this study.

The second key social sensitivity, that is perhaps the most intriguing, is an appreciation of the local natural environment. This factor strongly correlates with getting help, self-efficacy and learning, where other sensitivities do not correlate at all. Mulago shows the highest appreciation for the local environment (mentioned in more detail in Chapter 6), and is the area where there is most natural space despite still being a relatively degraded natural environment. The correlation of adaptability with an appreciation of the local environment shows how even small amounts of green space, clearings with large trees providing shade and meeting places, football pitches etc, may be critical for a community's attachment to place and associated adaptability. It is hard to find examples from similar slum contexts, or such an 'appreciation of nature' in adaptive capacity literature. However, the place literature supports the importance of place and ecological features, emphasising the importance of "unique natural and cultural components" for forming place attachment (Lewicka 2011; Adger et

al. 2011). While this literature is based on empirical work in very different contexts such as pristine arctic environments (Adger et al. 2011), the mechanism may be similar to the attachment to place that is occurring here in the slums. Instead, individuals may 'attach to' significant clearings or large trees providing shade and a meeting place amongst the slum.

The third key social sensitivity is the existence of social networks. Given how slum challenges often necessitate the help of others, the importance of networks is clear. For instance dealing with severe flood events requires many people to help shift the water out of people's homes and buildings. Networks also interact strongly with other social sensitivities so it is worth discussing this before the actual ways in which networks influence adaptability.

In her review of place attachment for instance, Lewicka (2011) showed that 'community ties' are the strongest predictor of attachment to place, specifically neighbourly relations. Ecological features, or environmental quality, were the other most important factor she found to determine place attachment. It is encouraging therefore that in the current study, all three of those features that Lewicka finds interrelate (social networks, ecological appreciation, and place) are the same three most significant determinants of adaptive capacity. The correlations indicate that by enhancing these features (social networks, ecological appreciation, place), it will promote resilience. Furthermore, while the direction of causality is hard to disentangle, these three features are likely to support self-perceptions of adaptive and innovative capacity, which are shown above to be important capacities. In other words, there will be an interaction between 'capacities' and 'sensitivities' as they have been delineated in this chapter.

5.4.4 The Importance of Social Networks and Types of Networks Involved

Social networks are an important factor in this study – both in that people respond through getting help, and that networks significantly correlate with

adaptive capacity generally. The ego-network analysis also reveals the aspects of social networks that make them important for adaptive capacity, including the existence of two types of social support.

The first social network finding to discuss is simply their high significance for the adaptive capacity of poor urban residents. Social networks correlate with a wide range of adaptive responses, and both in terms of strength and width of networks. Chapter 2 illustrated how social networks are a significant contributor to social resilience and adaptive capacity generally. Studies in urban Africa, particularly informal or poor urban areas, also find this (e.g. Lyons & Snoxell 2005; Adama 2012). Likewise in the slums of India, the “loss redistributive system”, made up of an individual’s linkages that might enable them to gather support during and after a time of crisis, was found to determine individuals’ ability to recover from urban shocks (Chatterjee 2010). In this study, linkages were characterised by local to global, formal to informal. The current study only focuses on individuals but the premise is the same – those linkages to individuals, organisations, officials, government etc are critical in determining adaptive capacity to shocks. In another key study in this field, Lourenço-Lindell (2002) describes in detail how social networks act as vital coping mechanisms for the poor, acting as “networks of survival” (Lourenco-Lindell 2002). In another, Kabiru and colleagues (2012) find that ‘resilient’ young people tend to have supportive parents, friends who have certain positive values, and belong to religious groups – i.e. their networks are key. This finding of social networks being central to surviving and becoming resilient in poor urban areas seems consistent with other geographical locations.

In addition to building resilience, it appears that strong, local networks encourage people to stay during times of crisis rather than leave the area. Of course the correlation of social networks with adaptability traits also indicates that where individuals do not have social networks, they do not show adaptive capabilities. And a significant number of respondents had little or no supportive networks, with 17% of interviewees having zero or

just one social 'supporter' and over 30% only two or less. But the relationship between social networks and slum survival or resilience is not entirely straightforward. Lourenco-Lindell (2002) explores the dynamics of these relations in more detail in her in-depth network study, noting that social networks cannot always be relied upon to provide the social capital required for the poor. She found that due to power imbalances some networks left individuals vulnerable. She also found that where material resources were acutely low, networks did not protect people from crises – for instance they were not able to contribute to, and benefit from, savings groups. Tutu (2012) also found that while membership of certain social groups correlates with self-rated levels of resilience, only strong leadership and having a boyfriend/girlfriend were major predictors in terms of social capital measures. Networks should not simply be invoked as a way in which poor urban residents survive therefore. However the range of examples show where networks have played a critical role in the adaptive capacity of slum-dwellers (e.g. traders in Nairobi in Lyons & Snoxell; informal economies in Nigeria in Adama and Burkino Faso in Berrou & Combarnous; young people in Kenyan slums in Kabiru et al.; survival networks in Kampala in the current study). This tension requires a nuanced response in order to address the vulnerabilities of those particular individuals or groups who lack the social support networks. A consideration of such heterogeneities is followed up in Chapter 6. These complexities do not refute the important point that this study makes, that "resilience rests, fundamentally, on relationships" (Luthar 2006).

As well as being important in general, the ego-network analysis reveals that two different types of networks appear to support adaptive capacity. These two network types are local networks from which individuals are helped by their neighbours, especially learning in times of crisis; and more general networks, linked to friends or relatives. The local networks do not necessarily involve material help but are uniquely correlated with not moving out of the area, getting local help, and learning from those around; while the broader networks involve material help and are correlated with

getting help and self-efficacy. Lourenco-Lindell (2002) made a slightly different distinction and found that kin and neighbours provide money and food (as opposed to non-local networks here providing material help). Her study included neighbours with kin while the current study separates them ("friends and relatives" only), but also it included market-based networks (not included here), which are important. Though categorisations differ, the key point is that ties with family/friends, neighbours, and market-place connections will differ by tie strength and type, but all perform useful adaptive functions. Evidently the distinction might not be clear in all instances (e.g. between neighbours on the one hand and distant friends on the other), but the evidence does suggest a difference in type and function of tie, for which the distinction is useful.

In fact, the local/neighbourly versus broader friend/relatives network distinction is somewhat akin to 'autonomous' versus 'embedded' ties that other authors distinguish as being fundamentally different but both serving positive economic outcomes. "Embedded social relations" (Berrou & Comparnou 2012) or "inherited social capital" (Lyons & Snoxell 2005) are the links that individuals already have through friends and family who are not necessarily in the same location as individuals. But as all these studies show, individuals also intentionally form local links with people around them (the autonomous ties too), and these links are critical – for learning from others in crisis times, and forming business relations in others for instance. As many of these networks will be embedded in sociocultural contexts of each individual, and networks are so important for adaptive capacity, the presence/absence of such autonomous (local) networks starts to explain why different migrant groups might show different adaptive capacities, as discussed in more detail below.

The distinction of local networks versus broader networks of friends or relatives found here also parallels the discussion on bonding versus bridging capital, and strong versus weak ties (Granovetter 1973). I propose that in this context, the weak ties – in terms of social support – may often be those

ties that individuals have not 'chosen' but are a consequence of where they live or who they have ended up doing business with (and so would still not necessarily help out in times of crisis). So while the strong ties are most often to family and friends, which are the links that provide the material help, it is the weaker ties that enable the local opportunities for work.

Both strong/bonding and weak/bridging ties serve a purpose: bridging social capital is very important for the success of industry, or basic enterprise activities (e.g. in fishing organisations, Marín et al. 2012). Indeed, Granovetter (2000) links weak ties with entrepreneurship, and strong ties with trust, while Ernstson and colleagues (2010) link weak ties with innovation. Given the importance of innovation demonstrated above, it is evident that weak ties will be important for slum survival. This is the reason why bigger cities will have greater innovation potential, essentially given the larger number of weak ties that may be formed. In business, these links are key (Lyons & Snoxell 2005; Adama 2012), however are also more vulnerable in times of crisis. On the other hand, of course strong ties will also be crucial, when it comes to individuals receiving help of some kind potentially with no return - as is the case when individuals give material or other support in times of crisis. Adama (2012) also argues that in the context of African informal economies, with the uncertainty and instability that exists, strong ties will favour approachability and therefore be more resilient and efficient in facing shocks. Hence rather than the argument that strong ties may impede economic activities (Barr 2002), Adama argues that in fact it is about the "strength of strong ties" for determining economic performance. Instead the trust, length and regularity of contact of strong ties allows access to financial support which may be required in times of crisis. Further, there are multiple ways to describe the strength of ties from older definitions including time, emotional intensity, intimacy, and reciprocal services to more current literature simplifying to frequency of contact and/or emotional intensity (Granovetter 1973; Jack 2010). In fact, it is also discovered in later analysis (see Section 6.3.3.1) that the time alters are

known affects the amount of help given, supporting these other ways of measuring strength of tie.

The weak versus strong ties debate is complex and the boundaries may not always be clear, but the findings here make a straightforward but powerful point – that both strong and weak ties are necessary for slum adaptive capacity as they serve separate functions in the adaptation process. Strong ties will be critical when help is needed in times of crisis, particularly material or financial support from friends or relatives. For individuals not in such chronic stress or when trying to build enterprise and innovate in the slums, many weak ties become important. As Berman and colleagues (2012) put it, this is when the transition is made from coping to adapting or even transforming. For the adaptive capacity of slum dwellers, a useful mix of strong and weak ties, of both embedded social relations and more autonomous ones is necessary.

5.4.5 The Source of Social Support

The large majority of social support for individuals comes from ‘within’ – helpers of the respondents living within the same city if not the same area. The above discussion suggests that both neighbourly networks as well as links elsewhere are of adaptive significance. Regarding location, the analysis of alter help shows that only 20% of help for individuals in times of crisis comes from outside of the city, and half of all help comes from within the same area (regardless of whether they were friends/relatives or neighbours – see Figure 1). To clarify, the discussion of strong and weak ties is based on the statements analysis and a distinction of "neighbours" versus "friends and relatives"; meanwhile this geographical analysis is based on the ego-network analysis and categories of "same place" (meaning the same slum area or 'zone'), "same city", "another city/countryside", and "another country".

While this study did not set out to understand the nature of rural-urban linkages, the finding that the majority of help comes locally throws into question some assumptions about the nature of rural-urban linkages. Many recent studies have emphasised the importance of these linkages, not just for the resilience of rural households, but also the survival of poor urban households (Mberu et al. 2012; Owuor 2007; Satterthwaite & Tacoli 2002; Tacoli 2002). Linkages to rural areas are supposed to be 'safety nets' for vulnerable urban households, for instance providing food security (Frayne 2004). On the contrary, this study suggests that in times of crisis, it is not the linkages with rural areas that provide sources of resilience for poor urban households, rather the majority of help comes from helpers living in the same area, or others also living in the city.

The discrepancy between the finding here of local support and the importance of rural-urban linkages may well be due to divergences with study design. For instance Mberu and colleagues (2012) only focused on old people in Nairobi informal settlements, and other studies focused on livelihoods in general rather than resilience to shocks. However the ecosystem service results in Chapter 4 also contradict existing studies, showing little provision from rural areas. Chapter 4 presents that only 15% of individuals receive food from the village, while Owuor (2007), Frayne (2004) and others argue that food production for urban households from rural areas is important for survival. In fact in Owuor's study, also in Kenya, only 5 per cent of urban dwellers returned from rural visits with money, and given the point in time (dataset analysed for this result was from 2001), it would be interesting to compare the situation now. What is clear is that the current study challenges, both in terms of social support and provision of ESS from rural areas, the importance of rural links as stated elsewhere.

This is not to say that rural linkages are of no importance for poor urban households however. This is not the point, as this study does not investigate livelihoods in general. The point is that for resilience to shocks, social support networks that provide emergency relief generally consist of

individuals living within the same city, if not area. The support comes from those 'strong ties' of friends and relatives living within the city. On this subject, one final question is raised: how will those linkages of poor urban households to rural areas change over the coming generations? It is not inconceivable that these linkages might erode with time: it appears that younger generations have less interest in returning to the village, and as this trait continues through time it is likely to increase the level of independence of future urban populations. Cohen (2011) found that migrants to urban areas rarely sever these ties, while on the other hand Mberu's study found that with increasing duration of residency there was a propensity to not maintain origin links. Other studies have shown that economic pressure and urbanisation tend to lead to decoupling of interpersonal relations within and outside communities, and are replaced by personal networks that cross those traditional social institutions and groups (Berrou & Comparnous 2012; evidence from Lourenco-Lindell 2002; Meagher 2005).

Whether or not those rural-urban linkages do erode with time, the dynamic that is observed in this study is that while both strong and weak ties are necessary for slum survival, adaptive capacity in crisis situations originates within the city. The resilience of individuals in the slum areas depends on intra-city-dependent relations and, as opposed to rural areas, is not so dependent on rural-urban linkages. This emphasises again the importance of local social cohesion for resilience of these communities.

The final finding in terms of social networks is that the local networks of well-known individuals take time to build. These 'local networks' are the neighbourly networks that are described above as weak ties providing non-material help. The evidence that these local links take time to build comes from: correlations between time alters are known by the ego and the number of helpers specifically living in the same place; and the adaptive responses of getting help from neighbours, and not leaving the area. (Other results on adaptive capacity changing with 'time' are presented in Chapter 6, but the results in Chapter 6 refer to correlations with 'duration of residence')

data, rather than ego-network data as here.) The result of local networks 'taking time' is that it will be hard to expect high levels of community resilience in areas where people struggle to settle and 'make roots', for example where eviction is a threat, or people are regularly moving in and out as in the inner city.

The detailed findings discussed in Sections 5.4.4 and 5.4.5 show that as there is a case for examining individual capacities when trying to understand adaptive capacity, one must also consider an individuals' social networks, and not just in simple terms but also certain details such as the balance of strong and weak ties.

5.5 Limitations & Improvements

The limitations of the adaptive capacity assessment presented in this chapter include trade-offs between a general and specific resilience approach, the inability to cover all potential factors of adaptive capacity, and the challenge of defining and measuring a 'resilient response'.

Firstly the approach of focusing on general resilience, i.e. multiple shocks, lacks the accuracy of a singular focus on one challenge or shock. For instance just focusing on climate change as many adaptive capacity studies have (e.g. Paavola 2008; Marshall 2010; Berman et al. 2012) allows a potentially greater depth of understanding of the process of adaptive capacity formation for that particular shock. However a specific approach lacks robustness to multiple 'pathways', and only captures the ways in which individuals respond to that particular shock (Cinner et al. 2012). Furthermore, focusing on reducing the vulnerability to one set of shocks at one point in time might in fact result in trade-offs in resilience to others, or indeed system resilience (Nelson et al. 2007; Daw et al. 2011). Importantly, the results of this chapter (Section 5.3.1.2) show that individuals in the context of the slums do indeed face many multiple shocks, often simultaneously, and which differ across the city. In addition to the pitfalls of

focusing on specific shocks, it would be hard to work out and assess the most significant shock for each individual, and anyway these would change with time. Despite the limitations then, the approach taken in this chapter seems appropriate.

It should also be mentioned that the adaptive capacity questions are framed around shocks that *individuals* are facing, rather than 'communal' or societal challenges. For instance the ego-network analysis is based around a question of challenges that individuals faced, rather than the community as a whole, that individuals might have also responded to. So we should bear caution in generalising the conclusions here to broader crises or collective action. In future, it would be useful to consider multiples scales, a recommendation in fact for resilience assessments in general (Walker 2004). Lastly a multi-scale as well as multi-stressor approach would help to give a more holistic understanding of resilience and vulnerability (Bunce et al. 2010).

In addition to the actual framing of the assessment, the details of its implementation could also be critiqued and potentially improved. Chapter 3 describes the detailed process by which statements were selected and refined in order to represent the facets of adaptive capacity. Some of the groups of statements had to be reduced to single statements, as the consistency between the others was not high enough to group them. Evidently the validity of a few of the adaptive capacity factors, such as learning, feelings of control and innovation, came down to these individual statements. While all these individual statements appear appropriate and the selection process was rigorous, it is worth trying to find other statements to group with these individual ones, to improve reliability next time.

There are undoubtedly other adaptive capacity factors/determinants that could have been included. The results of the correlation analysis indicate that while these determinants definitely influence adaptability, each

determinant alone cannot explain a large amount of the variation. This is understandable given the complexity of human responses, and the likely synergy of multiple factors. Furthermore, there could have been more of a focus on barriers to actual actions or the adaptation process itself. But given the focus on key determinants of adaptive capacity, and the review of the literature and pre-study testing that was carried out, the selection of adaptive capacity factors is a reasonable and justified attempt to cover the breadth of factors within a pragmatic research design. The details of which features of adaptive capacity should be included in its assessment is discussed in full in Chapter 7.

The social (ego-) network analysis could have been carried out in greater depth too. The ego-network analysis has the potential to provide more information on individuals' network composition for example occupation diversity or type of help, as well as network structure such as density or effective size of the network. The measure for the strength of tie could have been improved, for instance by using multiple measures and a weighted composite measure, as others have done (Adama 2012). However for the purposes of the research questions addressed here, the appropriate depth of analysis was carried out.

Finally there is an inherent limitation in working out a 'resilient' response without seeing the response 'in action'. Unless one actually observes the adaptive response first-hand, there is the challenge of relying on self-reporting. Of course observing the adaptive response would be a challenging and time-consuming research approach, although highly revealing. Therefore while this approach was not followed, efforts were made (see Section 5.2 on asking about responses to real shocks "this last year" only) to get as close as possible to finding out the adaptation outcomes.

5.6 Summary of Chapter 5

This chapter has found the patterns of adaptive strategies that slum-dwellers tend to employ in times of crisis; three key capacities that determine adaptive capacity (feelings of control, belief in change, and innovation); three key social sensitivities (attachment to place, the existence of networks, and an appreciation of nature); the importance of, and two different types of social network required for adaptive capacity; and the source of social support that comes from those networks. While some say the most important factors for adaptive capacity in slums are structural, or macro determinants such as population growth, demography and livelihood characteristics (Elias et al. 2011), the evidence here shows that socio-cognitive, or perceived capacities are critical too. Resilience in these contexts “rests on relationships” as much as individual capacities. More than that, different *types* of networks are required for individuals to both adapt and thrive, and some of these take time to build. Evidently there are other factors that are important for adaptive capacity too, such as structural or demographic factors, asset requirements, and institutional/governance factors, which are not covered here. However the analysis gives tangible results for capacities such as innovation and sense of place that can be built on, in order to build local adaptive capacity. Some of the debates of the importance of these factors is followed up in Chapter 7, and ways in which they might be built upon and turned into practice is considered in Chapter 8.

Chapter 6: The Differences in Adaptive Capacity Between Slum Areas, Population Groups, and Time

6.1 Background to the Chapter

Chapter 5 successfully highlighted key determinants of adaptive capacity for the residents of the three slums, as well as the ways in which social networks are important for slum-dwellers' adaptability. This chapter moves on to compare the adaptive capacity of the three slum areas, in order to understand how resilience may differ across different slum areas of a city. In addition, it compares adaptive capacity and social networks across different population groups, and with individuals' duration of residence in the slum. The findings involve significant differences in all three comparisons: slum areas differ both in the shocks they face and the average adaptive 'profiles' of their residents; migrant groups display different adaptabilities, mainly distinguished by different levels of social support networks; and there are significant changes to local facets of adaptive capacity with duration of residence.

As reviewed in Chapter 2, studies have already found that the vulnerability, or adaptive capacity, of slums is heterogeneous (Chatterjee 2010; Agarwal & Taneja 2005; Jankowska et al. 2011). The research design of this study is specifically around comparing inner city with more peripheral slums, in order to consider how adaptive capacities may change with spatial development of a city and by inference, with time. In this way, it is hoped the findings of this chapter in particular may be generalised to a greater extent. The other two comparative analyses in this chapter, comparing specific population groups and changes with duration of residence, simply use disaggregated data (population groups), and correlations (duration of residence).

Each "slum" is defined using the simplistic definition from the United Nations as discussed in Chapter 2, as a "run-down area of a city

characterized by substandard housing and squalor and lacking in tenure security”. Administrative boundaries are used as outlined in Chapter 3, comparing a sample of zones within three parishes of Kampala city: Kisenyi II, Mulago II, and Bwaise II. A description of the specific analyses carried out in this chapter is presented in the following section.

The third and final Research Question that frames this chapter is:

Question 3: How do adaptive capacities and social networks differ across poor urban areas and with time?

This is broken down into three sub-questions for the investigation in this chapter:

- 1) *How do adaptive strategies, and capacities, differ across slum areas?*
- 2) *How do adaptive capacities differ between specific migrant groups?*
- 3) *How do adaptive capacities change with duration of residence?*

6.2 Methods & Data

These three research questions are answered using the same data that were analysed in Chapter 5, from the social survey of 720 slum dwellers across three slum areas in Kampala. The methods used to obtain these data are outlined in more detail in Chapter 3 and Section 5.2, hence are not repeated here. In short, the primary method of data collection was a social survey that included an adaptive capacity assessment (statement ranking exercise) and a social network analysis tool.

As described in Chapter 3, the number of respondents was carefully chosen in order to carry out a statistically significant comparison between three slum areas. Roughly 240 questionnaires were carried out in each of the

three areas. For the first research question, adaptive capacity scores and ego-network analysis scores as in Chapter 5 are compared using a Kruskal-Wallis test, given that the data did not all conform to assumptions of normality. The second research question utilises the same data, disaggregated according to a few specific population groups (explained in more detail in Section 6.3.2). Individuals from these groups (e.g. Karamajong migrants) were separated from the main sample using background information in the main part of the questionnaire. As there are only approximately twenty individuals in each of the migrant groups, statistical comparisons could not be carried out. However this analysis is complemented with qualitative information from the focus groups, as described in Chapter 3. The third question correlates data from Chapter 5 (adaptive capacity and social network scores) according to the duration of residence of residents (from the main section of the questionnaire). The data were analysed using SPSS.

The results are presented in the order of the research questions noted at the start of the chapter, starting with a comparison of the three slum areas.

6.3 RESULTS

6.3.1 The Differences in Adaptive Capacities and Social Networks Across Three Slum Areas of the City

This section presents the analysis and results of the first research sub-question of this chapter, regarding the differences in adaptive capacities and social networks between the three slum areas studied. First the impact of a few specific shocks is compared across the three areas; second the average adaptive responses; third the average scores for adaptive capacities and social sensitivities; and fourth the average social network scores from the ego-network analysis. The analysis shows that the three areas in the city face different types of shocks, although in spite of this the average responses are similar. The exception to this is the amount of social support that individuals receive within the three slums, which differs significantly. The

three slums have significantly different average capacities and sensitivities, although when some factors are higher in one place, others are lower (i.e. they are not uniformly higher/lower in different areas). Finally the ego-network analysis results confirm the distinctive adaptive response of getting help, as there are significant differences in the amount of social support in the three areas.

In order to analyse the differences in adaptive capacities and social networks between the three areas, the scores from the adaptive capacity assessment and ego-network analysis are compared across the three study areas of Kisenyi (inner city), Mulago (middle), and Bwaise (periphery). Looking first at how shocks (impacts), responses, and capacities and sensitivities might differ across the three areas, a comparison of average scores for each sub-section is shown in Table 5. Where groups of statements were used for sub-sections in Sections II and III, one statement is used to represent the composite score. These findings are then presented in Sections 6.3.1.1 to 6.3.1.3. Following this, a comparative analysis of social support in the three areas is presented in Section 6.3.2.4, on the basis of the ego-network analysis results.

Table 5: Average scores on adaptive capacity factors from presentation of statements, for each slum study area; results according to 1-4 Likert scale of disagreement-agreement. Statistically significant results (according to Kruskal-Wallis test) in bold.

<u>Adaptive Capacity Statements</u>			
<u>IMPACTS</u>	KISENYI	MULAGO	BWAISE
Flooding	1.72	1.36	3.72
Money	3.35	3.56	3.72
Loss of life	2.72	3.09	2.88
Sickness	2.62	2.91	3.07
<u>I - ADAPTIVE STRATEGIES</u>			
Adaptive mobility			
<i>Shift elsewhere in city</i>	1.80	1.63	1.61
<i>Shift to village</i>	1.68	1.58	1.53
<i>Stay here (inv)</i>	1.73	2.17	1.84
Help			
<i>No help from others (inv)</i>	2.51	3.07	2.82
<i>Help from neighbours</i>	2.42	2.68	2.79
<i>Help from friends/relatives</i>	3.01	3.21	3.13
Self-Efficacy - Gave up (inv)	3.06	3.18	3.09
Learned from others	2.91	3.16	3.13
<u>II - DIMENSIONS OF RESPONSE</u>			
Feelings of control - Believe can change my life	3.48	3.58	3.51
Belief in change - Believe will get better	3.17	3.14	2.87
Readiness to move - I am ready to move if life gets worse	3.50	3.31	3.14
Innovation - Thinking of new ways to earn	3.39	3.43	3.29
Job flexibility - Ready to try a new job	3.61	3.41	3.37
Options to change - Many other things can do to earn	2.43	2.22	2.42
Planning & preparedness - Prepared for when problems come	2.88	3.05	2.68
<u>III - SOCIAL SENSITIVITY</u>			
Appreciation of nature - Want to look after natural environment	3.17	3.25	3.00
Attachment to place - I am proud to tell people I live here	2.74	2.84	2.62
Feelings for village - Would prefer to live in the village (inv)	3.29	3.35	3.37
Attachment to occupation - Proud of my job/what I do	2.78	2.93	2.83
Strong networks - Have strong friendships	2.87	2.91	3.07
Wide networks - Socialise with different people	3.25	3.14	3.15
<i>Socialise with those around (inv)</i>	3.17	3.34	3.09
Employability - Do not have abilities to do another job (inv)	3.05	3.33	3.26

The results of the analysis presented in Table 5 are statistically compared using Kruskal-Wallis tests (applying appropriate Bonferroni corrections as already mentioned), and the results can be found in Appendix 6. The results that are significantly different are shown in bold. The following discussion of individual differences is based on Tamhane's post-hoc statistical tests, although the statistics that are mentioned in the text below are the Kruskal-Wallis comparisons, as these show the analysis of difference across the three groups.

6.3.1.1 Differences in the Shocks Experienced in Each Slum Area

The first set of results in Table 5, under 'Impacts', shows that the three slum areas suffer disproportionately from different shocks, and this is confirmed by the Kruskal-Wallis results in Appendix 6. This difference was in fact observed during the pre-study and during the course of the research, and is confirmed from the response scores from individuals in this analysis. Bwaise residents suffer from flooding far more than other areas ($H=411$, $p \leq 0.001$), where loss of money is also a big impact. For loss of life, Mulago residents suffer the most ($H=11.9$, $p=0.003$). As a possible explanation for this result, respondents in Mulago often mentioned levels of corruption, crime, and murder there. Finally regarding sickness, respondents in the inner city slum (Kisenyi) have less of a problem than elsewhere ($H=17.2$, $p \leq 0.001$). Overall therefore, inner-city residents report lower levels of impact from severe shocks such as flooding, loss of money, loss of life, and sickness. This may be because in the inner-city slum there is greater access to services. At the same time however, many threats are not included here such as eviction, which is certainly a threat for Kisenyi residents.

6.3.1.2 Differences in Adaptive Responses in Each Slum Area

While the impacts experienced in each slum are different, the ways in which residents respond are actually relatively similar (see results in Table 5 under 'Adaptive Strategies'). The one response that differs between the areas is in how much help residents receive in times of crisis ($H=46.8$,

$p \leq 0.001$). Kisenyi is significantly worst in this regard, residents getting least help from friends/relatives and neighbours. Residents of Mulago receive the most help from friends/relatives in times of crisis, while Bwaise shows marginally more help from neighbours. Mulago also shows significantly higher scores for people not 'just staying put' ($H=27.8$, $p \leq 0.001$), and marginally higher self-efficacy. It therefore appears that in terms of adaptive response, Mulago residents demonstrate more adaptability (even if this is their ability to temporarily leave).

6.3.1.3 Differences in Adaptive Capacities and Sensitivities in Each Slum Area

In terms of the capacities and sensitivities, there are higher levels of individual capacities in the inner city area. One notable difference apart from this overall trend is a particularly elevated appreciation of nature in the middle-urban slum, Mulago ($H=11.6$, $P=0.003$). On examination of the scores in Section II and III in Table 5 (noting the bold for statistically significant differences), Bwaise shows significantly lower belief in change ($H=11.1$, $p=0.004$), innovation ($H=12.5$, $p=0.002$), job flexibility ($H=16.7$, $p \leq 0.001$) and planning capabilities ($H=19.6$, $p \leq 0.001$). By contrast, while slum residents in Kisenyi receive less help from others around them, they show stronger belief that the area will get better and have a stronger willingness to try new jobs. In short, the inner city slum (Kisenyi) shows higher individual capabilities.

This makes sense given the area that Kisenyi is, in the centre of town where residents are seeking out employment opportunities but are not necessarily forming strong social groups; the area is full of business but also fragmented with isolated people groups including many international migrants. In Bwaise on the edge of the city on the other hand, individuals face severe challenges, some stuck in flood-prone areas not able to sell their properties, showing less capacities to adapt and yet receiving greater help from each other in times of crisis. To a large simplification, Mulago could be described as being somewhere in between.

The other particular difference between the three areas is the factor of ‘an appreciation of nature’, which is significantly higher in Mulago (middle-urban). Again this makes sense given that in Kisenyi there is no space for anything ‘natural’ (individuals made that exact comment), in Bwaise people have a strong negative view of nature given their vulnerability to flooding living on/adjacent to the wetland, while in Mulago there is the occasional clearing, large tree providing shade, or makeshift football pitch in an open area. These simple natural characteristics of the slum landscape apparently make a big difference to people’s appreciation of their surroundings – and as observed in Chapter 5, a correlation with their propensity to adapt.

6.3.1.4 Differences in Social Support in Each Area

The previous three sections are based on the adaptive capacity assessment scores presented in Table 5. By utilising the results of the ego-network analysis, this section describes the differences in social support in the three slum areas. This analysis shows that the average amount of social support that residents receive in the inner urban slum is significantly less than on the outskirts of the city. In combination with other network measures, the peripheral slum shows greater social cohesion, in contrast to the lower individual capacities described above. In addition, an analysis of the location of alters shows that in the peripheral slum, more help ‘comes from within’ (i.e. helpers living locally), again supporting the finding that social cohesion is lower in the inner city despite individual capacities there being higher.

While the comparison of results from the adaptive capacity assessment (in Table 5) has shown a number of key differences between the three areas, the results of Chapter 5 and the differences in adaptive responses (Section 6.3.1.2 above) suggest that there are also significant differences in the social support that residents of each area receives. In order to assess this, the results of the ego-network analysis are compared for each area. This involves averaging the network measures for the individuals in each area. A

comparison of average figures for key social network variables is shown in Table 6, the statistical comparison for which can be found in Appendix 7:

Table 6: Average scores for ego-network measures across the three slum areas; the "amount of help" was from a 4-point scale summed across all the alters; the "%from same origin" refers to alters of same origin as ego; "% from same place" to alters living in the same slum area as the ego. Statistically significant results according to the Kruskal-Wallis test shown in Appendix 7 are shown in bold.

	Average Duration of Residence (days)	Mean no. Alters	Mean Amount of Help	Mean no. Helpers - Material help	Mean % from Same Origin	Mean % from Same Place	Mean Time Known
KISENYI	3246	3.08	8.34	2.48	54%	43%	40.79
MULAGO	3416	3.80	9.33	2.63	53%	49%	44.63
BWAISE	3580	4.32	10.98	3.27	43%	59%	49.50

Table 6 shows that in times of crisis, residents of Kisenyi receive much less help than the other two areas, Bwaise residents receiving the most ($H=30.1$, $p \leq 0.001$). This finding corroborates with results for 'getting help' from the adaptive capacity assessment. Residents of Bwaise also receive the most material help (food, money, resources etc as opposed to advice or emotional support – $H=25.4$, $p \leq 0.001$), and residents have the longest-known helpers ($H=15.1$, $p=0.001$). This is consistent with the idea of greater social cohesion in this peripheral slum, despite lower individual capacities.

Having found differences in the average amount of help that slum residents receive, another important aspect of understanding their social support is where residents' help comes from, i.e. whether from individuals in the same area helping each other, or from contacts outside of the area who contribute in times of crisis. In order to investigate this, the amount of help according to the location of alters is examined. The results are shown in Figure 18 below.

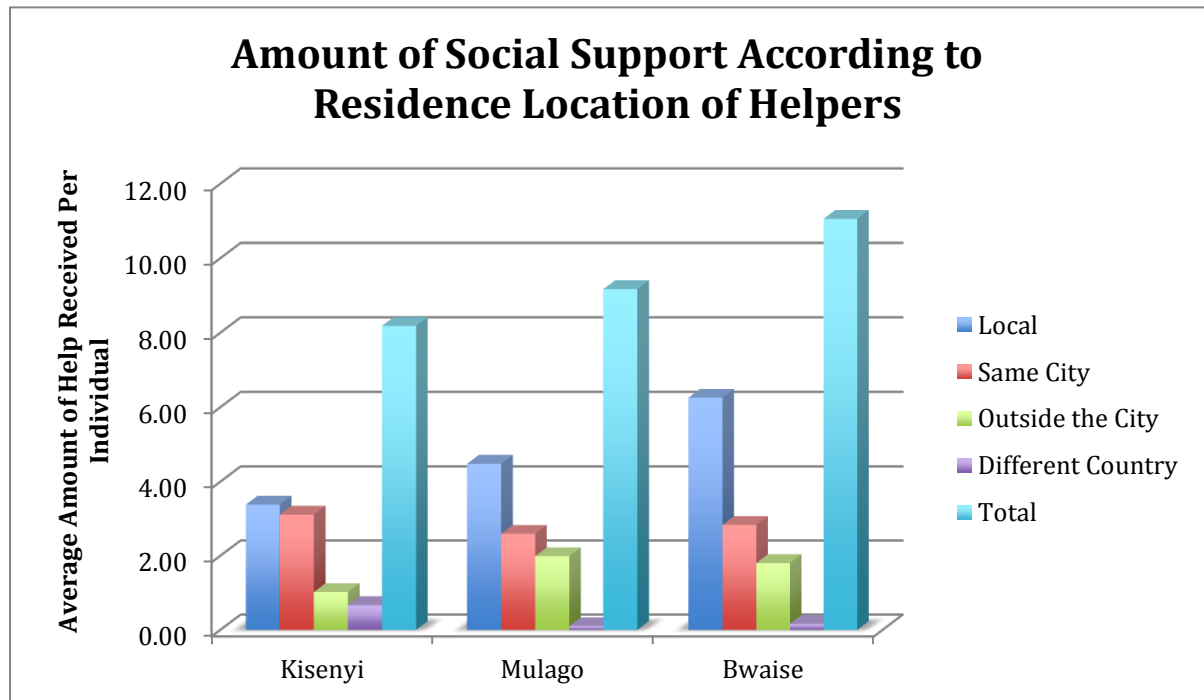


Figure 18: Graph showing the average amount of help given to individuals in the three slum areas, according to the location of the helpers (alters). Amount of help was reported by ego according to a 4-point scale (Essential, A lot, Some, A little, None).

After the finding that residents of peripheral Bwaise receive more help, Figure 18 shows that the amount of help that comes ‘from within’ is also higher in towards the edge of the city. In fact, 10 to 15% more help for residents of Bwaise comes from helpers living in the same slum area than in Mulago or Kisenyi (see Table 6 – ‘Mean % from Same Place’). Residents of Kisenyi receive less help overall but there is a larger proportion of helpers coming from the same place of origin (see Table 6) and whilst small, a larger fraction of help from internationally (3.2%).

This result is consistent with the description of the social dynamics of the three slums mentioned earlier. The inner city slum has a more ‘fragmented’ social makeup, where individuals receive less social support but from a wider range of contacts including internationally. Indeed Kisenyi is home to many international migrant groups due to its centrality in the city. The higher percentage of ‘same origin’ helpers may also be explained by the relatively larger number of distant migrants, who use linkages from their previous location or ‘home’ residence for their social support, rather than

forming new linkages with people living locally. The peripheral slum on the other hand may have lower average capacities, but shows higher social cohesion as more residents obtain help from their fellow local slum dwellers, whom they have known longer.

In summary of Section 6.3.1 and the first sub-question of this chapter, both the shocks that residents face, and the makeup of adaptive capacity and social networks of the residents are significantly different in the three slum areas from inner city to periphery. The specific challenges in each area are different, for example Bwaise residents suffering much more from flooding, and Mulago apparently from loss of life (e.g. from violent crime). The adaptive responses, however, are not so different in each area. The one response that differs is how individuals obtain help from others, which is higher in Bwaise. This result is confirmed through the ego-network analysis, which shows that in the inner-city slum where communities are more fragmented there is significantly less help and relatively little comes from helpers living in the same area. However Kisenyi shows the highest individual adaptive capacities. In the peripheral slum on the other hand, capacities may be lower but social cohesion is higher with greater social support, and relatively more coming from within the same area. A question then arises whether there is a trade-off between groups of 'resilient' individuals lacking social cohesion, and more vulnerable but socially cohesive ones; this is addressed in the Discussion section below.

6.3.2 The Differences in Adaptive Capacities and Social Networks in Different Population (Migrant) Groups in the City

Having found significant differences in the resilience of the three slum areas, this section presents a comparative analysis of different population groups, specifically migrant groups, in comparison with the 'resident' population. Migrant groups show unique levels of adaptive capacity: while vulnerabilities tend to be higher, certain migrant groups show remarkable adaptability. This is due to specific cultural norms and practices, which

mean that each group shows different adaptive capacity 'profiles' (i.e. the different makeup of capacities and sensitivities), and means of response. Specifically, social networks distinguish the adaptability of one group from another more than other capacities. This once again highlights the critical importance of 'who you know', for the adaptability of slum residents in these areas.

The quantitative analysis presented in this section uses similar methods and analysis as in the area comparison in Section 6.3.2, just at a finer scale. Three particular migrant groups are considered, the Somali, Congolese, and the Karamajong. These groups had been observed during fieldwork, and had given a significant number of questionnaire interviews. The two former groups are international migrants, while the Karamajong are internal, although very different in culture and appearance and even treated as 'foreigners' in many ways. The quantitative information on individuals in these groups was separated from the sample population using codes from the migration histories given during the interviews. It should be noted that the remaining 'local residents' category still contains other types of migrant including those who have migrated from varying distances within Uganda, and over varying lengths of time. However the migrant groups chosen represent relatively distinct population groups from the average population. In addition to this quantitative comparison, targeted focus groups for all but one of the groups are used to add qualitative information to the analysis of groups' adaptive capacities. The qualitative analysis of focus group discussions is presented first in Section 6.3.2.1, followed by a quantitative comparison of scores from the adaptive capacity assessment and ego-network analysis (Section 6.3.2.2).

6.3.2.1 Focus Group Discussions on the Adaptive Capacities of Migrant Groups

The focus groups reveal that, in general, migrant groups face a range of extra challenges that result in deficits of adaptive capacity, although particular migrant groups have unique adaptive strategies that mean they remain

relatively adaptable. Focus groups were carried out as per the methods described in Chapter 3, Section 3.4.5. As this method was applied towards the end of the fieldwork, the groups were chosen based on prior observations and pre-analysis, as described above.

Migrant groups face a number of challenges that can limit their adaptive capacity. Firstly, the focus groups reveal how the groups face social and political discrimination. For instance certain groups report to not being able to have their needs heard by local leaders. Secondly, they often have a lack of tenure and therefore sense of place. The Karamajong, for instance, mentioned that they feel little attachment to the area because, in addition to discrimination, they do not own the land or property they live in. Thirdly, some migrant groups are close-knit and isolated because they remain in the same zone of a slum, and speak a unique language. Language became a barrier to further integration in the slum. Furthermore, some migrant groups were accused of 'self-isolating' (rather than the isolation being from external discrimination), for example the Bafumbila in Mulago. These factors contribute to a general self-depiction from the focus groups of a relatively lower resilience in the migrant groups.

Having said this, certain migrant groups show particular strategies and means of adaptability. Many of the Somali communities encountered during the study form large, close-knit communities. In stark contrast to the Karamajong, many of these Somali residents talk about having a strong attachment to place (within Kisenyi in particular). This has a group-specific cause, which is that they are proud to be living in the same area as the first Somali migrants who settled in the city (in an area known as "Little Mogadishu"). The Somalis also have a particular adaptive mechanism that specifically builds resilience to financial difficulties. The Somali communities have lists of all the residents in that area, something that is facilitated by the fact that they tend to settle in communal blocks of shared rooms run by a Somali 'manager', in which there is a real culture of community. Other lists were reported to extend to the wider area too. In times of crisis, such as

someone dying and money being needed to pay for the burial, people on the list would be contacted to help contribute towards the costs. The other adaptive strategy that is unique to the Somali community here is through key individuals who have international links. Through these friends or relatives overseas, they receive significant financial remittances, which are often shared through the individual's wider family and friends in the slum area. Through these mechanisms, the Somali community is an example of a migrant group that faces the extra challenges including discrimination mentioned above, but still shows remarkable adaptive capacity through unique adaptive mechanisms. Other population groups will likely show other specific adaptive mechanisms, although this in-depth assessment is not within the scope of this analysis.

In addition to differences in the adaptive capacity of specific migrant groups, other groups within the longer-term residents of the slums show unique adaptive capacity profiles. Discussions amongst other population groups, such as young men or older residents, reveal specific challenges to building individual resilience. These are often for similar reasons as migrant groups. For instance tenants (as opposed to home-owners) say that they have "no options" to develop or make improvements to their property or plot, which becomes a barrier to any significant autonomous adaptation measures. Alternatively, the "unpopular" residents in an area are often mentioned to not receive help and be discriminated against, just like certain migrant groups. Such groups include thieves or prostitutes. However within these excluded groups there are often high levels of in-group social support, for instance within groups of prostitutes living/working in the same building. A different challenge faces the young, who report to not being lent money for job-creation ideas, because of generic lack of trust towards them. The older residents, by contrast, mention becoming 'trapped' – having moved to the city, but run out of money and no longer physically able to work in order to generate the funds to return to the village. The focus groups therefore reveal a range of challenges specific limitations to certain groups' adaptive

capacities, as well as unique mechanisms that groups may use to deal with the challenges of slum life.

Although it is beyond the scope of this analysis to investigate in depth the adaptive strategies of each migrant group, the focus group analysis shows on the one hand that migrant populations have many factors that may make them less adaptable, however there are particular groups that show great social cohesion and resilience, through cultural norms and specific (financial) adaptive mechanisms. This qualitative analysis is complemented with the quantitative comparison of migrant group scores presented below.

6.3.2.2 Differences in Adaptive Capacity and Social Networks in Population (Migrant) Groups

In line with the qualitative assessment above, a quantitative comparison of adaptive capacity scores and ego-network measures presented in this section shows how migrant groups differ in the strength of their social support networks (cf. strength of social cohesion in Somalis community and international support links). By contrast, their individual capacities do not differ much between the population groups.

In order to quantitatively compare the adaptive capacity and social networks of the groups, Table 7 below presents the average scores for a number of ego-network measures, as well as for some adaptive capacity factors ('Readiness to leave', 'Strength of network', and 'Width of networks'). More adaptive capacity factors were examined (as in Chapter 5), but only a few are presented here, which are of relevance to the analysis and show some distinct differences. Unfortunately the number of individuals from these migrant groups is not large enough to carry out rigorous statistical tests however some strong assertions can be made from particular striking quantitative results. These are mentioned in more detail below.

Table 7: Average scores for ego-network measures and adaptive capacity scores according to specific population groups. Some scores are negative as they come from composite adaptive capacity indices. Although statistical tests were not carried out, results in bold represent important differences.

Migrant Group	Amount of Help	Time Helpers Known	Help	Help from neighb's	Help from friends / rel's	Readiness to Leave	Strength of Network	Width of Networks
'Local Residents'	9.86	46.97	2.85	2.65	3.13	0.03	2.96	0.02
Somali	6.23	22.94	2.48	2.61	3.21	-0.36	3.09	-0.54
Congolese	6.36	22.36	2.21	1.79	2.50	0.26	2.57	0.34
Karamajong	7.14	28.50	1.86	2.57	2.57	-0.36	2.14	0.29

Unlike the differences between the slum areas, and between the focus groups of different migrant groups, the quantitative analysis presented in Table 7 shows no major differences in adaptive capacities (e.g. factors such as 'Readiness to leave' though many more examined) between migrant groups and local residents. However, the social network scores show great divergences, with migrant groups on average having weaker social support.

These differences can be observed through the various ego-network measures shown in the table. For instance, all of the migrant groups have on average fewer helpers per person, and receive less help in total. Furthermore, their helpers are known less time and more help comes from alters living in the same place. This lines up with migrants not having had time to make contacts from further afield, and having less social support than local residents. The discrimination described above corresponds to the low levels of help from friends or relatives that the Congolese and Karamajong receive. The Congolese receive the very least social support, which makes sense given that the individuals interviewed were staying in an enclosed set of rooms almost separated from the rest of the slum. On the other hand, the strength of tight social support networks that are reported in the qualitative information about the Somalis is observed in the two

scores on strength and width of networks: Somalis residents on average actually have stronger networks than local networks albeit very 'narrow' (i.e. within their own community).

Just as the focus groups have shown differences in migrant groups' adaptability and even unique mechanisms for certain groups, so too is this observed in the quantitative analysis. Specifically those mechanisms discussed were often through social networks, which are the distinguishing feature in the quantitative analysis too.

In summary of Section 6.3.2 and the investigation of migrant groups' adaptive capacity, a combination of qualitative enquiry through focus groups and quantitative comparison of the adaptive capacity assessment and ego-network analysis reveal significant differences in the resilience of migrant groups. Firstly they face extra challenges to the local population, and often have lower adaptive capacity. However where groups are large and close-knit, they may form unique adaptive mechanisms. Both these mechanisms, and the distinguishing measures between different groups tends to be around social networks, which again supports their importance in the adaptive capacity of slum dwellers. The next section moves on to examine how adaptive capacities and social networks differ according to the duration of residence that slum dwellers are resident within an area.

6.3.3 The Changes in Adaptive Capacities and Social Networks with Duration of Residence

Having examined heterogeneities between different areas, and different groups, this section moves on to assess how capacities change with 'time', or duration of residence. The principal finding is that *local* aspects of resilience take time. These local aspects include determinants of adaptive capacity such as attachment to place or to a job, and the reticence to move out of an area in times of crisis. Other correlating factors include receiving help from others, and learning from others. Other features of adaptive capacity that

require less of a local sense of place (e.g. innovation, feelings of control) do not show this relationship with duration of residence.

The analysis of the relationship between duration of residence and adaptive capacity is carried out using data on the residence duration of each respondent, which was obtained during the questionnaires. The data were previously coded according to the number of days each respondent had lived in 'that place', i.e. the specific slum area of the city (often individuals moved to the city from outside and then moved again multiple times between slum areas). These data are then correlated (using non-parametric Spearman rank test) against: firstly, adaptive responses; secondly, capacities; thirdly, social sensitivities; and fourthly, social network scores. The correlations for each of these can be found in Appendix 8.

This use of duration of residence data does not give a truly longitudinal representation of the process of urbanisation in place. However by correlating against a large number of residents, a temporal cross-section can be inferred to tell us about the urbanisation process over time. In addition to the quantitative adaptive capacity scores, the findings in this section are complemented with qualitative information gleaned from the focus groups. The table of results from the Spearman rank correlations can be found in Appendix 8; as in Chapter 5 only relationships between variables that are significant to $p < 0.05$ are mentioned here as "correlated".

6.3.3.1 Correlation Analysis Between Duration of Residence and Adaptive Strategies, Capacities, Social Sensitivities, and Social Network Measures

The adaptive responses that positively correlate with duration of residence are adaptive mobility, getting help, and learning from neighbours. The likelihood of individuals leaving in times of crisis (adaptive mobility) is the response with the most significant relationship to duration of residence. All three 'leaving' statements strongly significantly negatively correlate with residence duration ("Shift elsewhere", $r_{s[690]} = -.215$, $p \leq 0.001$; "back to

village”, $rs[691]=-0.151$, $p\leq 0.001$; “not stay”, $rs[693]=-0.100$, $p=0.008$). In other words, individuals are less likely to leave as they stay longer in an area. The other responses that correlate with residence duration are getting help from neighbours ($rs[691]=0.127$, $p=0.001$) and learning from neighbours ($rs[693]=0.110$, $p=0.004$). The result that individuals obtain more help locally as they stay in an area is supported by the focus group discussions, in which long-term local residents reported that they would help each other as neighbours even ahead of tribesmates, having lived in close proximity for a significant period of time. Importantly, all of these responses are ‘local’, i.e. the longer people stay the more likely they are to be involved in local adaptation process, and not leaving the area. Other adaptive responses show no significant relationship with duration of residence.

The capacities that correlate with duration of residence are an unwillingness to leave (“Readiness to leave”, $rs[681]=-0.202$, $p\leq 0.001$), and negative job flexibility i.e. unwillingness to change jobs ($rs[689]=-0.110$, $p=0.004$). The first result confirms the adaptive mobility response above, that the people who leave during a crisis are predominantly those who have not been resident in the area a long time. The second result may actually reflect a positive result that individuals who are resident longer in the slum are more likely to have found a job, and developed attachment to it. Indeed, one focus group participant indicated that you are only likely to have a job if you are known – which as observed from the relationship between social networks and duration of residence, takes time.

The sensitivities that strongly significantly correlate with duration of residence are attachment to place ($rs[689]=0.202$, $p\leq 0.001$) and attachment to occupation ($rs[681]=0.114$, $p=0.003$), and the strength and width of networks ($rs[693]=0.136$, $p\leq 0.001$; $rs[690]=0.124$, $p=0.001$). Out of these, attachment to place has the strongest relation. Again, there is a consistency in the findings as the negative correlation with job flexibility above corresponds to attachment to occupation (and to place) forming that

prevented individuals trying new jobs. In addition to these positive correlations, employability is significantly negatively correlated. This negative result may be because the statement is referring to “having the abilities to do another job” and as seen already, individuals become attached to their job over time and so may not feel they have the abilities to do anything else. As well as these attachments (and potentially reduced flexibility) that appear to form over time, so too do social networks.

However, unlike in previous analyses (e.g. Section 6.3.2), the social network measures do not support a strengthening of networks with duration of residence. While individuals *report* to have stronger and wider social networks the longer they stay in a place, this does not translate into actually receiving help in times of crisis (as measured in the ego-network analysis). However, there is a highly significant correlation between ‘time known’ (how long the alter was known by the ego) and the amount of help the ego receives ($r_{s[686]}=.218, p\leq 0.001$). This suggests that it is the actual time that each alter is known, rather than how long the ego spends in an area, that determines the amount of help the ego receives. Whilst hard to disentangle given linkages forming over time, this makes intuitive sense that the actual mediating variable is through the strength of the bond that forms according to the time each alter has been known.

Finally, the focus groups reveal other added benefits of having lived in a certain area a long time, for example one group of young residents described how police would let “insiders” go when arrested, if they knew them; they also talked about life and surviving in the area really as “it just depends who you know”. These sorts of dynamics are what builds resilience (even if in unscrupulous ways), through the social networks that have been shown to build with duration of residence.

In summary, the correlations in this analysis suggest that significant changes occur to the adaptability of individuals as they stay in one area over a period of time. The changes are predominantly ‘local’, for example obtaining extra

support from neighbours or learning from others locally in times of crisis. There certainly appears to be a process of attachment too, which results in attachment to place and attachment to occupation, whilst also a reduced flexibility to try new jobs (not necessarily a bad thing if residents have found work). Social networks increase over time too, although more the time that helpers are known rather than the length of stay in an area per se.

Reconsidering the analysis in Section 6.3.1, the relationship of adaptive capacities with length of residence helps to explain some of the geographical differences between the three slums too: for example, how in Bwaise people have known each other longer and the average residence duration is longer, which is also where individuals get more help in times of crisis and more from local contacts. The demonstration of these adaptive capacities 'building' with time is crucial for understanding social resilience in rapidly urbanising areas, and will be discussed briefly below.

6.4 Discussion of Results

This chapter finds significant heterogeneities in adaptive capacity, between slum areas, population groups, and with the duration of residence of slum dwellers. The following discussion explains some of the major findings presented above, including how shocks may differ but strategies remain similar, how different adaptive capacity profiles may lead to scale trade-offs, how migrant groups show complex differences in adaptive capacity distinguished by social networks, and how specific local capacities increase with duration of residence of slum dwellers.

6.4.1 Heterogeneities Between Slum Areas

The results from this chapter show that there are significant differences in adaptive capacity across the city, between slum areas that on first glance could easily be considered to have very similar socioeconomic status and resilience profiles. Such slum heterogeneity has been observed in other developing country cities too (Chatterjee 2010; Jankowska et al. 2011).

There are some important policy implications of this finding, but these are primarily followed up in Chapter 8; similarly a wider discussion of heterogeneity of both ecosystem services and adaptive capacity in Chapter 7. The discussion in this section briefly expounds and explains two main findings from the results of this chapter.

The first finding that requires some explanation is the differences in shocks that each slum faces, while the strategy responses of individuals in each area are roughly the same. Again, this has been found elsewhere (Chatterjee 2010) and I posit for two key reasons: first, slum dwellers, with limited capacities and resources, only have a narrow range of possible responses. For instance if they do not temporarily move away for one problem, they are unlikely to be able to for another. Therefore with a narrow range, adaptive responses are likely to be similar for multiple threats. Second, as argued for the rationale of taking a general resilience approach in Chapter 3, slum dwellers are continually dealing with, responding to, and attempting to suppress the effects of multiple shocks and challenges whilst maintaining livelihood activities. Hence considering each shock individually is not realistic. For instance, separating the impact of flooding from theft from sickness for a slum dweller is often not possible. To take one example, residents of Bwaise would talk about how when the floods came, police would come round and ask for receipts of goods purchased such as sofas or televisions. They would know that during this time the floodwater had often washed away belongings such as these papers and so they would be able to corruptly confiscate those belongings. Similarly, dealing with the impact of flooding (e.g. putting homes back together) would often come with facing flood-related sickness (e.g. dysentery/typhoid) in themselves if not family/household members. Thus while the shocks differ for each area, slum dwellers are used to dealing with multiple challenges simultaneously and their responses reflect that.

Having said that, the one strategy that differs significantly between slums is the amount of help received. Chatterjee (2012) describes a similar situation

in Mumbai, India, where the variety of support networks resulted in great heterogeneity in the capacity to cope amongst slums experiencing flooding. The striking importance of social networks is a theme of this thesis, and much like the differences between migrant groups below, social networks are a distinguishing feature of resilience.

Secondly, while adaptive strategies do not differ much between the three areas, the differences in capacities and sensitivities are complex. From the comparative results of both adaptive capacity and ego-network assessments, there appears to be a juxtaposition of social cohesion benefits with individual capacities. In Bwaise (the peripheral slum) residents receive relatively more help (shown through both analyses), but individual capacities are low. In Kisenyi on the other hand (in the inner city), there is much less help and less coming from within the area, but levels of belief in change, innovation, and willingness to try new jobs are significantly higher. This difference is not surprising when we consider that being in the middle of the city, Kisenyi contains many individuals seeking out work, as well as more migrants. While seeking out employment opportunities, Kisenyi residents are less likely to be as interested in forming strong social groups, given their motives for locating there and likelihood of moving away sooner. Another explanation for the low social cohesion found in Kisenyi is that residents face a greater threat of eviction. The slum is adjacent to the inner city business district and so is an area of high value for developers. Eviction destroys the rich social networks that may have developed, and even the threat of it may undermine individuals' investment in their area and local networks (Dobson et al. 2011). Therefore, Kisenyi appears socially 'fragmented' but at the same time is full of individuals yearning to thrive economically and showing relatively high individual capacities. By contrast, the population of Bwaise shows greater cohesion, but this peripheral slum also contains many individuals who are 'stuck' there, lacking opportunities of the inner city.

This juxtaposition of social cohesion benefits with individual capacities could lead to a trade-off between community-level, and individual resilience. As discussed in Waters (2012), a good example of this trade-off observed in the current study is when particularly adaptable individuals leave an area in times of crisis. For example when floodwater comes some residents are able to move to friends elsewhere in the city, or even have the money to stay in a hostel in another part of town until the floodwater disappears. This response makes sense from an individual resilience perspective, but of course is only available to those with resources (financial or good contacts). Moreover by leaving, it drains the area of potential resources, innovation, funds and help that that individual may have contributed towards community efforts to 'rebuild'. This potential trade-off between collective and individual resilience is discussed in more detail in Chapter 7. As this chapter found, heterogeneities exist in the adaptive capacity of different population groups as well as between areas, and this area of findings is discussed next.

6.4.2 Heterogeneities Between Different Population Groups

The results in Section 6.3.2 show that there are complex differences in the adaptive capacities of different population groups. As in Section 6.4.1, this section expounds some of the major results, and synthesises some of the complexities of the findings, for instance tying together qualitative and quantitative understandings. The section includes a brief summary of the different adaptive capacity of migrant groups, why social networks can be of such importance comparing between different groups, and an explanation of why certain subgroups lack adaptive capacity using qualitative understandings from fieldwork.

Migrant groups are socially and politically discriminated against in a number of ways. However depending on the social support networks that they form amongst themselves, this does not necessarily lead to them totally lacking adaptive capacity. Obviously there are a number of complex cultural

and social dynamics that contribute to each migrant groups' adaptability, but the contrast of Somali and Karamajong social support highlights the importance of social support networks – both within, and to the outside community. Where these groups form large enough, close-knit communities (as the Somalis did), remarkable resilience is shown; where no such social support existed, individuals end up with very low adaptive capacity. One particular way that these networks are used is in financial adaptive mechanisms of the Somalis community, where money is gathered together in an organised way after the death of a family member.

The social network analysis confirms the qualitative findings, showing weaker social support networks in migrant groups (albeit with samples too small to carry out rigorous statistical tests). No significant differences are observed in adaptive capacities and social sensitivities, but migrant groups show stark differences in social support in times of crisis. Migrant networks are consistently smaller, known less long, and receive less help. It is unsurprising therefore that migrants are often more vulnerable (Béné 2009). Likewise the 'narrowness' of Somalis networks is reflected in their network scores. However in the Somalis example the importance of strong ties is clear – for while their social networks are narrow, their networks are on average stronger than other migrants, and even local residents too; and this enables them to deal with shocks. On the other hand, the lack of adaptive capacity described for the Karamajong is reflected in their weaker networks, and receiving far less help.

While some 'excluded' groups may use networks to form identity and adaptability (Imas & Weston 2012), this will not always be the case. In social capital terms, the Somalis show how individuals retreat into small groups due to discrimination and hardship. But these groups may show high bonding capital that minimizes stress and enhances capacity to cope in the short term. Arguably in the longer term, their lack of bridging capital (weak ties) means they remain excluded from wider society, and this weakens community coherence and community adaptive potential. This discussion is

not to imply that networks are the single most distinguishing factor for adaptability, as economic and political constraints also play a key role too (Chatterjee 2010), but evidently social support linkages are of utmost importance in defining a groups' adaptive capacity.

Aside from migrant groups, there are other specific groups that show particular vulnerability, again often due to a lack of social support. These include new residents, who have not yet formed networks and/or do not know norms of behaviour or adapting mechanisms; tenants who have "no other options" and are vulnerable to eviction; the unpopular e.g. prostitutes; the young, lacking trust to borrow money for employment investments; and the old, often 'stuck' due to lack of capital and capabilities to make money. As the comparison between slum areas demonstrates, these unique limitations to adaptability show the importance of understanding which key features of adaptive capacity are acting as the 'bottleneck' for each group. While the particular determinants of adaptive capacity in each case will be complex and include cultural and agency factors not included here, the central role of networks once again emerges as it did in Chapter 5.

Having observed the heterogeneities in features of adaptive capacity for different areas and different population groups, the final area of results is now considered, regarding how these different capacities change over time.

6.4.3 Heterogeneities over Duration of Residence

The third and final heterogeneous dynamic of slum adaptive capacity is that local aspects of adaptive capacity increase with the duration of residence of slum dwellers. This section explains how and why some of these factors increase with duration of residence, how this is encouraging if simultaneously a challenge, and how the strength of social support linkages are more related to the length of those relationships rather than the amount of time spent in an area.

The findings in Section 6.3.3 show that both social networks and certain local capacities 'take time' to form. In support of this, the ego-network analysis in Chapter 5, and discussed in Section 5.4.5, also indicates that local networks take time to build. The capacities that change significantly with the duration of residence are attachment to place, attachment to occupation and the existence of networks – all 'local' features, or at least to the city. Out of these local features, attachment to place is most strongly related to duration of residence. In addition, there is a relationship with local learning and neighbourly help, and even not moving out of the area, all of which support this notion that 'building local takes time'. Kuruppu and Liverman (2011) describe how previous experiences will affect adaptive capacity. They explain that staying in an area allows the individual to experience shocks and therefore increase adaptive capacity, as responses they learn become embedded in permanent 'schemas' or cognitive frames of reference. This cognitive shift that occurs over duration of residence alters their perceived adaptive capacity and therefore their real capacity to adapt. However the results from this chapter suggest it is not just perceived adaptive capacity that shifts over time, but that local attachment and 'community-building' are also contributing to this temporal process of adaptive capacity increasing. The mediating mechanisms for how overall adaptability increases over time are hard to predict, but ultimately both processes are likely to be at play – internal cognitive models shifting as well as external attachments forming. Both processes seem to enable individuals to adapt better as they spend time in the place.

The conclusion that these local capacities take time to form is, on the one hand, a challenge to supposing that interventions may build these facets of adaptive capacity immediately (e.g. attachment to place), on the other it is encouraging that simply as individuals stay in a place for a significant period of time, their adaptability will likely increase as features such as place attachment increases and networks are formed. The provision of social support is different however, in that it was the time alters were known rather than the length of stay that correlated. This suggests that individuals

move into an area with social support links already in place (friends/relatives etc), and again supports the findings that it is predominantly strong ties with well-known individuals that are key for getting help in times of crisis. Understandably, these strong ties take time to occur, which explains the relationship with the length of time that alters are known.

This section has synthesised the findings of this chapter and explained some of the major findings, including certain complexities in the differences in adaptive capacities between areas and groups, and the different ways that resilience may change over time. A broader consideration of these results is discussed in Section 7.3 of Chapter 7. Finally a summary of this chapter is presented after potential limitations that may have existed.

6.5 Limitations and Improvements

Given that this chapter presents a comparative analysis of results that already appear in Chapters 4 and 5, the majority of limitations and criticisms relating to methods and data have already been mentioned in those chapters. With regard to the first research question of this chapter (the comparison of areas), there are enough respondents from each area such that statistical tests could be carried out (see Kruskal-Wallis test results in Appendices 6 and 7). For the comparison of migrant groups however, a much smaller number of respondents were in each category and so it is not possible to carry out statistical tests. Evidently this is not ideal in terms of robustness. If the focus of the analysis was on different population groups, a purposive sampling strategy could have ensured enough respondents were sampled from each group. However this was not the scope of the analysis, which instead focused primarily on the differences between the areas, hence the sampling design around that.

The focus group information was highly useful in the comparison of the adaptive capacity of different population groups, and also how aspects

changed for individuals over time. In both instances this information was used as supplementary evidence, utilising the few statements that emerged on that particular subject. Were the focus of the research project solely on the adaptive mechanisms of these groups, the research design could have been improved by: a) framing the focus groups entirely around this topic, and b) carrying out more rigorous analysis of the qualitative data. However, this chapter instead triangulated information from focus groups as well as quantitative comparisons (albeit not statistically significant). The consistency of results, for instance in migrant adaptive capacities, suggests in fact that the results are robust.

The analysis of the third research question, of adaptive capacities with duration of residence, is met by the same challenge as the correlation analyses in Chapter 5 – that one cannot imply causation from the correlations. However the strength of the associations, in combination with a few key qualitative insights, allow strong assertions to be made regarding the changes that occur in adaptive capacity over time. Future in-depth work should investigate the actual process of formation of aspects such as attachment to place. Finally, this chapter compared areas, population groups, and a temporal dynamic via duration of residence. There are multiple other comparisons that could be carried out such as how adaptive capacity differs between men and women, occupations, or age. For the broad focus of the research on understanding slum resilience however, the comparisons chosen here were most appropriate.

6.6 Summary of Chapter 6

This chapter has found that across three different dynamics of the slum – place, people group, and time – there are significant differences in adaptive capacity. Different areas in the city face different shocks, and yet the responses tend to be similar. The adaptive capacities however differ significantly between slum areas, and not necessarily in uniform ways. In fact, there is almost an inverse relationship between social cohesion, and the

aggregate level of individual capacities, which makes a challenging point regarding a potential trade-off between individual and community resilience that is followed up in Chapter 7. Comparing across people groups, migrant populations tend to have low capacities but not always – the existence of specific coping mechanisms in particular groups allow them to be adaptable to shocks and crises. Across the three types of heterogeneity (area, migrant group, and time) the strength of networks is a consistently distinguishing factor. However in addition to other ‘local’ aspects of adaptive capacity, they take time to build where other capacities do not. The significance of these findings is discussed in Chapter 7. Chapter 8 follows up on the importance of considering these heterogeneities in assessments of adaptive capacity and projects aimed at building urban resilience, as well as how to build on the positive result that over time, certain capacities tend to improve.

Chapter 7: Discussion

7.1 Introduction

The aim of this thesis is to understand the important features of resilience for individuals living in poor urban areas. Chapter 2 identified research gaps in relation to the current understanding of resilience for individuals living in poor urban areas: the ways in which ecosystem services might be used, the most important aspects of adaptive capacity, and the ways in which these capacities might differ between and within slums. The three results chapters tackled the three research questions that arose from these knowledge gaps. Chapter 4 highlighted the degree to which slum residents used ecosystem services, how that usage differs according to the ecology of the areas, and how residents value ecosystem services differently according to their relative income. Chapter 5 found key determinants of adaptive capacity that include socio-cognitive factors and the importance of networks. Chapter 6 found differences in adaptive capacity across different areas of the city, different people groups, and with duration of residence of individuals in the slum.

This chapter discusses three crosscutting findings from the results chapters, as well as their importance in relation to current understandings from the literature. The findings are discussed according to meta-themes of the thesis, bringing together social and ecological results as per the resilience framework and the notion of linked social-ecological systems. Three main themes are addressed: the main features of resilience in poor urban areas, heterogeneities in urban resilience, and lessons for measuring urban resilience. Section 7.2 brings together results from Chapters 4 and 5 to show what contributes towards the adaptive capacity of slum-dwellers. The results of key contributors to urban resilience are then compared with existing theory and some challenging contributions made particularly around urban agriculture, social networks, and sense of place. The next section (7.3) discusses a crosscutting finding of the research, that slum

adaptive capacity is highly heterogeneous. This heterogeneity covers spatial distribution of adaptive capacity, scales, and time; and all three are discussed. Finally Section 7.4 discusses the methodological contributions of the thesis, and how insights from the attempts here to measure ecosystem services and adaptive capacity may inform and improve current frameworks and assessments of ecosystem services and local adaptive capacity in poor urban areas. This methodological discussion feeds into Chapter 8, which concludes with the importance of resilience assessment in research, and the ways that key resilience components may be built upon.

7.2 Social and Ecological Components of Resilience in Poor Urban Areas

Bringing together both social and ecological components of resilience in poor urban areas, this thesis finds that local ecosystem services are not used very much or demanded by most slum residents; that critical features of adaptive capacity are around social support networks and a sense of place; and that for both social support and the transfer of ecological goods, rural to urban links are not that important for resilience to shocks. The most important or novel results are discussed here, specifically those results that contribute significantly to building an understanding of resilience in poor urban areas.

7.2.1 The Importance of Ecosystem Services in Poor Urban Areas

This thesis provides a contribution to empirical work in the study of ecosystem services in poor urban areas. As Chapter 2 described, empirical study of the role of ecosystem services, either for well-being or resilience, has rarely been carried out in poor urban areas. This thesis challenges a few of the studies on the importance of ecosystem services for poor urban residents, suggesting that positive *local* ecosystem services do not have much bearing on the resilience of the urban poor. Instead, their perceptions tend to be rather negative towards nature and they are more affected by ecosystem *disservices*, or the failure of those ecosystems to function

properly resulting in impacts such as flooding or contamination of water sources.

Many recent studies have emphasised the importance of green space, ecological values, or ecosystem services for urban areas. Few of these studies have been in African cities however (Simon 2010), and what few there have are biased towards South Africa, or on specific services such as “urban gardens” (Cilliers et al. 2012). However, to give some comparable examples to this study, a few studies do demonstrate ecological values in poor urban areas in the developing world. Schäffler and Swilling (2013) demonstrated the value to the city of the world’s largest urban forest in Johannesburg. Lannas and Turpie (2009) compared different provisioning ESS from agricultural production of a rural and urban wetland in South Africa, finding that the urban wetland had more value due to more intensive use. Another relevant finding regarding the value of urban wetlands comes from Kampala, which revealed that the water purification qualities of the Nakivubo wetland in the city were equivalent to the cost of a sewerage treatment plant (Schuyt 2005). Other studies have focused on broader green spaces within African cities, finding multiple values they provide: ‘soft engineering options’ for mitigating and adapting to climate change (Kitha & Lyth 2011 in Mombasa), huge values when the total ecosystem services to the city are considered as well as ecosystem-based adaptation options too (e.g. Durban, Roberts 2010), and even “municipal commonage areas” that the urban poor benefit most from (Davenport et al. 2012).

However, all of these examples focus on tangible areas of ‘ecosystem’ or clearly demarcated green space within the city. In the case of Kampala, the area of wetlands decreased from 20.6% to 1.9% between 1980 and 2002 (Nyakaana et al. 2006), and so the remaining intact ecosystem is now virtually none. Similarly the study by Kitha and Lyth focused on a specific landscape rehabilitation project. So while the importance of these specific areas of demarcated green space for the city as a whole is clear, the focus in the current research is on ecosystem services that exist and are valued

within slums in developing country cities. Put another way, the focus is on the ecology *in* cities rather than the ecology *of* cities (Jansson 2013). This fine-scale perspective is necessary in order to get the resolution for understanding ecosystem service links (e.g. to well-being – Duraiappah 2011), and perhaps has not been given much consideration yet, due to data scarcity. As a starting point therefore, many studies have demonstrated the importance of urban ecosystem services, but rarely have they focused on the fine scale within the city, and often only in clearly demarcated green space i.e. contexts that are not entirely comparable with this study.

The results of this research find that the average slum resident uses and values ecosystem services very little. Regarding provisioning services, this is primarily because of lack of space, but it also due to perceptions – respondents feel that green spaces are not something for the poor as they are only in the wealthier parts of town. These barriers are described in more detail in Section 4.3.1.3. This likely led to further degradation of what green spaces there are. As mentioned already, it is hard to find any studies that also assess or measure a wide spread of ESS in poor urban areas, to assess whether this result of low ESS use and value is ‘normal’. Instead the level of urban agriculture is discussed below, as an example of a provisioning service.

In terms of ecosystem services preferences, the results suggest that individuals favour provisioning services, especially if they are particularly poor. In general, and on a global scale, provisioning services are valued and utilised more than other types of services (Raudsepp-Hearne et al. 2010; Rodríguez et al. 2006). The same result is found at a local scale in Chapter 4, and some reasons for this preference are mentioned in that chapter. Primarily, poor urban residents are focused on meeting their basic needs, and only those with relatively higher income therefore consider benefits such as cultural values. Robards and colleagues (2011) discuss how poverty traps can mean that the poorest are sometimes excluded from natural resources leading to illegal or alternate sourcing of those resources and

environmental degradation, causing a vicious cycle. Indeed, in this instance the poorest are effectively financially excluded, as they are not able to afford water from the public taps or the small fees for access to public toilets. This means they have to exploit contaminated natural sources of water, putting themselves at greater health risks.

This finding of very low ecosystem service use is contradictory to many other studies in the context of African cities. As a point of discussion for provisioning service use, urban agriculture is taken as an exemplar provisioning service because there is a relative wealth of research and discussion on this ecological benefit where for other ESS there is not. Much research suggests how important urban agriculture is for the well-being and resilience of the urban poor (e.g. Lwasa et al. 2012; De Zeeuw et al. 2011; Lee-Smith 2010) and put simply, this study does not. Only 3% of respondents report to grow food and only an additional 5% to keeping livestock. The figures are mentioned in more detail in Chapter 4, but one review suggests up to 80% of vegetable requirements are met by urban agriculture in Africa (Eriksen-Hamel & Danso 2010) and in Kampala specifically, 26.5% of the population was found to be involved in urban farming (crops or livestock) based on a 2003 survey (Lee-Smith 2010 for review). It is important to understand why there might be such significant discrepancies therefore. Possible reasons include: a) because a different definition of urban or area of focus is being used (i.e. production is occurring only in specific areas of the city); b) because Kampala is different to elsewhere; c) because the situation has changed since some of these surveys mentioned in the literature were carried out; or d) because other studies are not including the poorest urban populations. These four possible reasons for the discrepancy between the findings of this study about the importance of urban agriculture, and those elsewhere, are now considered in some detail, as they likely represent other provisioning services and the green space in general in slums too.

The first potential reason for the discrepancy in levels of urban agriculture is that other studies focus on different areas or boundaries of the city. Many studies for instance discuss (and use data for) the importance of urban agriculture for the city as a whole (e.g. Mbaye & Moustier 2000). As such, there may be specific areas within the city that are designated for urban agriculture, but only a relatively small proportion of people benefit directly from this ecosystem service. Likewise, many studies include 'peri-urban' areas in their research design (e.g. Eriksen-Hamel & Danso 2010), where a larger proportion of urban agriculture is likely to be carried out. This does not show that urban agriculture is not important for cities as a whole, but potentially that the number of poor urban residents benefiting directly from urban agriculture is not many.

Secondly, it is possible that other cities in Africa are just different in the opportunities for, and barriers to urban agriculture, resulting in higher levels of production or participation. Studies have documented high levels, or at least high potential, of urban agriculture in countries such as Kenya, South Africa and Cameroon. However some of these have no data on the percentage of residents who carry out urban agriculture, focusing instead on processes such as community empowerment (Seymoar et al. 2010), or taking a purposive or stratified research design that focuses on households already carrying out urban agriculture (e.g. Foeken & Mwangi 2000; Karanja et al. 2010; Ajebe 2012; Mkwambisi et al. 2011; Gallaher et al. 2013). These studies tend to show the potential of urban agriculture therefore, but not the actual levels of use.

Thirdly, the situation may well have changed with time given that many of these studies are based on data that is ten or twenty years old. For example, the most recent empirical study used in Lee-Smith's 2010 review comprised 2003 data, with other studies in this review from 1993. Given the pressures of urbanisation, there is likely to be much less available land in Kampala and slums such as Kisenyi, Mulago and Bwaise now than at the time of this survey, hence less urban agriculture. On the other hand the percentages of

urban agriculture had not changed greatly during that time (1993-2003), although urbanisation has occurred most rapidly in Africa in recent years (Montgomery 2008). Regarding data reliability more generally, Zezza and Tasciotti (2008) state that we should not overemphasise the contribution of urban agriculture in terms of income, while Cilliers and colleagues (2012) find that there is currently not enough evidence to prove that urban agriculture produces enough food to alleviate poverty in South Africa. In short, it appears that data supporting urban agriculture in Africa are often old and questionable in reliability.

The fourth and last suggested reason for the discrepancy is that other studies may 'miss' the urban poor, or specifically slum areas. This ties in with the first reason but concerns research focus more than research design. It has already been shown that the urban poor are underrepresented in farming activities (Foeken & Owuor 2008), often because they lack access to plots required for farming (Crush et al. 2011; Gallaher et al. 2013), or because of lower levels of home ownership (Cilliers et al. 2012; Karanja et al. 2010). Within the brief comparison of studies discussed here, the current study is one of the very few that focuses on slums in particular, or makes an effort to include these areas (with few exceptions, e.g. Gallaher et al. 2013). As mentioned for the second possible reason, many studies focus solely on the 'examples' of urban agriculture, rather than surveying its uptake. The systematic review of Lwasa and colleagues (2012) for example, involved follow-up fieldwork of visiting *practising* urban agriculture farmers, who are not necessarily in 'typical' poor urban or slum areas. Therefore, given the likelihood that urban agriculture generally benefits the *less poor*, unless reviews are rigorous in their random sampling or target poor areas specifically, they will not be able to sample the prevalence of urban agriculture in slum environments. As the current study focuses solely on slum areas, I would hold to the conclusion that urban agriculture tends not to properly benefit the poorest in a city.

To conclude why this study finds much lower levels of urban agriculture in the three slums in Kampala than most comparable studies, there appear to be a few factors. The only proposed reason that is rejected entirely is the possibility that the urban agriculture situation in Kampala is unique for African cities. Given differences and biases in research design, and questionable data elsewhere (Zezza & Tasciotti 2008), there is yet to be a strong case documenting urban agriculture as prevalent in poor urban areas. Another review for Southern Africa also concluded that urban agriculture is not as widely practiced or as important as is sometimes claimed (Crush et al. 2011). In fact, when considering the urban poor specifically the low percentages involved in urban farming found here are comparable with, say, Nairobi (Foeken & Owuor 2008). Urban agriculture seems more common in peri-urban as opposed to inner-city areas. Furthermore, given that urbanisation shifts these livelihood activities outwards from the city centre (as Lee-Smith puts it, “shifting cultivation”), it is also probable that there are currently lower levels of urban agriculture in poor urban areas than there has been in previous years. It is important to note that this thesis focused entirely on slum areas rather than a random cross-section of the city, and as such there are few comparable investigations of broad ESS usage in slums.

This is *not* to say that urban agriculture has no potential for poor urban areas, as many studies show its potential for social capital and food security (e.g. Gallaher et al. 2013). Instead, it appears that a only few individuals, and a few areas probably mainly in the peri-urban zone, practise urban agriculture. This has benefits for the city as a whole, certainly increasing food security and urban resilience at the city level. But the argument that it benefits a large proportion of the urban poor, or increases their resilience is not supported by the findings here. There are certainly current barriers to urban agriculture, which in this case include lack of space and negative perceptions or lack of knowledge. However these are surmountable given the right policy framing and practical interventions. The conclusion therefore is that while for a city as a whole urban agriculture may be a key

asset for food security and resilience (Lwasa et al. 2012; Schäffler & Swilling 2013), for the resilience of most slum-dwellers it is currently still of little importance.

Despite this negative result of low ecosystem service use overall, the results highlight the importance of regulating and cultural services, as well as ecosystem disservices. Again, there is very little discussion of either of these categories of ESS in comparable studies of urban nature. Respondents in this study were found to value cultural and regulating services combined as much as provisioning ones. The main benefits mentioned are trees for shade and the aesthetics of plants and birds. The importance of these categories of values for individuals' adaptive capacity is demonstrated by the correlation (in Chapter 5) of 'appreciation of the local environment' with adaptability. This result might not fit into quantitative assessments such as the TEEB framework, which uses indicators such as the number of visitors to parks to measure cultural (recreational) values (for instance). But the finding does indicate that services such as aesthetic values of green spaces or lone trees are meaningful for slum residents. As Subedi and colleagues (2008) report, this might come down to the "loveliness of a lone tree". The importance of green space within the slums is discussed in greater depth in the section below (7.2.2).

While an appreciation of green space positively impacts many slum residents, many others report the negative impacts of ecosystem disservices. Disservices include living in close proximity to wetlands and being faced with many mosquitoes. This then means that many slum residents have a negative view of 'nature' in general. Most studies do not give much attention to ecosystem disservices (Cilliers et al. 2012), which is not surprising as the ESS framework is selective, not acknowledging disservices (Ernstson & Sörlin 2013). Only a few studies have documented certain ecosystem disservices, such as safety issues in dark parks, pollen causing health problems, or disservices associated with forests (Lyytimäki et al. 2008; Lyytimäki & Sipilä 2009; Dobbs et al. 2011; Escobedo et al.

2011). Given the different ecosystem disservices found here, it is important that these are taken into account when considering ESS in urban environments, especially as the disservices are also found to influence slum-dwellers' perceptions of nature (see Chapter 4, Section 4.3.1.3).

This study also highlights the inadequacy of the methods used to try to capture the full range of ecosystem services in poor urban areas. While disservices could simply be given more attention in ESS frameworks, it seems clear that a richer understanding of cultural and regulating services in this context is necessary. Alternative concepts and ways of understanding may help to add this richness. For example, Camillo Sitte's considerations of 'decorative' and 'hygienic green' from 1900 provide an alternate framing and perspective on urban nature (see in Csepely-Knorr 2011). In fact, this was one of the most referred to typologies in the decades after its publication. For instance Sitte describes a huge tree, growing behind a wall. Some of the branches are hanging over the wall and the green leaves of the tree bring life to the whole street. He argues that people's imaginations do not need mass effects to be stimulated (e.g. large amounts of trees), rather small things are sufficient. Sitte gives the example of a solitary palm tree in Rome, which gives people the impression of being in a southern town, and that the single palm tree contributes the same as a whole palm grove would. A very similar phenomenon is found in Mulago slum – where the existence of lone solitary trees provide values of shade, aesthetic beauty, and communal space, despite being just single trees amongst a whole slum. People would even comment that they appreciate just seeing the top of the tree. This wider consideration of ways understanding urban nature is currently being explored in African Centre for Cities' 'Ways of Knowing Urban Ecologies' project, and is highly necessary. A wider consideration of values would help understand the links between cultural and regulating services and social and psychological well-being, which is sorely needed (Raudsepp-Hearne et al. 2010). Just as the work of many scholars has richly described the social function and dynamics of poor urban spaces (e.g. Myers 2011; Pieterse 2011b; Simone 2010), a richer understanding of the way that

urban nature is created, valued and influences individual well-being in these contexts is required. More on how these values might be actually measured is discussed in Section 7.4.1 below.

This thesis provides many novel contributions with regard to the role of ecosystem services in poor urban areas. First, it is argued that local ESS such as urban agriculture really are not currently used to a great degree (contrary to many other studies), but only the poorest have to rely on them occasionally. Second, regulating and cultural services have real meaning for slum residents, and novel ways of understanding and measuring these values are necessary. Amongst other adaptive capacity determinants, the following section shows the importance of an appreciation for the local environment.

7.2.2 Adaptive Capacity in Poor Urban Areas

7.2.2.1 Determinants of Adaptive Capacity in Poor Urban Areas

As for the study of ESS in slum areas, this study is unique in measuring adaptive capacity in poor urban areas. As described in Chapter 2, adaptive capacity is conceptualised in this thesis as being a component of overall resilience, in addition to more external drivers of exposure. Adaptive capacity determines the degree to which individuals will be affected by, and able to deal with the exposure to shocks and stresses. Other studies *characterise* adaptive capacity but very few studies have both characterised and measured adaptive capacity, with singular exceptions (Engle 2011; Engle & Lemos 2010). Nadine Marshall measured components of adaptive capacity or social resilience in a few different contexts using a similar methodology to this thesis, but in rural contexts and with regard to specific livelihoods (e.g. Marshall et al. 2007; Marshall 2010). This section highlights some of the most important determinants of adaptive capacity that are discovered in Chapter 5 and discusses the significance of these findings in relation to comparable studies. Having identified these determinants, one is able to then 'build on what you already have' (Chatterjee 2010; Kuruppu &

Liverman 2011). The way this might be carried out in order to increase local resilience is followed up in Chapter 8.

There are six determinants found in Chapter 5 that correlate significantly with adaptable behaviours in slum residents. Three of these are initially characterised under 'adaptive capacities' and three under 'social sensitivities'. However for the purposes of discussion, and how they fit with other concepts in the literature and with each other, they are discussed altogether and in a slightly different order here.

The first key determinant of adaptive capacity, that also garners attention in the adaptive capacity literature, is innovation. Innovation not only has been found by others to contribute towards adaptive capacity (Gupta et al. 2010; Jones et al. 2010b; Levine et al. 2011), but also to have other benefits such as encouraging general resilience (Nielsen & Vigh 2012). Furthermore, innovation may not only contribute to adaptation but also to transformative change (see Moore & Westley for review), which in this context might look like slum individuals finding entirely new livelihoods or building up the resources to move out of highly vulnerable areas. More work is certainly required to understand the actual process by which innovation and individuals' innovative capacity affects their adaptability, including what other prerequisites are necessary for it to lead to adaptive outcomes. One thing is clear from other studies however, that innovative ideas often flow through social networks and innovation benefits from information being received through such networks (Moore & Westley 2011). This linkage between innovation and networks is depicted in the model presented at the end of this section. Social networks are another important determinant that was found in the results of this study.

Social networks are one of the most critical determinants of adaptive capacity for slum individuals. Not only do social networks relate with innovation as mentioned above, but in this study they correlate with a range of adaptive responses, are the only factor to correlate with people *not*

leaving the area in times of crisis (Chapter 5), and are the distinguishing feature between different groups' levels of adaptive capacity (Chapter 6). Other studies on poor urban areas also find the importance of social networks for the urban poor (Lyons & Snoxell 2005; Adama 2012; Chatterjee 2010; Lourenço-Lindell 2002b; Kabiru et al. 2012). For example Braun and Aßheuer (2011) carried out empirical work with a large number of questionnaires in Dhaka, Bangladesh, and found that mutual help and social support were the dominant feature of slum-dwellers surviving floods, regardless of how strongly people were affected. This study also concluded what was found here, that despite poor education and resources and being highly vulnerable, slum dwellers show a remarkable capacity to adapt.

Social networks in fact serve a wide variety of purposes. They are central in economic and entrepreneurial activity within slum areas as Adama (2012) found in informal recycling in Nigeria. They serve to flow information, ideas and knowledge (Berrou & Combarous 2012), are intentionally created to support business and entrepreneurial activity (Lyons & Snoxell 2005), and act as a way of constructing meaningful, organisational identities for slum-dwellers (Imas & Weston 2012). As such these webs of social relationships enable access to a range of opportunities in the city and become a social infrastructure of themselves, of critical importance for 'making it' in the city (Simone 2004; Simone 2010). Furthermore, Robert Sampson's long-term research in large American cities suggests that effective networks in neighbourhoods (along with local NGOs that take responsibilities) will reduce crime rates in those areas (Sun et al. 2004; Sampson & Groves 1989). Moving beyond 'survival' to transformation, certain network structures are critical to enable individuals to innovate collectively across scales, allowing social innovations to form. In this way individuals may avoid poverty or rigidity traps and thereby experience transformation (Moore & Westley 2011). Building social networks in slums therefore (discussed later in Chapter 8) will not just increase resilience, but also contribute to the general well-being, identity, safety, and economic improvement of slum-dwellers.

Having mentioned those wide-ranging benefits of social networks, the existence of social networks alone should not be put forward as a panacea to solve the welfare issues of the poor (Lourenço-Lindell 2002b), as some more simplistic notions of social capital suggest (Lourenço-Lindell 2002a for review). Lourenço-Lindell's thesis (2002) on informal livelihoods and social networks in Guinea-Bissau gives some reasons why. She goes into much detail regarding the roles and power dynamics of these networks and hence is able to demonstrate some of these complexities. She finds that while social networks are important, there are power imbalances within networks that mean particular individuals may not actually benefit from the links. Likewise some groups are excluded from particular networks, for example those who are too poor to access savings groups (Lourenço-Lindell 2002). However the current study measures networks specifically in terms of realised social support to the individual. This bypasses situations where individuals are not actually benefiting and where there is exclusion from help, as the ego-network analysis only measures ties that have already delivered support. What is clear is that more information than just the existence of ties is necessary in research, and indeed this study found that multiple types of networks serve roles in adaptive capacity.

In fact, two different types of network appear to serve different roles in adaptive capacity. While in reality there will be some crossover between these two categories (e.g. neighbours who are also relatives etc.), they serve a useful distinction to understand the different functions of social networks in this context. First there are local networks, neighbours who helped in terms of learning from others and non-material help. Second there are non-local but stronger friend/relative links who gave material help. This finding corresponds to other categorisations in the literature: strong (non-local, kin) versus weak (local) ties (Granovetter 1973); bonding (kin) versus bridging capital (local connections for help or business) (Adger 2003; Pelling & High 2005); and embedded (kin) versus autonomous (local) ties (Berrou & Combarous 2012). Further details of specific differences in some

of these categorisations and the specific roles of each type of tie were given in Chapter 5.

The key point is that both network types are necessary for slum residents, serving different roles as a part of adaptive capacity. Some studies have emphasised the importance of one or the other, for instance weak ties for entrepreneurship or innovation (Elfring & Hulsink 2003; Hauser et al. 2007), or strong ties for trust or in uncertain contexts such as slums (Adama 2012). However, as others also emphasise (Fafchamps & Minten 2002; Halpern 2005 from Lewicka et al. 2011), the evidence here suggests that both network types have necessary roles. Berrou and Combarrous (2012) call this useful mix of strong and weak ties the “paradox of embeddedness”. Obviously the dichotomy is not clear-cut, but in general weaker, perhaps non-kin and autonomous ties are useful for access to information (and innovation), employment, and business connections while stronger, probably kin or friendship ties are useful in times of crisis and for risk sharing and social insurance. Equally Moore and Westley (2011) give an example of where both types are required for the same process: for the invention of an innovation lots of weak and diverse ties are required (for access to diverse skills and knowledge), while the adoption of that innovation requires strong bonds and trust. Lastly strong ties are shown in this thesis to take time to form, just as Berrou and Combarrous (2012) also found, and this is due to the fact that trust builds with regular contact over a prolonged period. However once those strong ties are formed, they enable quicker access to financial/material resources.

The finding that different types of social network exist, and are both required for adaptive capacity, challenges simplistic notions and measurements of social capital. (While this thesis is not framed or focused around the social capital literature, this finding is important to note given the crossover of concepts with social network theory, and social capital with adaptive capacity (Pelling & High 2005)). Some social capital assessments, or measures of social capital within wider resilience assessments, measure

social capital as merely the membership of certain groups (e.g. Maluccio et al. 2000; Van Deth 2003). While this is a useful basic proxy, it is clear from this study and empirical reviews (Lindell & Utas 2012) that there is a great diversity and complexity of forms of social organisation across urban networks in African cities. Studies that use such simplistic, generalised indicators inevitably miss both this diversity, and the possible different types of tie that are important in that context. Some social capital studies do differentiate well between different types of ties however, differentiating bonding, bridging, and linking capital (e.g. Wolf et al. 2010). However, network analyses obviously reveal a greater depth of understanding of the composition and structure of these networks and types of tie, which can be useful for understanding how networks affect overall adaptability.

In addition to multiple types of networks, there are factors that are necessary to complement the functioning of social relations. In fact, social capital assessments have been criticised for not capturing aspects of power and agency, and simply passing the burden of social reproduction onto the poor. Lourenço-Lindell (2002a) argues that traditional social capital discourses neglect potential marginalisation and exclusion of certain groups, and the (un)sustainability of networks. She therefore makes the case to 'get rid of social capital' (or the dominant social capital discourse), in favour of an approach that considers more of the "politics of support mobilisation". Moore and Westley (2011) give another example of how agency is required within networks, for the transmission of innovations. In addition to considering multiple network types therefore, it is useful to consider networks as both structure and agency. My conclusion with regard to the dominant social capital discourse that Lourenço-Lindell discusses is rather than 'throwing the baby out with the bathwater', social capital measurement may be complemented by parallel considerations of the nature of types of ties, as well as the political context, local norms, and agency. In this way, not only the 'people as infrastructure' will be considered, but also how that social capital is mobilised. This then lines up with the working definition of adaptive capacity from Nelson and colleagues (2007), that it is not just the

preconditions necessary to enable adaptation but also the ability to mobilise these elements. While 'agency' per se is not a focal point of this study, similar socio-cognitive factors are found to be of utmost importance.

'Socio-cognitive factors' also have a key role in determining the adaptive capacity of individuals. The two components that are found in Chapter 5 to significantly correlate with adaptability are 'belief in change locally' and 'feelings of control'. These match similar findings elsewhere of the importance of community self-image and trust, and *perceived* adaptive capacity (Petheram et al. 2010; Kuruppu & Liverman 2011). Other studies may conceptualise these determinants slightly differently but the important contribution is the same – that as well as structure, resources and social relational perspectives, subjective or socio-cognitive factors are critical in understanding individuals' adaptive capacity. Innovation, as described above, also fits into this categorisation of subjective factors.

As mentioned, other studies consider some of these socio-cognitive factors as a part of 'agency' and there is certainly an overlap in these concepts. Agency can be defined as the ability or independent capability to act on one's will (Brown & Westaway 2011). As such, agency is related to perceived adaptive capacity as measured here (Grothmann & Patt 2005; Marshall 2010). This thesis focuses on factors discussed in the environmental change literature (Grothmann & Patt 2005; Pelling & High 2005) but it is useful to consider agency, as a key determinant of adaptive capacity, in greater depth. Brown and Westaway (2011) for instance demonstrate how much can be learned for agency and resilience from the literatures of human development, human well-being and development, and disasters and community resilience. One significant contribution from Sumner (2010, see Brown & Westaway 2012) is that well-being is three-dimensional, made up of material, subjective, and relational aspects, and this thesis is demonstrating that similar areas exist for components of adaptive capacity. While it is outside the scope of this discussion to go into these literatures or the exact components of particular models (e.g. Grothmann &

Patt 2005), the key point is that adaptive capacity is determined in part by socio-cognitive factors, and therefore a consideration of agency is important in trying to understand adaptive capacity in poor urban contexts. The particular psychosocial or socio-cognitive factors that might be at play should be considered from a wide variety of literatures.

In addition to networks, innovation, and agency, having a 'sense of place' is strongly related to individuals being adaptable in times of crisis. Sense of place is related to, though somewhat separate from, both networks and socio-cognitive factors. In addition to 'belief in local change' mentioned already, the results here distinguish two separate components to place as determinants of adaptive capacity, broadly relating to ecological and social features. Put another way, this refers to physical versus social factors of place attachment (Lewicka 2011).

As a part of a sense of place, having an appreciation of the local natural environment is one of the most important determinants of adaptive capacity. As one of the 'social sensitivity' statements in Chapter 5, this factor reflects a sense of individuals wanting to care for the local natural environment. The evidence for its influence on adaptive capacity is strong. Indeed, Chapter 5 describes how an appreciation of local environment correlates with adaptive responses where other determinants do not. In a similar vein, previous research has demonstrated the provisioning or regulating services that urban green spaces provide, or even recreational values from these areas (Vejre et al. 2010; Bolund & Hunhammar 1999; Ernstson et al. 2010). However as Schäffler and Swilling (2013) review, the concept of urban green space is often treated as something that is *nice* to have rather than being seen for its ecological and social functions. But this thesis demonstrates that an appreciation for the local environment, even in degraded areas, may actually affect how well individuals respond to shocks. Given the small amounts of green space that existed in Mulago where this factor is highest, the implication is that even small amounts of green space or the existence of lone trees will contribute towards a sense of place and

the adaptive capacity of slum individuals. Therefore, green space should not just be seen as a luxury that is limited to protected or wealthy areas, which was how many slum residents perceived it to be. In fact, even in poor, degraded urban environments it should be considered as a foundational way to improve the liveability and resilience for local people. There are very few examples of green infrastructure investments in developing country cities (e.g. Da Cunha 2001), but Chapter 8 explores the potential of this further.

If an appreciation of local nature represents an 'ecological attachment to place', then 'social attachment to place' is also highly significant for adaptive capacity. Like agency and social networks, the study of place attachment has a huge literature and there are many ways of dissecting the concept. But the central finding that place attachment determines adaptive capacity in slums is both well founded and in other regards, novel. Supporting the finding here, Lewicka's (2011) review of forty years of work on place attachment found that place-attached persons are more satisfied with life overall, have stronger bonding social capital and local ties, and trust people more. Other studies have found a strong link between place attachment and social capital specifically (Adger 2003; Yohe & Tol 2002). Along with duration of residence, neighbourhood ties are consistently the strongest predictor of place attachment (Lewicka 2011). Place attachment is therefore clearly linked with social ties. Following the finding in Chapter 5 that both bonding and bridging capital are important for adaptive capacity, Lewicka has suggested that spaces that encourage these two types of networks will also be most likely to encourage emotional attachments in the people living there (Lewicka 2011). While most of these studies link place attachment and social ties therefore, given the links between adaptive capacity and social capital (Pelling & High 2005) these studies suggest place attachment will boost adaptive capacity.

Despite the general alignment and relationship between social capital, place attachment, and adaptive capacity in the literature, social capital rarely

appears alongside place attachment in empirical studies (Wood & Giles-Corti 2008). Furthermore despite there being an 'immensity' of literature on place (Trentelman 2009), the concepts therein are sometimes under-represented in mainstream discourses such as climate change (Adger, Barnett, et al. 2011). One important aspect of the results here is the context of place attachment within slum areas. Lewicka's review found that place attachment can be present even when people are living in a high risk area, where there is increased mobility, where people are commuting elsewhere, where individuals have more than one residence, or even where people are living in involuntary locations (see Lewicka 2011 for review of studies). Ironically the slum areas in this study embody all of these aspects for certain slum-dwellers. In fact, slum areas often have a strong sense of place for their residents, being places where different realms of life that would likely be separated in Western cities are spatially and functionally integrated (Nijman 2010). It is important to note, therefore, that even in an area that is degraded ecologically and socially (with respect to crime and community divisions etc), individuals still develop social and ecological attachments to place. There are further aspects of place attachment that will be fruitful to examine in this context in future, such as the relationship between place, duration of residence and networks, the types of space within slums that engender attachment, and the different scales at which it forms. The finding that slum-dwellers with a strong attachment to place are likely to adapt better to shocks is an important result for policy that is followed up in Chapter 8.

This study has discovered a number of individual determinants that positively influence adaptive capacity, but it has also become clear that they inter-relate and are mutually supportive. For instance, it has been described how innovation is often spread through social networks, how social networks require agency in order to motivate that flow of information, support or innovations, and how the existence of social networks and an appreciation of nature help form attachment to place (Lewicka 2011). Chapter 5 demonstrated this empirically with the finding that attachment to

place, the existence of strong, and wide networks, and attachment to occupation all co-exist in individuals, while an appreciation of nature did not. It is hard to disentangle the relative importance of each, or the causative direction of influence, but the important finding is that a number of determinants coalesce around this notion of a 'sense of place'. From the findings of this thesis and the diverse bodies of literature discussed, it is suggested that sense of place has components of: a belief in change locally and a sense of agency, an appreciation of local nature, an attachment to place and the existence of local social networks. When building local adaptive capacity, it will be important to a) work out which of these factors are strong or weak, and b) how they can be increased so that they mutually support each other.

In addition to the determinants mentioned here, there are evidently other factors that influence slum adaptive capacity, and moreover determinants of exposure that affect slum resilience. Having reviewed the influence of various capacities and sensitivities on the adaptability of individuals, it should be reminded that the empirical measurement in this study is specifically of *adaptive capacity*, rather than exposure. There will be other determinants of adaptive capacity not covered here, such as more socio-economic factors such as income and wealth. Moser and colleagues (2010) for instance found that the most important asset for the urban poor in adaptation to climate change is housing. As well as those factors of adaptive capacity, there are determinants of exposure not covered here that will have a profound affect on general resilience. These include deficits in basic infrastructure that affect the degree to which individuals are exposed to shocks, and the way in which they access basic needs such as water and sanitation. For example, Adelekan (2010) found that vulnerability to flooding in the slums of Lagos is linked most with the provision of adequate infrastructure and management of the environment. From a vulnerability perspective (therefore including exposure), Lankao and Tribbia (2009) carried out a meta-analysis of frameworks and found a number of critical determinants along the lines mentioned here: age, exposure to hazard,

access/quality of infrastructure, income, location, and access/quality of services.

Alongside the importance of infrastructure and asset availability, local governance greatly influences the resilience of slum dwellers. There are a number of different governance determinants of adaptive capacity that have been discovered through the different fields of study on adaptive governance, adaptive management, vulnerability and resilience (Hill 2013b). For slums, this is mostly likely to play out in the transparency and fairness of local governance, where corruption can often result in extremely inequitable distribution of resources. While outside of the scope of the analysis, anecdotal stories are found in this research that reveal this, for example where thieves are released because of their connections with local leaders. The complexities of urban governance should be carefully considered, in general and especially in particular informal urban spaces such as market places where the complexities of urban governance even challenge Western notions of governance (Lindell 2008). Finally, another critical factor linked to governance is land tenure and ownership, as tenants (as opposed to owners) have limited capacity and less commitment to improving housing stock for example (Revi 2008). Overall, these factors should be considered alongside the determinants found in this study.

7.2.2.2 A Model of Adaptive Capacity Determinants

The investigation of determinants of adaptive capacity in poor urban areas has generated concrete results as to what are the most important components, which can then be targeted when it comes to building resilience. In addition it has been noted that 'external' features that influence exposure and adaptive capacity such as the provision of basic infrastructure, and the general governance landscape, will influence the resilience of individuals. All of these factors are combined to form a model of influences on local adaptive capacity in poor urban environments. This is shown in Figure 19 below. The model includes both subjective and objective factors, and resolves around place. It is aimed at the local level, although the

role of governance is positioned at a higher level given that it influences all of the local-level determinants (e.g. availability of jobs, state of nature etc; see blue box at the top). Assets and infrastructure are included as a grouped external factor to the model (see black boxes in Figure 19), including tangible natural, physical and financial assets, as well as intangible assets not already included, such as the availability of information and other human factors such as education. The analysis of key determinants of adaptive capacity carried out in Chapter 5 and discussed in this section is visualised in the following model:

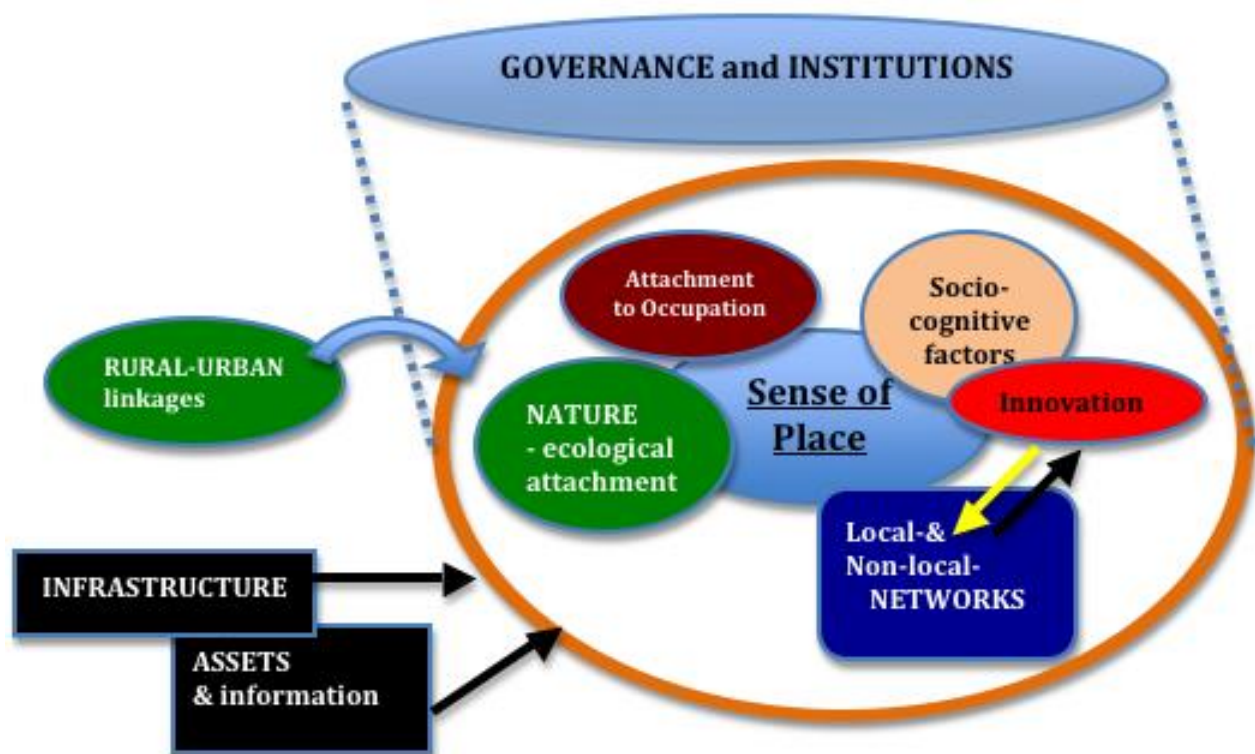


Figure 16: A model of local adaptive capacity in poor urban areas. Determinants from the results of this study are shown in the orange circle; other important factors are shown outside of this. The determinants primarily influence at the local level, except for governance and institutions, which operate at higher level.

The factors that emerge from the findings of this study are within the orange circle in Figure 19 above. The areas of overlap reflect the mutuality of certain factors. The centrality of 'Sense of place' reflects how many factors

form a part of this important aspect of adaptive capacity – cognitive perceptions and agency, attachment both to natural aspects of the environment as well as social including jobs, and the existence of social networks. The arrows between networks and innovation reflect the way in which networks are requisite for the spread of innovation and likewise networks provide information for the innovation process, as discussed above. This model is formed from the results of the semi-quantitative analysis carried out in this study, as well as a short review of relevant literature. As such, urban features such as identity, which require more qualitative understandings exemplified through much African urbanism scholarship (Pieterse 2011a; Simone 2010; Lindell 2008), are not explicitly included, however I suggest they would exist in parallel and hence contribute to the central understanding of a sense of place. Solely the results of this study are presented here in model form, however a fuller discussion of how these features relate to other adaptive capacity frameworks is given in Section 7.4, as well as a discussion of how they may be built upon.

7.2.3 The Importance of Urban-Rural Linkages in Poor Urban Resilience

In order to understand the adaptive capacity of individuals living in poor urban areas, an understanding of both the local components of adaptive capacity, as well as the degree to which individuals are dependent on outside (rural) areas is required. Hence while the research design of this project is not focused on those linkages, the data are investigated to explore this aspect in brief. In short, the research reveals that contrary to many similar studies, rural-urban linkages are not highly significant for the adaptive capacity of slum dwellers.

Chapter 5 described how many studies have argued that rural-urban linkages are important not just for the resilience of rural households but also for the survival of poor urban households in terms of financial support as well as food security (e.g. Mberu et al. 2012; Owuor 2007; Frayne 2004). However in both social and ecological terms, the results of this thesis

indicate the opposite – that the adaptive capacity of poor urban individuals (in times of crisis) is not greatly determined by sources of support from the village. Chapter 4 shows that this is true for food or agricultural produce, Chapter 5 shows that the vast majority of social support in times of crisis came from within the same slum if not the same city. It should be clarified that this investigation is with regard to adaptive capacity to *shocks*, rather than regular remittances for example. Potential reasons for this discrepancy with other studies are given in those previous chapters, including differences in study design where some focused purely on the young or the old, for example (Mberu et al. 2012; Tutu 2012), or how on close examination percentages of those receiving support was actually still quite low. When considering the importance of urban agriculture, few studies explicitly consider the urban poor and the same might be true for studies of rural-urban linkages, hence missing the unique dynamics in slum contexts.

In spite of contrary studies therefore, the results here indicate that rural-urban linkages do *not* play a large role in the adaptive capacity of the urban poor. Furthermore, there are a few studies that also find this. Mkwambisi and colleagues (2011) found in Malawi that while remittances often flow back from more affluent urban family members, there was little evidence for rural families supporting urban residents. This is consistent with studies elsewhere in Africa, despite some contrary findings as already mentioned (Frayne 2004). With regard to food consumption, it is generally the case that urban food is in fact bought with incomes rather than being brought from the village (Garrett 2000), as is also found in the current study. Hence regarding both social and ecological resources necessary for adaptability, local components are more important.

This relative independence of slum dwellers from rural linkages is, in fact, consistent with broader trends of urbanisation. For instance it is not uncommon now for cities to produce very little of the ecosystem services that are consumed within the city (Jansson 2013), food production is shifting further away from the point of consumption (Steel 2010; Berg 2009

– in Barthel et al. 2010), and there is an inevitable process in a context such as observed here that hyper-urbanisation without proper planning will reduce the amount of green space (Cilliers 2009). Socially, Chapter 5 also briefly discussed how social ties back to the village (that are necessary for social support for instance) may erode with time. Gutman (2007) describes the potential consequences of this trajectory from a global perspective, how since the Industrial Revolution the rural-urban compact has developed in such a way that the rural population has become increasingly marginalised and ecosystems are increasingly destroyed. Countries like Uganda, with still a predominantly rural population, are still further behind on this trajectory but the lessons should be heeded now. At a local level and for the welfare/resilience of the urban poor, it may appear that rural linkages are not that important. However to achieve environmental sustainability as countries like Uganda continue to urbanise, it will be necessary to take the recommendations of Gutman and others on board – for example encouraging employment and income flow back to rural areas, helping the rural poor become suppliers of ecosystem services to the cities, and managing markets for these ecosystem goods and services.

Some have suggested that the rural/urban divide is becoming an obsolete dichotomy, however I would argue that it is a useful distinction that just requires consideration of both rural and urban in tandem. Some have argued for the obsolescence of this divide because of the rural/urban interlinkages present in food security and production, but in fact have mainly focused on peri-urban areas (Lerner & Eakin 2011). Others have focused on the large quantities of rural produce that are sold in peri-urban and urban markets (Mkwambisi 2007, cited in Mkwambisi et al. 2011). When trying to address the full spectrum of rural to inner-city slum however some characterisation is evidently helpful; they just must be considered simultaneously in order to both understand the nuances of interlinkages discussed and to take account of possible conflicts over development resources. This study finds that at the local level, rural linkages are not very important for the adaptive capacity of slum dwellers who

depend more on intra-city relations. However their consideration becomes critical when considering regional or global environmental sustainability. As has been stressed in Sections 7.2.1 and 7.2.3, this finding adds weight to the importance of building both green space and a local sense of place in these slum areas.

This first main section of the discussion has described the key social and ecological components of adaptive capacity for poor urban dwellers. Other lineages of research have identified determinants of urban vulnerability but there have been few case studies from a social-ecological resilience approach, or that have focused on adaptive capacity (Lankao & Tribbia 2009). This thesis makes a number of challenging findings contrary to studies in the literature, that local ecosystem services are not used that much in slum areas; that urban agriculture is not that important for most slum dwellers; and that rural linkages do not provide much help in times of crisis. A positive finding is that only small amounts of green space or trees amongst the slums appear to boost individuals' sense of place and therefore adaptability. Finally the main determinants of adaptive capacity (along with other stand-out determinants from the literature not included here) are assembled into a model that should be helpful in considering slum adaptive capacity in future.

7.3 Heterogeneity of Urban Resilience

The second main point of discussion from the findings of this study is that poor urban areas display remarkable levels of heterogeneity – not just between different slum areas, but between individual groups living in those areas, and with the duration of residence that slum dwellers are present there. This discussion brings together the key results of Chapter 6, as well as differences observed in ecosystem services by area and by individuals' characteristics, as mentioned at the end of Chapter 4. These heterogeneities are explored in this next section.

7.3.1 Heterogeneity in Spatial Distribution of Ecosystem Services and Adaptive Capacities

The results of this study suggest that slum areas within a city may have markedly different 'profiles' of resilience. The research design allowed a spatial comparison for both ecosystem service and adaptive capacity measurements, and both (social and ecological) components of resilience show substantial differences. For instance in terms of ESS, the inner-city slum (Kisenyi) receives more food from outside, while the peripheral slum (Bwaise) has a handful of residents keeping livestock. The one slum area with some open green spaces and trees (not associated with wetlands), Mulago, has approximately double the amount of residents reporting to appreciate regulating and cultural values as the other slum areas. Regarding social components of resilience, areas are statistically significantly different: inner-city residents show more innovation and agency while peripheral slum-dwellers show lower levels of individual capabilities but they receive much more help and have stronger social support linkages. Even on first glance therefore, the city is a heterogeneous landscape of adaptive capacity and resilience.

The fact that spatial heterogeneities in ecosystem service usage match the ecology of those areas is encouraging. It has already been discussed (in Section 7.2.2) how small amounts of green space correlate with a sense of place and adaptability, as observed in Mulago. By explicitly linking this finding to the ecology of the area, it makes an even stronger case that if made available, residents will value green space and the presence of vegetation. Further, contrary to other urban ecosystem service settings such as Stockholm (Barthel et al. 2010; Bolund & Hunhammar 1999), this thesis demonstrates the case in an area that is generally in poor condition, and where there are little or no direct (provisioning) benefits coming to residents either. Green spaces are rarely valued in developing country cities, but the evidence here and elsewhere (Cilliers 2009) suggests that if they are provided for and maintained, they will have significant benefits for the urban poor.

As well as different levels of resilience in slums across a city, there are likely to be different configurations of adaptive capacity components. In other words, when two slum areas differ in adaptive capacity, it is likely that the relative importance and makeup of different determinants will differ too. Jankowska and colleagues (2011), using very different methods to analyse vulnerability in Accra, Ghana, found similar complexity when it came to the status of different slum areas; in fact the results differed according to the vulnerability index that was used. Therefore there is a need to understand which factor(s) determining adaptive capacity is/are indeed limiting. With urbanisation processes continuing to shape and change cities such as Kampala, the slum conditions exemplified by Kisenyi and Bwaise will likely continue to coexist, even when certain slums become more urbanised, other new peripheral ones will emerge.

Moreover, the differences in adaptive capacity profiles suggest that there is a trade-off between areas with relatively higher individual capacities (e.g. innovation, agency) and areas with relatively higher social cohesion as measured by social support and strength of ties. What this difference might translate into, as argued in Waters (2012), is a potential trade-off between individual-level resilience (capacities to act) and community-level resilience (social cohesion and therefore ability to act collectively). This is exemplified, as described in Chapter 6, by highly adaptable individuals leaving the area temporarily during times of crisis. While this trade-off between scales may appear to be a challenging finding (given possible assumptions that aggregate individual resilience should translate into community-scale resilience), the ecosystem service literature has already highlighted the challenge, demonstrating that trade-offs exist across space, time and between multiple ESS (Rodríguez 2006). Assumptive notions of adaptive capacity at one scale translating into higher adaptive capacity at another should therefore be receive further consideration.

This potential trade-off also begs the question of which situation/community is more 'resilient', the one showing more community cohesion, or the one with greater individual adaptability. From the analysis carried out here this answer is hard to pin down, as it is difficult to empirically measure which community is objectively more 'adaptable' (see Limitations section). These alternate 'states' may in fact represent alternate 'basins of attraction' and therefore coexist, as described by resilience theory (Walker 2004). However the process by which individual adaptive capacities 'scale up' into forming community-level resilience (or not) requires further investigation.

7.3.2 Heterogeneity in Adaptive Capacity of Population Groups

To understand the resilience of poor urban areas, it is crucial to realise not just that different slum areas show different aggregate levels of resilience, but also that different people groups will too. It is already well-known that in vulnerable environments, specific groups suffer disproportionately, for example women, or the young and elderly (e.g. to climate change - Gasper et al. 2011). With corresponding results through both qualitative and quantitative analyses, Chapter 6 found a number of specific groups who show lower levels of adaptive capacity in the slum. Migrant groups in particular (both domestic and international, e.g. the Karamajong, Somalis and Congolese) are less adaptable in general. But the arguably more important finding is that adaptive capacities (e.g. innovation or belief in change) do not differ significantly with the 'background population'. Instead, it is measures of social networks that distinguish the groups. Furthermore, where migrant groups have strong social support networks in place such as for the Somalis, they actually show high levels of adaptability in times of crisis.

Social networks therefore seem to be one of, if not the most significant, defining feature of the resilience of different slum groups/populations. It has been discussed elsewhere (Foresight 2012) how a lack of social support

can hinder new migrants to a poor urban area from adapting well to shocks. Again, the strong/weak ties distinction helps us to understand the adaptability of specific groups: for example specific migrant groups may develop social support mechanisms through linkages within their group, or strong ties (e.g. the Somalis). However, they may simultaneously lack the broader, weak ties with more diverse individuals, which allow integration into wider society. Therefore they may be able to survive using localised/same-group strong ties, but remain relatively excluded when it comes to forming social or business partnerships. Other ostracised social groups, such as prostitutes, face the same dilemma: they have strong ties that enable them to 'look after their own', but inevitably always face barriers to integrating with most of the rest of the community. As emphasised in the proposed model at the end of Section 7.2, a network perspective is key to understanding slum resilience.

In a similar way, different types of slum dweller utilise different ecosystem services to meet their daily needs. Analysing in a slightly different way to the adaptive capacity comparison, Chapter 4 investigates the characteristics of ESS-users within the slums and finds that it is the poorest of the poor who use local provisioning services such as accessing water via local wells, rather than public taps. By contrast only relatively wealthier individuals value regulating and cultural services. As reviewed in Chapter 2, there is still relatively little understanding of the links between income levels and use of ecosystem services, especially in urban areas. Cilliers and colleagues (2012) found the same result in a South African city, that relatively poorer residents use provisioning services more, however the current demonstration of this link in slums is novel. In one way, this contradicts the finding in this study that urban agriculture is not used very much in the slums. However the services in this particular analysis are those that only the most desperate would use, whereas the point for urban agriculture is that certain barriers such as lack of space mean that the majority of residents cannot carry it out. In actual fact therefore, the conclusion in both regards is that the availability and provision of local ecosystem services may affect the poorest of the poor,

even if they are currently not able to benefit from them. The maintenance of natural resources and benefits from local ecosystems should therefore be built upon for urban resilience.

The differential patterns of ESS use according to relative income also necessitate a critical equity perspective to understand who benefits from local ecosystem services (Ernstson 2008). In this case, the use of provisioning ESS by the poorest individuals actually indicates an extreme vulnerability, as for example they use communally available, contaminated water sources, rather than investing in provisioning services such as urban agriculture. However understanding *who* uses these types of service, or even which residents are affected by ecosystem disservices, is key to understanding the resilience of the population as a whole. Why this is important is that projects that enhance certain urban ESS or create green space must be aware that there will be both winners and losers (Daw et al. 2011). Furthermore, this will also be the case for social ‘enhancements’ within the community such as education to increase employability; in other words bottlenecks to resilience will be different for different people and population groups.

7.3.3 Changes Over Time and Effect of Urbanisation

In addition to spatial heterogeneities, the adaptive capacities of slum areas are dynamic over time. Chapter 6 shows how specific capacities correlate with duration of residence i.e. capacities increase according to how long residents stay there. Crucially, it is ‘local’ capacities that take time to build, such as attachment to place, social networks, learning from others and receiving neighbourly help. It has already been discussed how a comprehensive review found neighbourhood ties and duration of residence to be the best predictors of place attachment (Lewicka 2011), therefore the question arises whether duration of residence directly allows an attachment to place to form, or whether the time present in an area allows strong bonds to be formed that then generate a place attachment, or some of both. The

fact that strong ties, unlike other capacities, correlate with the time alters were known and not the actual duration of residence indicates that it is the former – that strong ties build somewhat independently of ‘place’. This suggests that individuals move into a slum area already with certain strong ties in place, building weaker networks with non-kin etc once in the area. This matches up with the strong/weak tie distinctions discussed above. Evidently this has significant consequences for understanding slum adaptive capacity: first that a sense of place ‘naturally’ builds with time (Lewicka found the most impact over the first five years), and second that both social networks *and* attachment to place are required in order to build individuals’ adaptive capacity.

This positive process of a sense of place building with slum dwellers’ residence time may work against more macro urbanisation drivers that contribute to reducing community resilience over time. Ecologically, urbanisation without proper planning will reduce the amount of green space. Socially, rapid urbanisation and the political pressures of urban development may result in high demand for land, community fragmentation, and low ‘community’ resilience. The situation in inner-city Kisumu demonstrates that where there is such high demand for land, an associated threat of eviction for many, resultant fragmentation of social groups and low residence time, social cohesion is low. As discussed, these factors reduce the likelihood of place attachment forming in individuals too. Without regulation, and security and political stability to keep individuals in that place, social cohesion has little chance to form. Indeed Elias and colleagues (2011) claim that urban changes (and accompanying changes in population, demographic and livelihood characteristics) are the main factors that influence adaptive capacity. These macro drivers undoubtedly play a crucial role in determining the resilience of poor urban areas.

Ultimately, there is likely to be a shifting pattern of different areas’ levels of adaptive capacity. It has been observed that rather than there being one slum area more ‘resilient’ all-round than others, there exists strengths and

weaknesses, and different unique 'bottlenecks' of each area or people group to resilience. Just as an inner-city slum might decrease in social cohesion as demand for land increases, so too is it likely to attract the more adaptive individuals, who have greater potential for innovation and employment (Ferré 2011; Tutu 2012). Meanwhile in areas of the city where residents might be less able to gain access to services but land is cheaper and more available, populations may establish and build community resilience. Laid on top of this will be the effects of government interventions and development. At a city scale, areas experience cycles of neglect and decay over time, followed by renovation and development. The precise spatial factors will vary in each case, but include land and market dynamics (Simon 2011).

In general, other studies have identified vulnerable segments within developing country cities including slums and informal settlements, and the low-income, women and children (Revi 2008; Hardoy & Pandiella 2009). Few however have actually measured vulnerability or adaptive capacity within slum areas. Of these, some have focused on specific aspects such as Agarwal and Taneja (2005), who found that differential vulnerabilities across slums that have led to varying degrees of health burden on slum children. Using different methods altogether, Jankowska and colleagues (2011) used census data and spatial regression models to analyse the effect of locations on vulnerability indices. They also found that the oft-made assumption of uniform vulnerability is wrong and urban vulnerabilities are in fact highly complex. They even found it hard to "draw an arbitrary line between slum and non-slum", emphasising the variability in the vulnerability of different neighbourhoods. By complete contrast of research method, Ruiz (2013) carried out months of ethnographic work in a shantytown in Santiago de Chile and discovered three different ways or 'orientations' that residents took on as safety responses to deal with the (gang) violence in the area. Implicit to these different orientations is the importance of individual differences in agency and even personality, as noted in the determinants of adaptive capacity in this study. Ruiz notes how

individuals even “rearticulate their subjectivities in ways which not at all times make completely sense”. These different research contexts and methodologies come to the same fundamental conclusion – that poor urban areas are highly heterogeneous in terms of the ways that different residents cope with problems, and the capacities that they have at their disposal to do so. Bearing this in mind will be crucial when considering slum development, as discussed in Chapter 8.

In contrast to these studies and the findings of this thesis, much of the discourse around slum vulnerability paints a rather uniform picture (Simon 2011). Furthermore, this picture is often in a rather negative light, focusing on more of the pathologies of this context (Davis 2006b). This may be partly an artefact of the methods of ‘measurement’: by assessing the situation in slums only through aggregate data and ‘generic descriptions’, it is possible to miss the nuances and heterogeneities highlighted here, as well as the positive stories of resilience and survival. Pieterse (2011a) argues that these types of insight into everyday life in African cities will best be grasped through literary works, anthropological studies, films and perhaps investigative reportage. Alongside the individual-level analysis that is carried out in this study therefore, it is clear that further qualitative work will help to elucidate the nuances and complexities of slum life, including the ways in which different individuals and groups cope with shocks and stresses. Lastly these discussions challenge the take-all usage of ‘slum’ terminologies, not just because of the diversity of definitions (Simon 2011) but also the blurred boundaries that exist given the balance of strengths and weaknesses that will occur from ‘slum’ to ‘slum’ within a city.

The second crosscutting synthesis discussion has demonstrated the heterogeneity of urban resilience, both between different slum areas, between people groups, and according to more obvious determinants such as income. These heterogeneities necessitate a critical equity perspective when it comes to assessing the provision of benefits from development interventions or public amenities such as green spaces. In addition to these

spatial heterogeneities, levels of adaptive capacity within different slum areas are likely to be in flux as urbanisation puts different demands on areas of the city. Despite this constant change, there are encouraging linkages found – between the availability of green space and corresponding appreciation of nature, as well as the increase in sense of place with duration of residence. It suggests that as long as careful assessments of the heterogeneities in adaptive capacity are taken into account and the relevant strengths and weaknesses identified, there is real potential to build on individual capacities in specific areas or people groups, i.e. as targeted responses to build resilience.

7.4 Frameworks and Assessment

The final section of these discussions is focused around the methodological contributions of the research, and how lessons learned may improve assessments of urban ecosystem services and adaptive capacity in future. This section addresses the ways of understanding and measuring ecological and social aspects of resilience, followed by a consideration of how these frameworks might be combined.

7.4.1 Improvement of Ecosystem Service Measurement in Poor Urban Areas

From the attempt to measure ecosystem services in this study, it appears that current frameworks are poorly suited to capture ecological benefits in poor urban areas. This is for a number of reasons including the types of ecological benefits in slums not ‘fitting’ with current ESS classification systems, the challenges of identifying and measuring ESS when there are not clear ecological boundaries, measurement methods still lacking for certain services, as well as some more fundamental challenges with the ecosystem service approach.

The implementation of an assessment of ecosystem services in this context, based on the ESS approach and TEEB framework as described in Chapter 2, proved challenging. The closed questions were able to capture specific benefits such as the percentage of people carrying out urban agriculture or

people's sources of water for drinking and bathing. The open question in the questionnaire did allow individuals to express wider benefits that they appreciated from local nature, but responses tended to be limited, quite short, and sometimes ambiguous and therefore hard to fit into classification systems. In short, the implementation based on current ESS frameworks was challenging and thus those frameworks are reconsidered and critiqued in this section.

The reason why it is hard to measure the ecosystem benefits used by slum dwellers is partly because the benefits do not fit easily into current ecosystem frameworks. As Chapter 2 describes, the conceptualisation and method used in this study was primarily based on the TEEB framework of ecosystem services as it has most recently been applied in a cities manual (TEEB 2011). The reason for using this classification system is because it is relatively new and is one of the only attempts to apply the framework to urban areas. In this study the focus is on 'final ecosystem goods and services' (FEGS) and benefits (Fisher & Turner 2008; Fisher et al. 2009), and those produced within the city. Unfortunately the benefits found often do not match up clearly with the classification system, or typical examples given.

To explain this mismatch through some examples, the TEEB manual suggests certain services to investigate including food, and indeed it was possible to assess urban agriculture. However the case study example for food, as a provisioning service, is the rare case of Havana where urban gardens have been a success. Obviously the small amounts of food produced in and between poor urban areas such as the slums studied here is very different. For raw materials, the manual suggests biofuels or non-timber forest products however these types of examples are not relevant for ESS produced *within* a city such as Kampala. Forests can provide important services in the form of fresh water production, however again this is a service outside of the city. For regulating services, examples from TEEB included urban parks and again it is hard to translate this to small patches of

degraded green space, as would be the only comparable service in much of poor urban Africa. Finally cultural values are exemplified through a church in Lebanon preserving intact Mediterranean forest, and the case studies to demonstrate recreation and mental and physical health from green space come from China (9) and the USA (1). By contrast, the kinds of benefits that are identified in this study, such as individuals gathering around trees for shade and communal space, or an appreciation of single lone trees amongst a degraded slum, are evidently harder (though not impossible through willingness-to-pay approaches etc) to measure. The point is that it is hard from frameworks such as TEEB and others to know how one would identify and measure the ecosystem goods and services relevant in poor urban areas.

Another challenge is that most of the examples of urban measurement of ecosystem services (e.g. Roberts 2010) involve clear boundaries of green space, which is not what exists for urban nature in slums. Were one to focus on the clearly defined areas of green space, or 'urban gardens' as others have done (Barthel & Isendahl 2013), the research would miss the degraded bits of habitat in poor urban areas, that this study has shown still provide benefits.

Furthermore, while benefits from cultural services are mentioned in these frameworks, there is still little in the surrounding literature to document how to measure them that would be of relevance in poor urban areas (e.g. Church et al. 2011). Examples are given of valuing particular sites of cultural or religious significance, which is not the type of cultural values in a poor urban area, although they do exist more in the form of 'ecological attachment to place' as discussed above. Norgaard (2010) points out that much of ESS literature is around simplified stock-flow understandings of ecology, and that we are going to need to try to understand cultural aspects more fully if ecosystem service approaches are going to be about more than material needs.

Indeed, there is still a focus on valuation in most ecosystem service literature, given the goal of influencing decision-makers. Even in the context of urban Africa, Schäffler and Swilling (2013) suggest that detailed ESS valuations and calculations are required to determine the potential of green infrastructure. This will require moving beyond rural assessments, or measuring the effects of urbanisation on ESS delivery elsewhere, to a focus on local ESS value within urban areas. In the past there has been a tendency for ecological valuation studies to focus on data-rich areas such as the Gariep Basin (MEA 2005), and in fact data scarcity currently limits the application of rigorous ESS frameworks (Nelson 2011). For cities that have more mixed spaces, and areas of degraded habitat, there is a huge task of adjusting methodologies and collecting baseline data. There is still no evidence of many of the ESS frameworks used in practice and certainly in comparable contexts to this study (Nahlik et al. 2012), and more empirical case studies of ESS measurement, especially in urban areas, are required. However, the purpose of this study is (in part) to determine the importance of ecosystem services for the resilience of slum dwellers. While there is a need for improvements to ESS frameworks as they stand, I would argue that in order to understand the resilience of poor urban areas, an attempt at economic valuation of green spaces might not be the best step forward, as I shall discuss later.

Lastly, there are also more fundamental criticisms of the ecosystem service framework that are useful to consider for improving valuations of ecological goods and benefits in poor urban areas. One critique is that different ESS are currently measured in such different ways that valuations are hard to compare, and furthermore that ESS definitions and classifications are not even that clear in many frameworks (Nahlik et al. 2012). For instance it is hard to compare the value of urban agriculture with the value of aesthetic benefits from marginal green spaces. Most frameworks also do not consider individual perspectives or the beneficiaries. This is important as especially in dynamic urban spaces, ESS are shaped and determined by social values, or are 'socially produced' (Ernstson 2008). This study demonstrates the

importance of including these individual perceptions, given the finding of negative perceptions of green space as being of no value in poorer areas. Ernstson and Sörlin (2013) point out a few further critiques of the ESS approach that are pertinent to this discussion: the lack of focus on disservices, as already mentioned and shown here to be important; the lack of concern with equity, social diversity and the distribution of benefits which as Section 7.3.1 showed is relevant and important to consider (Daw et al. 2011); and the measurability and comparability as demonstrated through the challenges of assessing cultural services. The critiques of comparability of measurement, incorporation of individual perspectives, and concern with equity have all been shown to be important in poor urban areas and therefore require consideration if ESS are to be measured in that context.

Out of the possible ESS frameworks reviewed in Chapter 2, the 'final ecosystem service goods and services' (FEGS) approach has most traction, due to its focus on benefits and operational definition and classification. However the wider critiques of the ESS approach mentioned here, as well as the specific challenges of non-boundary areas, degraded habitats, benefits that are hard to fit in classification systems, and difficulties in measurement in mixed spaces where data is scarce, means that alternate ways of measuring urban green space should be considered.

For the purposes of understanding resilience at least, these alternate ways of understanding urban nature in slums could move away from economic valuations. In fact, it would be useful to get back to the original 'metaphor' of ecosystem services as Norgaard (2010) points out, demonstrating the many values that are non-valuable and non-marketable. A working definition would require explicit mention of the distribution of benefits to force consideration of which services or spaces are prioritised and who benefits. However given the challenges of understanding the value creation processes and the importance of perceptions, I suggest critical ethnographies are also needed, that describe how ESS are enacted in-place, rather than trying to always objectify them and compare (Ernstson & Sörlin 2013). As per the

recommendation below of finding the most important aspects of adaptive capacity locally, this approach will encourage localised understandings of how different ESS are valued. The value-creation process may be different from city to city, and even perhaps slum to slum. Given a more neutral starting point, it will also include disservices (Lyytimäki & Sipilä 2009), other values that might 'slip through the net' of classification systems, and acknowledge key aspects of local history.

Evidently both approaches (ESS measurement through frameworks such as TEEB, and critical ethnographies) have their benefits, and so what is suggested here is to see the ESS approach as just one in a toolkit of different 'ways of knowing'. A similar approach is advocated below for social components. In taking this approach, it is hoped that flexible assessments will capture the pertinent cultural values and different expressions of value for shared slum spaces. Furthermore, I advocate a 'pragmatism' approach (Robards et al. 2011), that shifts away from a singular use of economic valuation to one that encompasses a "greater sense of shared responsibility through pluralistic deliberation, informed by a plurality of experiences toward a common good" (Parker 1995; from Robards et al. 2011). Such an approach would necessarily include more qualitative understandings, make them more location-specific, and would empower local communities.

7.4.2 Assessing Adaptive Capacity at the Local Level

The results demonstrate that certain determinants have a strong impact on how well individuals respond in times of crisis. It will be an important step forward to map resilience and vulnerability in urbanising cities (Agarwal & Taneja 2005; Deshingkar & Sward 2012), and in order to do this it is crucial to understand what the most important factors are to examine. This challenge is the focus of the following discussion.

For reasons specified in Chapters 2 and 3, the investigation revolves around understanding determinants of adaptive capacity, as opposed to

investigating aspects or determinants of exposure. By building generic adaptive capacity, the ability of individuals to respond to a wide range of daily shocks and stresses is increased, and even to make opportunities from these events. The approach employed in this study of first measuring features of adaptive capacity and then characterising, as suggested by Engle (2011), worked effectively. It allowed a broad suite of factors to be considered, and then refined for further investigation. As mentioned later, the method built well upon, and added to, Marshall's approach (2007, 2008), and generated tangible results. This resulted in a model being developed that visualises the findings of this study (shown at end of Section 7.2.2). These findings are now compared with other conceptualisations of local adaptive capacity, and the method used to assess adaptive capacity is briefly discussed.

While there has not been a large amount of study on the measurement of local adaptive capacity especially in urban areas, two particular practitioner reviews are useful for comparison of results. Both focus on 'community resilience', as opposed to the individual-scale taken here, however similar factors will obviously have an influence. As well as being applied in development interventions, these two frameworks both reviewed the academic literature thoroughly and so are useful points of comparison for the findings here. The first framework of "local adaptive capacity" is put forward by ODI (Jones et al. 2010b) and used by the ACCRA partners (e.g. Levine et al. 2011; Ibrahim & Ward 2012), and includes five themes: the asset base, institutions and entitlements, knowledge and information, innovation, and flexible forward-looking decision making and governance. This framework is designed primarily around rural communities and focuses on adaptive capacity. The other is proposed by Arup International Development (Arup 2011), which has six characteristics of a safe and resilient community: knowledgeable and healthy, organised, connected, infrastructure and services, economic opportunities, and that can manage its natural assets. This second framework of Arup is aimed at to define "characteristics of a resilient community", and as such is also at the

community scale, refers to urban contexts but uses both rural and urban studies, and is focused on 'resilience' as opposed to adaptive capacity. Given the focus on resilience rather than adaptive capacity, there are broader factors in the Arup framework that might not apply to adaptive capacity of individuals. However given the linkages between adaptive capacity and resilience, it is fruitful to compare the Arup framework as well.

By comparing the frameworks that these practitioner assessments propose, with the empirical model developed from the results of this study (in Section 7.2.2), it will help to increase understanding of how to best assess, and build, urban adaptive capacity. In terms of the similarities between the two other frameworks, the availability of information and assets are found in both frameworks (although with slightly different conceptualisations of 'assets'). Given their importance in the literature, assets and information are also included in the suggested model, external to the key determinants studied here (see model at end of Section 7.2.2). The ODI framework also includes institutions and entitlements, innovation, and flexible decision-making and governance. Although arranged slightly differently, these features from the ODI framework appear in the model presented above: governance and institutions are mapped onto the determinants of adaptive capacity, innovations are a central part, and decision-making features within the socio-cognitive factors. The main features of the ODI framework are therefore similar to the findings in this thesis.

The Arup framework differs somewhat more than the ODI framework from the model here however, and there are lessons to be learned from this. Given its focus at a higher scale of community, or even city, and on resilience as opposed to adaptive capacity, features are included that could not be measured at an individual level. Infrastructure and services are critical for urban resilience for example, but would not be measured as a part of individual adaptive capacity. In an urban context, Arup are right to include economic opportunities and networks (at this scale considering external connections), where the ACCRA study bundles these within all 'assets' which

I feel fails to give economic and network features enough significance in an urban framework. On the other hand, the Arup framework seems to lack attention to governance. The lessons from this comparison are that if the model proposed here were to be scaled up, it should include higher-scale considerations such as city-wide infrastructure (e.g. disaster protection), networks not just between individuals but from cities to other cities and trade linkages, and labour opportunities.

What these two practitioner frameworks do not include however is the importance of socio-cognitive factors in determining individuals' and groups' adaptive capacity. These factors have been shown here and elsewhere to be of significance in understanding adaptive capacity, including in the work by Marshall on which the adaptive capacity methodology is based (Brown & Westaway 2011; Marshall 2010; N. A. Marshall & P. A. Marshall 2007; Elias et al. 2011; Grothmann & Patt 2005). In addition to the two practitioner frameworks, other studies have successfully measured adaptive capacity in a quantitative way (Cinner et al. 2012) and do not include socio-cognitive factors including human agency, and perceptions of risk and adaptation. Admittedly these factors (e.g. agency) influence adaptive capacity more directly at the individual level, but they will scale up and affect community resilience. For example, communities of individuals with a strong attachment to place are likely to show greater adaptability as a whole.

While current frameworks include social networks or social capital, this study has demonstrated the value and importance in measuring social networks in detail. To date, when social networks are included as a form of social capital or adaptive capacity (e.g. Jones et al. 2010a), they are often qualitatively measured through the presence of community participation (e.g. membership of groups) or linkage (e.g. Tutu 2012). However as Lindell (2002) and others point out, this does not capture the power dynamics of such linkages, or the less formalised relations developed outside of those organisations and social groups (Adama 2012), which are in fact highly

significant for individual or community resilience. Given the importance of different *types* of networks, there is at least a differentiation of bridging and bonding capital required (e.g. Marín et al. 2012), if not a measurement of strength and content of ties.

More generally, it is important that assessments of adaptive capacity include both subjective and objective factors. In addition to their importance in determining adaptive capacity, the inclusion of subjective factors in follow-up adaptation interventions will make them location- and case-specific, as well as helping to empower communities (Tol & Yohe 2007; Kuruppu & Liverman 2011). Berkes and Ross (2013) present a framework that gives a good example of incorporating objective and subjective factors, suggesting that the social-ecological literature should be combined with psychology of development, and mental health literature. Just as Brown and Westaway (2011) point out, when literatures such as psychological resilience and agency are included, these subjective factors will be too. Put another way, external (objective) factors are often included in assessments, but rarely are the internal factors (e.g. agency) that strongly determine how well individuals respond. Of course there are multiple approaches and frameworks to measuring these features, and the purpose of this discussion is to highlight those features that should be considered. For instance, Ainuddin and Routray (2012) assess community resilience to earthquake hazards according to indicators of social, economic, institutional, and physical resilience.

The inclusion of subjective (including socio-cognitive) factors and social networks in adaptive capacity assessments will require flexible methodologies. For example, models such as the MPACC model for understanding individual adaptation decisions could be used alongside community or city-scale frameworks (Grothmann & Patt 2005; Jones et al. 2010b). Regarding methods for measuring the determinants of adaptive capacity, the statement ranking method adapted from Marshall (2007) worked most effectively. Moreover, its application found a number of

different (novel) determinants that should be incorporated in future assessments of urban adaptive capacity, such as 'ecological attachment' (appreciation of nature) and innovation, as well as those already highlighted in Marshall's work, such as attachment to place and attachment to occupation.

For social networks, a streamlined version of the ego-network analysis carried out in this study could be employed (streamlined by perhaps asking less questions to each alter according to the specific research question). As for objective factors, these could be relatively easily coordinated with the types of factors measured here. They can just be obtained at the start of interviews, or if more information is required then individual/household level information could be gathered from secondary sources such as traditional livelihood surveys (e.g. World Bank Living Standards Surveys). In short, the assessment of the most important determinants of adaptive capacity is likely to require both qualitative and quantitative approaches. This study gives some examples of where this dual approach can be highly complementary, for example in the analysis of migrant groups' adaptive capacities where statistically significant differences are shown between migrant groups in their adaptive capacities, while the focus groups gives further insights into the mechanisms of these adaptive behaviours.

As already mentioned, African urbanism scholarship gives a richer example of the importance of qualitative insights into every 'lived vitalities' (Pieterse 2011a) and these types of insights should be included alongside quantitative assessments of adaptive capacity. So finally, in addition to an assessment framework proposed here that includes subjective and objective determinants of adaptive capacity, simultaneous qualitative investigation into certain features that could not be assessed through such investigation is required. This is not to be seen as a failure of the resilience approach to understanding the complex nature of slum capacities and dynamics; rather in applying an ecologically rooted concept to the social setting, we are able to learn great lessons but should not lose the insights from critical social

science (Davoudi 2012). The types of issues that will be encompassed through this more qualitative approach will include, but are not limited to: the political discourse; the distribution of power (covered somewhat in 'governance and institutions' above); patterns of land use and spatial efficiency; and finally but not least importantly, qualitative descriptions that animate what is going on in the 'real city', including cultural practices and the fine scale of behaviours (Pieterse 2011a; Pieterse 2011b; Simon 2011). More ethnographic approaches will also enrich analyses carried out in this study, such as understanding the spatiality of the city, and understanding the sense of belonging and attachment that citizens feel to their home areas.

In summary, this study demonstrates an effective approach to measuring adaptive capacity that included lessons from resilience and vulnerability approaches, namely applying an assessment that is context-specific but also enables the use of specific indicators. The model that emerged from the results of key determinants of adaptive capacity (plus key aspects from the literature not included in the analysis) provides a great starting point for measuring adaptive capacity, especially in poor urban areas. Compared against other 'working' frameworks it would be improved by considering what features would be added if assessing at a higher (e.g. city-) scale.

7.4.3 Considering Scale and Context for Assessing Adaptive Capacity

This study focuses on adaptive capacity at the level of individuals. However, most other adaptive capacity or resilience frameworks are targeted at the community or city scale (e.g. Jones et al. 2010b; Arup 2011; Berkes & Ross 2013). From the findings of this study, the most significant factors are shown in the model at the end of Section 7.2.2. In addition to the empirical results of this study, the model includes the influence of governance and institutions, and some macro factors. Both of these additional factors have impacts at the community level, but the focus of the model is at the individual level. The challenge that deserves brief discussion therefore is

if/how the findings are translated to higher scales, and at what scale assessments should be carried out.

On the one hand, the relevant aspects of adaptive capacity will differ according to scale, as exemplified by the differences in Arup's framework (and discussed above). Given that most interventions target the community scale, it could be argued that assessment frameworks should be framed at that scale. Furthermore, it has been questioned whether individual-scale factors, especially relating to subjective factors or agency, cancel out over multiple actors or over time (Grothmann & Patt 2005). Given this possibility, it could be argued that there are more important factors that should be considered at the community or city scale.

However, there is also an argument that an understanding of certain urban dynamics will be lost as assessments scale up or aggregate (Simon 2011), and areas such as social infrastructure should be tailored to the community scale. In addition, analysing only at higher scales is likely to miss the level of disaggregation required to find pockets of deprivation (Duraiappah 2011), or specific weakness in adaptive capacity. Examples that demonstrate this from the current study would be migrant groups and the specific ways in which they are vulnerable. By contrast, by understanding these fine-scale dynamics, it is more likely that nuanced, tailored interventions will be formed.

Obviously where there is limited capacity for assessment and intervention, then the scale at which interventions are going to be made should be assessed; however, in order to fully understand the dynamics of adaptive capacity in an urban system, multiple scales should ideally be considered – to capture nuances and heterogeneities at the local level as well as factors such as power and governance at higher scales.

Finally, in our increasingly globalised world, as it becomes important to understand rural-urban linkages and the process of peri-urbanisation of

rural areas, there is a need for frameworks that are able to appropriately deal with both rural and urban (Young et al. 2006; Moench & Dixit 2004). These frameworks will help to build an understanding of adaptive capacity cross-systems.

To some degree, the adaptive capacity model suggested here could cross rural/urban divides and social-ecological systems. Indeed Lankao and Tribbia (2009) found that seven key determinants of vulnerability they identified held across different case studies. However those determinants were for vulnerability (as opposed to adaptive capacity) and were more objective/socio-economic and therefore less likely to differ with culture/population group. The comparison of adaptive capacity frameworks in this thesis (Section 7.4.2 above) reveals that specific factors such as economic opportunities may be more important in urban areas than rural, where the state of natural resource-based livelihoods has more of an impact. In addition, the model suggested here is derived in part from empirical derivations of the most important determinants of adaptive capacity, and the subjective factors especially may change with location and context. In support of this, Kuruppu and Liverman (2011) argue that subjective factors of adaptive capacity are specific to the resource system. In the urban context this might translate into specificity to a city or regional context, with its specific cultural norms and resource availability. Alternatively it might be useful to assess specific subjective factors according to the shocks, for example adaptive capacity to flooding as opposed to loss of livelihoods.

Given the specificity of adaptive capacity determinants, and the heterogeneities discussed earlier, it will be important to work out the different subjective determinants of adaptive capacity for a given slum/city. As suggested at the start of this section, that could involve an assessment including many features followed by a post-analysis characterisation of adaptive capacity for that particular context. The initial features would be informed by empirical studies such as the current study as well as relevant literature, but the final framework would be informed by local analysis and

characterisation. Once the most important factors are ascertained, interventions could be designed to positively target those factors/weak points. For example, education may build feelings of control over certain circumstances and local challenges; social networks may build self-efficacy. More generally, interventions that target those subjective factors will build links between communities and institutions and encourage reflexive learning that challenges current schemas (Kuruppu & Liverman 2011).

The third and final crosscutting theme of this study's discussions, the lessons learned for urban resilience frameworks, suggests the need for multiple 'ways of knowing'. The model developed from the results of this study is a good starting point for measuring adaptive capacity, and is consistent with other studies. Furthermore the methods used to assess adaptive capacity determinants worked well, and this methodological work should be built upon. However, it does require additional factors were it to be scaled up. Mixed methods are required to include multiple types of factors (i.e. subjective and objective). For understanding the real value of local nature and the 'lived vitalities' of urban life and social function, more ethnographic approaches should also be included alongside quantitative assessments.

There is no reason why flexible methods to assess local ecosystem goods and services should not be included alongside the adaptive capacity assessment. From the challenges of assessment in poor urban areas, it appears that economic valuation is not necessarily the best approach in this context. More flexible methods to assess their importance may be used, and the reliance of individuals on local ESS should be included as part of the 'assets' in the model diagram.

More generally, assessments should be context-specific and nested within multiple scales, as well as systemic in their applicability. The latter will be possible through assessments of a recent shock or stress to multiple groups that have experienced a relatively uniform event, or to measure adaptive

capacity before, during, and after an event. Having identified important aspects of resilience both in terms of adaptive capacities, and aspects of urban nature that have potential to increase resilience, the implications for development policy are followed up in Chapter 8.

7.5 Conclusion

This thesis has provided some key lessons for understanding, and measuring resilience in poor urban areas. The first main area of findings provides key aspects of both adaptive capacity and usage of ecosystem services that benefits the resilience of slum dwellers. There are challenging findings that local ecosystem services are not used much, and rural-urban linkages appear to play only a minor role in slum residents' resilience. On the other hand, correlations with attachment to place and the finding that only the very poorest use provisioning services suggest the *potential* of urban green spaces and maintenance of urban nature even in slums. Similarly the significant correlations of features such as social networks indicate that building on particular facets will significantly enhance the resilience of individuals. The second area of findings shows the importance of paying attention to heterogeneities, and particularly vulnerable areas and groups. The positive aspect of this is that if the 'bottlenecks' of resilience can be identified in this way, it will be easier to consider targeted responses. Against a backdrop of urbanisation threats to the urban poor, an encouraging finding of local features of adaptive capacity building with residence duration strongly suggests the importance and benefits of stable and transparent local governance. The third and final area of findings makes tangible recommendations for adaptive capacity and ecosystem service assessments. A model of adaptive capacity components in poor urban areas is provided. However an understanding of both social and ecological components of resilience will be enriched through more qualitative understandings to complement the more structured assessments presented here.

Chapter 8: Conclusions

8.1 Introduction

The aim of this thesis is to understand the important features of resilience for individuals living in poor urban areas. This is achieved through the investigation of three research objectives. Various aspects of urban resilience are explored and novel aspects individuals' resilience discovered. First the ecological components of social resilience are examined through the ecosystem services approach (Chapter 4); second the social components through an assessment of adaptive capacity (Chapter 5); and third the heterogeneities in urban resilience are assessed across different areas, population groups and with time (Chapter 6).

The three research questions posed at the start of the thesis are as follows:

Question 1: What is the level of ecosystem service use in poor urban areas and how does that change across a city?

Question 2: For residents of poor urban areas, what are the most important aspects of adaptive capacity?

Question 3: How do adaptive capacities and social networks differ across poor urban areas and with time?

The three research questions are tackled in Chapters 4, 5, and 6 respectively. Chapter 7 draws out some crosscutting discussions, including the most important aspects of individuals' resilience, heterogeneities that exist, and the way that these findings contribute to frameworks of ecosystem services and local adaptive capacity. Finally this concluding chapter presents the main findings of the three research strands, the conclusions of Chapter 7 discussions, and the implications for research, policy, and practice.

8.2 Main Findings of the Thesis

Question 1: What is the level of ecosystem service use in poor urban areas and how does that change across a city?

Chapter 4 presents the results of this question and the first central finding of the thesis: that most residents of the three slums make limited direct use of ecosystem services. This includes urban agriculture that has been purported in comparable literature to be of much importance to the livelihoods and food security of the urban poor. Incorporating insights from focus groups, Chapter 4 also presents some of the reasons for low ecosystem service usage, including lack of space, lack of tenure, the topography of the settlements, as well as perceptions of green space. Residents report to view urban nature as something only for the wealthy, and it appears that certain ecosystem *disservices* such as mosquitoes from the wetland on the periphery of the city also give residents a rather negative view of nature and green spaces. On the other hand, aspects of urban nature still provide certain aesthetic and regulating services such as shade, and the distribution of these values matches up with the locations where there are in fact greater amounts of green space and trees (analysis in Chapter 5). This result also confirms that lack of access is the primary reason for low ecosystem service use in poor urban areas, and were patches of green space to exist, they would be utilised. Lastly, it is the poorest of the slum residents who use provisioning services such as water from the well, which again suggests the potential for poverty-reduction and resilience-building through protecting and maintaining ecosystem services in these areas.

Question 2: For residents of poor urban areas, what are the most important aspects of adaptive capacity?

Chapter 5 presents the results of the adaptive capacity assessment. Firstly, it is clear that slum dwellers tend to deal with problems with the help of others. This is understandable given the nature of many of the challenges in

these contexts, such as floods that require more than one 'pair of hands' to respond to the problems. From the correlation analysis, of potential determinants with adaptive strategies employed, three 'social sensitivities' and three 'capacities' are found to be significantly associated with the adaptability of slum residents. From these findings, a simple model is proposed that incorporates the most important determinants of adaptive capacity. Key determinants of adaptive capacity are found to include innovation, social networks, feelings of control and belief in change, attachment to occupation, and an appreciation of local nature. It is not possible to compare the relative importance of these determinants to, say, structural or objective factors such as income, but it is clear that these determinants are highly influential in individuals' adaptive capacity. Contrary to certain discussions of the importance of rural connections for urban dwellers, the vast majority of help in times of crisis came from 'within' – from helpers living in the same city if not the same slum areas. Additionally, two types of networks are found to be important for adaptive capacity, weaker local ties with neighbours and people in the area, and stronger kin ties with those possibly living elsewhere. The overwhelming importance of social networks throughout the analyses and the comparison of groups below, suggests that in these contexts resilience is in large part determined by 'who you know'.

Question 3: How do adaptive capacities and social networks differ across poor urban areas and with time?

Chapter 6 presents clear differences in adaptive capacities between the three slum areas studied – in the city centre, halfway out of the city, and on its edge; between different migrant groups; and with time that residents stayed in the area. In short, slums are highly unique in terms of their adaptive capacities and social networks, and the same is true of different population groups such as migrant groups and different age groups. From the differences observed in the three areas, there appears to be a potential

trade-off between individual capacities (higher in the inner city slum where people in general had moved to work) and social cohesion (higher in slums further out where there are more communal spaces and a greater 'sense of place'). While migrant groups on the whole are less adaptable, this was not always the case depending on the adaptive mechanisms of certain groups. These adaptive mechanisms in turn depend on social customs and cultural norms. Capacities do not actually differ much between groups but instead the strength of social support networks distinguishes groups, again enforcing the importance of networks for determining slum residents' adaptive capacity and resilience. Lastly, many 'local' capacities such as attachment to place and learning from others show a positive correlation with residence time, suggesting that as individuals stay in an area, adaptive capacities build as attachments and networks are being formed.

Returning to the aim of the thesis therefore, it appears that slum dwellers use social sources of resilience far more than ecological ones. The importance of social networks and socio-cognitive determinants of adaptive capacity is of particular note, as is the fact that urban resilience in poor urban areas is so heterogeneous.

The limitations of those findings are now considered, followed by their implications for research and policy/practice.

8.3 Limitations of the Study

Each results chapter (Chapters 4, 5 and 6) presents some reflections on the particular limitations of that chapter's findings, and of the specific methods used in that chapter. This section focuses on the broader limitations of the thesis approach as a whole.

The decision to take a *general* resilience (or generic adaptive capacity) approach is well founded from theory and pre-study investigations (see

Chapter 3 for justification). However there are also benefits to taking a focus on specific resilience. By focusing on one type of shock there are fewer variables against which to assess the important determinants, and so some extra accuracy is gained. Further, it offers the possibility of measuring differential recoverability and adaptive responses to different shocks. On the other hand the approach of only focusing on one shock lacks robustness (Cinner et al. 2012). Moreover, in the context of poor urban areas, general resilience is more appropriate and useful, given the multiplicity and synergy of shocks that most residents face (see Waters 2012 for more discussion on this).

A related limitation is the focus on shocks and stresses that impact individuals, rather than society or the community as a whole. Questions targeted at the individual level may not capture broader challenges that affect the wider community, such as destruction of some of the slum area, or removal of certain public services (i.e. say if it affected only one part of the slum). The findings therefore relate to individual adaptive responses. One should be careful about drawing conclusions from the results here to broader scale crises, or collective action. On the other hand, the individual-level approach allows an analysis of specific determinants and fine-scale heterogeneities, for example correlating by individuals' duration of residence or comparing by migrant group. On balance therefore, while there are potential weaknesses, the general resilience approach at an individual scale worked well, and the method of asking the question 'the resilience of what, to what?' and taking time to frame and bound the system before carrying out the research is recommended. This ensures that local needs are taken into account, rather than starting an urban resilience assessment with an *a priori* research agenda.

Regarding the ecosystem service assessment, limitations include the limited methods to capture the full range of benefits from local ecosystems. Regulating services in particular may have existed but are not measured, for example erosion prevention by vegetation on slum hillsides, or the

moderation of flood events through certain patches of vegetation. This is due to the research focus on benefits that individuals perceive, and articulate a value for. The questionnaire contains an open question that attempts to pull out all such values, however a more deliberative, communal discussion might be more fruitful in future.

The adaptive capacity assessment has an inherent limitation in that it is trying to measure a latent capacity; it is not possible to actually observe the adaptive responses taking place. The only way round this is to observe before, during, and after a shock. This would require ethnographic work to ensure that the researcher is there during the flood event, eviction etc. Given that this study does not measure actual actions, it could be criticised that the study measured intentions rather than actual adaptive capacity. However because of the way in which the interview questions are framed (focusing on and specifying real shocks that respondents faced “this last year”), it is appropriate to presume that responses were indeed carried out.

Furthermore, the adaptive capacity assessment does not capture the actual ways in which individuals respond to shocks (although some statements were noted for possible future analysis), and more qualitative research would help in this regard. A further challenge is the accuracy and validity of individual statements that represent aspects of adaptive capacity. Chapter 3 describes the rigorous methodology that includes statistical tests to sort and refine groups of statements. Unfortunately after this process, some factors were best represented by a single statement. It could also be argued that certain statements are actually measuring specific nuances of the factors and determinants as labelled, for example the statement for ‘innovation’ actually describes the ability of individuals to look for new ways to earn money, rather than innovation more generally. Whilst the statements did come in part from pre-study interviews, the process of finding statements could be refined in future.

In spite of these limitations, some of which are inevitable trade-offs given the research approach, this study makes a number of significant contributions to research, which are summarised in the following section.

8.4 Implications for Research

This thesis makes three crosscutting contributions to knowledge: first it successfully demonstrates some of the most important aspects of resilience for individuals living in poor urban areas; second it shows how individual slums, and population groups, are unique in their adaptive capacities; and third it contributes to considering how both social and ecological aspects of individual and community resilience might be measured in poor urban areas.

The first main contribution of the thesis is in finding important determinants of resilience for poor urban dwellers. Chapters 4 and 5 demonstrate how using appropriate frameworks and contextualised methodologies (e.g. presentation of adaptive capacity statements), one is able to find the most important aspects of resilience, in terms of both social and ecological components. Regarding ecological aspects, the thesis presents challenging findings that local ecosystem services are not that important for individuals' resilience, and neither are rural-urban linkages. The findings pertaining to the importance of urban agriculture contradict much of the literature on this subject, showing that very few slum residents actually carry out and benefit from urban agriculture. The majority simply buy from the markets, which are supplied by rural areas. The value of urban agriculture in poor urban areas should not be overstated therefore. As Chapter 7 discusses, urban agriculture still has the potential to increase food security and local resilience, it is just that currently there is little taking place in the slums. In addition to barriers of lack of space and lack of tenure, the study also finds that slum dwellers' perceptions of nature (as something only for the wealthy) greatly inhibits the likelihood of their stewardship of natural areas.

Despite the low levels of ecosystem service use in poor urban areas, it is clear that there are real benefits from patches of green space in slum environments. Slum residents report to appreciate less tangible values such as the aesthetics of vegetation or shade, and these benefits correspond to where there was more green space. As discussed below, research should endeavour to more explicitly consider ecosystem services in poor urban areas, as well as the values from patches of vegetation or green spaces, even if they are degraded.

Regarding social components of individual resilience, a number of significant determinants of adaptive capacity as summarised in Chapter 7 include the importance of socio-cognitive determinants, which overlap with considerations of agency elsewhere (c.f. Brown & Westaway 2011). The overwhelming importance of social networks, as well as the distinct roles of different network types, suggests a greater understanding of the function of social networks in slum environments is also required. In addition, individuals' sense of place is an important determinant of adaptive capacity, even in degraded slum conditions. The study of place attachment has a rich history (Lewicka 2011), although requires adapting and applying to slum contexts.

The analysis of the amount of food brought back from the village (in Chapter 4), as well as the location of helpers in times of crisis (in Chapter 5) reveals that rural-urban linkages are not actually that important for the adaptive capacity of slum dwellers. As is the case with urban agriculture, this contradicts much comparable literature, although it should be asserted that this result pertains to times of crisis rather than more general remittance support etc. However, the general finding remains that for residents of poor urban areas, intra-urban resources (including people) are where support comes from in times of crisis. This finding does not negate the need to consider broader-scale sustainability challenges, and the sustainable provision of ecosystem services from healthy and resilient (rural)

ecosystems that urban areas depend on (Jansson 2013). However it emphasises the importance of building *local* adaptive capacity and sources of resilience, both social and ecological. Unlike other authors (Lerner & Eakin 2011), I do not recommend rendering the rural/urban divide obsolete, as they have greatly different characteristics. Instead, both should be considered in tandem – the resilience of rural ecosystems that sustain and deliver ecosystem services alongside the intra-urban capacities that generate urban resilience.

The second main contribution of the thesis is in understanding the importance of heterogeneities in resilience, in a poor urban context. The analysis in Chapter 6 shows the uniqueness of individual slums, even within the same city, in terms of their adaptive capacity ‘profiles’. The fact that social cohesion is not necessarily higher (in fact shows an inverse relationship) when individual capacities are greater overall in a slum suggests that a potential trade-off might exist between individual-level and community-scale resilience, although this requires further investigation. The result that different migrant groups show distinct adaptive capacities suggests the importance of keeping urban resilience analyses disaggregated. The result also suggests that in the context of migration research and policy, it will be important to not view migrants as one amorphous ‘less adaptive’/vulnerable group. Heterogeneities also exist in ecosystem service provision and levels of use amongst the slums, which again shows the need for a disaggregated analysis of ecological aspects of urban resilience. In general, the need to consider spatial and temporal dynamics in urban resilience has been shown.

The third broad contribution of this thesis is in making recommendations for how resilience might be assessed in poor urban areas. The process and findings of the assessment of local ecosystem services in Chapter 4 reveals some difficulties in applying current ecosystem service frameworks to poor urban areas. From the difficulties in identifying different ‘services’, it seems that classification systems need ‘grounding’ through empirical work in poor

urban areas. The study also met difficulties in actually measuring local ecosystem services. Thus measurement tools require further work so that ecosystem services in slum areas might be assessed, i.e. in areas where nature is degraded and/or not clearly demarcated as in gardens or urban parks. Accompanying these tools, there is a need for greater ecological understanding of how degraded green spaces might still provide ESS, for an understanding of how local residents value those areas, and of how we might assess and incorporate less tangible services and values such as aesthetic benefits and attachment to place. In short, the measurement of ecosystem services in poor urban areas requires greater research.

In terms of measuring adaptive capacity, the findings of Chapter 5 make a strong case for including both subjective and objective factors in a framework, and show the effectiveness of some of the methods used (statement ranking and social network analysis). The study demonstrates the usefulness of both measuring and characterising adaptive capacity; further assessments will build on the investigation of key determinants and perhaps recommend different arrangements and importance of factors from the model in Chapter 7, according to the local context. As a specific tool separate from the measurement of most determinants, the ego-network analysis allows not just an assessment of the importance of social networks, but also the different types and composition of those support networks, and where the help came from. The inclusion of some form of social network or social relational approach is therefore highly recommended for assessments of urban resilience, and as mentioned below there are even more social network analyses that could be carried out. Many of the factors identified here (e.g. place attachment) will be better understood with more qualitative or ethnographic research approaches and these should be carried out in tandem with some of the methods demonstrated here. A good example from this study of the usefulness of such a multi-method approach is the comparison of migrant group adaptive capacities in Chapter 6. The quantitative comparison of adaptive capacity determinants shows significant differences, and then the focus group discussions reveal how

those differences came to be, including the different adaptive mechanisms that each migrant group employed. This combination of quantitative and qualitative methods will also help build understanding of factors such as attachment to place, the role of different social network types, and in general the uniqueness of different slum contexts. It will also encourage the interdisciplinary study of slum environments, which will be a useful step forward.

In summary, this study demonstrates how local ecosystem services are of little importance for the resilience of poor urban areas, however this is primarily due to lack of access rather than potential. Socio-cognitive determinants of adaptive capacity are of utmost importance, as is a detailed understanding of the role of social networks. Rural-urban linkages are of less importance than found elsewhere, as intra-urban sources of social support and resilience are key. Slums must be understood as unique in their adaptive capacities, and differences between different demographic groups taken account for. Finally there is much improvement necessary for measurements of ecosystem services and adaptive capacity in poor urban areas, however the methods and findings here (e.g. model presented in Chapter 7) provide a solid foundation for this.

8.5 Future Research Directions

Out of the suggestions above for refining urban resilience frameworks, the limitations of the study, and the extra research questions and analyses that it was not possible to cover here, there are many potential avenues for further research into the resilience of rapidly urbanising/poor urban areas. The study of resilience and social dynamics in slum contexts is a fertile and much-needed area of research.

Section 8.4 already indicated some areas of research that are required to improve assessments of urban ecosystem services, and adaptive capacity. More research is required into the levels of uptake of, and barriers to, urban

agriculture in slum areas given the divergence in results here from findings elsewhere. From the finding of slum residents valuing intangible benefits such as aesthetic values, further research is needed on the role of green spaces and vegetation amongst slum areas, and the delivery of ecosystem services even from small patches of degraded habitat. This study hints at why slum dwellers do not use or value ecosystem services; further research should focus on the formation of values and the reasons *why* ecological areas become degraded in urbanising spaces, as well as ways to address this, and the negative perceptions of urban nature. Given the limitations of the methods in including the full range of ecosystem services, research should also focus on regulating and cultural services in this context, and how they relate to resilience and well-being.

As for social components, the adaptive capacity measurement tool presented here worked well, but further refinement is possible and would improve accuracy. Methodologically, the correlation analysis could be improved by carrying out multiple regression analyses in order to assess the relative importance of different determinants, or even hierarchical regressions in order to investigate 'underlying'/mediating factors. Given the large sample across which the correlations are carried out (720 individuals), the results of the determinants of adaptive capacity are robust. However future studies should replicate this assessment in different contexts, in order to assess how the most important factors differ. Another useful angle would be to measure differential adaptability and utilisation of different adaptive capacities according to different shocks and stresses that individuals face. Furthermore, research should consider how 'transformative capacities' might differ, and if there are trade-offs with adaptive capacities. As mentioned above, qualitative investigations should be carried out alongside quantitative assessments of adaptive capacity to give a deeper understanding of factors such as place attachment, and factors of agency.

There is much future research potential in the application of social network analysis to slum communities. In fact, the level of analysis of social network data in this thesis only just scratches the surface of the potential research questions that could be investigated, without even obtaining further data. Given the strong influence of social networks found in this study, and the effect of different types of networks, further investigation is likely to build the understanding of urban resilience and how different networks and social linkages build individuals' adaptive capacity. Future research should consider the structural and compositional nature of social support networks, even if still using ego-network approaches rather than full social network analyses. Other possible lines of enquiry include: the effect of social networks on other variables such as income or wealth; an analysis of the actual amount of help given; the effect of place of origin on social support (do people of the same ethnic background help more?); an analysis of amount of help according to relation/occupational category (do relations help more than non-relations?, do people help their own occupations more?); as well as structural analyses that could decipher the network structure of adaptable individuals.

Given the significant differences in resilience found between slums and different demographic groups, further comparative analyses would yield insights on the uniqueness, and consistency of certain determinants, of slum adaptive capacity. Both the adaptive capacity assessment and social network analysis would replicate well in such comparative analyses. These tools could be used for instance to investigate how social network structure and composition differs between slums in different countries and cultures, or how the types of adaptive capacities and strategies utilised differ in various slum contexts. Such systemic, comparative analyses would further help to improve a model of adaptive capacity determinants.

As well as comparing slums of different cities or countries, more fine-scaled spatial analysis would be revealing. The comparison of slums in peripheral, 'middle-urban', and inner-urban locations in Chapter 6 shows how spatial

patterns of resilience may occur, for instance relatively lower social cohesion in the inner city slums. It would be revealing therefore to investigate at a finer scale how the geography of the city influences the spatial patterns of resilience and vulnerabilities. Future research could analyse and compare by slum zones (the sub-areas of slum districts), or even use GPS location data of each respondent (this was actually recorded for each interview, so is very feasible). This latter strategy would allow fine-scale spatial understandings of patterns of resilience, for example analysing individual resilience according to proximity to services, or even green space.

This study demonstrates an assessment of the most important aspects of resilience at an individual level, and provides a model of potential determinants at this scale. However it also suggests how at higher scales other factors need to be considered, and so a next step would be to consider how to either a) scale up the research findings, or b) incorporate them into higher-level resilience assessments. Given the importance of multiple scales as discussed in Chapter 7, future research should carry out multi-scale assessments of urban resilience, incorporating disaggregated, local adaptive capacity assessments with city-wide considerations. This study also discussed the relative importance of rural-urban linkages, and future research should consider urban and rural frameworks in tandem, such that the urban needs of the city and its capabilities and vulnerabilities are compared alongside rural examinations of ecosystem health etc. There are still gaps in our understanding of the cross-scale dynamics between individual and community resilience (Brown & Westaway 2011) and given the potential trade-offs demonstrated in this thesis, the relationship between individual capacities and community resilience should be given more attention.

This discussion has raised a number of future research avenues, including: understanding ecosystem services in poor urban areas, social determinants of resilience and the role of networks, the spatial dynamics of slum resilience, and urban resilience across multiple scales and rural/urban

divides. In pursuing these, our understanding of how to best cope with and adapt to the growing slums worldwide will be greatly increased. Many of these future research directions will rely on research efforts being truly interdisciplinary. As well as quantitative assessments and lessons learned from the adaptive capacity, environmental change and psychological resilience literature, richer understandings should be incorporated from other research disciplines such as African urbanism.

8.6 Implications for Policy and Practice

In addition to highlighting prominent future research directions, the results of this thesis raise recommendations for policy and practice. Especially from the assessment of important aspects of resilience in poor urban areas, a number of local-level recommendations to build the resilience of slum areas are proposed. These include measuring adaptive capacity prior to development interventions, building upon local capacities, focusing on general resilience, building social networks of support, and creating and maintaining green space within slum areas.

The first recommendation is to encourage measurement of adaptive capacity as part of slum development. The significant influence of unique adaptive capacity determinants, the surprising ecological findings in this context, and the significant differences between slums and population groups all point to a recommendation of measuring local adaptive capacity before considering adaptation or development interventions. There will be three areas of benefit from doing this: understanding the strengths and weaknesses of the local area and population, picking up on local heterogeneities, and improving frameworks.

By carrying out local assessments of adaptive capacity (that include both subjective and objective factors), practitioners will be able to better understand the strengths and adaptive capabilities of a population, instead of just focusing on the areas of vulnerability. These local capacities may well

become entry points, such as innovation, on which to build local interventions. Similarly, when it comes to socio-cognitive factors or perceptions, one will be able to identify barriers to be addressed that would otherwise hold back other interventions. For example, addressing negative perceptions of urban nature in poor urban areas will probably be necessary before making green spaces more available. This approach of measuring adaptive capabilities (including negative aspects) will mean that development interventions in slum areas are not just delivering infrastructure (which is important), but also are 'building on what they have', expanding the range of choices for slum residents. Moreover, it represents a shift from 'projectised' interventions where participation consists of asking what communities want, to starting from a deep understanding of current capacities and areas of vulnerability (Levine et al. 2011).

Another benefit of measuring adaptive capacities locally (as observed in this thesis) is that heterogeneities will be observed and noticed through the analysis. This means that 'bottlenecks' of adaptive capacity in an area may be identified, and potentially different solutions generated for different areas or population groups. To take an example from this study, for inner city areas such as Kisenyi whose residents show high levels of innovation and employability, yet lack high levels of social support, providing structures to build social networks will be key. By contrast, in areas such as Bwaise where social support networks are stronger but individuals lack skills and capacities, workshops or education opportunities to build those individual skills may be more needed. In other words, a disaggregated assessment of adaptive capacity for a city will allow for variegated responses, which will likely be much more effective than blanket policies.

The third benefit of carrying out adaptive capacity assessments prior to policy or practice interventions is the iterative improvement of local resilience frameworks and models. These then form a template for future interventions, and important policy areas to focus on. Chapter 7 presents a

model from the results here, which would be improved as assessments are repeated and refined.

Once local adaptive capacity assessments have found key determinants locally, local capabilities should be built upon as part of development interventions. In light of the controversial result here that rural-urban linkages are not that important for the resilience of slum dwellers, the importance of building local sources of resilience is emphasised. The specific determinants will vary from case to case, but this study suggests a few factors are of particular importance and are likely to be elsewhere too.

Based on the results in Chapter 5, some of the specific aspects of resilience that should be built upon are innovation, a sense of agency, and a sense of place. In line with recommendations elsewhere, urban innovation should be encouraged and developed (Ernstson et al. 2010). Development interventions should also focus on building feelings of control and belief in change in the area, or in other words a positive sense of agency or ability to adapt. Although these factors are perhaps harder to cultivate, stable and transparent governance will help to create the environment for their formation. Making local political processes transparent will help to make slum residents feel more secure and not fear eviction, thereby increasing the likelihood of local investment in resilience measures (both structural and local social networks etc). Furthermore, the results here show that by facilitating residents staying in one place longer (e.g. through increased security), individuals' sense of place and adaptability will build. Thus there is a potential 'double benefit' of establishing security and stability in an area, that residents increase both their individual perceived adaptive capacity as well as their sense of place for the area. In addition to focusing on building these specific aspects of resilience, policies should focus more generally around building *in situ*, as opposed to clearance and resettlement of slum areas. Clearance is far too often used as a pretext for land acquisition, whereas building local resilience *in situ* may actually increase the sense of

place in those areas, reduce the levels of crime, and result in increased property and amenity values (Simon 2011).

Another particularly important entry point for building resilience is social networks. The consistent finding of the importance of social networks from the adaptive capacity assessment, ego-network analysis, and comparison of different population groups, solidly supports this. Building local networks may be achieved through strengthening community or saving groups, as per the work of Slum Dwellers International and other NGOs (d' Cruz & Mudimu 2013; Makau et al. 2012; Weru 2004). Social support networks should especially be built in areas where there is an absence of services and regulated support. By doing so, the presence of strong local networks of support will likely increase the sustainability of other interventions too. On the basis of the findings in Chapter 5, two types of support network should be encouraged. Community projects that allow people to come into contact with those outside their specific neighbourhood or social cliques will be important (encouraging weaker ties), as will encouraging the maintenance of stronger (kin) networks. The important goal of achieving stable governance will also allow local social networks to form as people feel secure in a place, and 'put down roots'. This may help to ensure slums become places of permanence and more positive identity.

In addition to measuring adaptive capacity and 'building local', the findings here support building *general* resilience. This means not focusing urban resilience measures on specific, individual shocks (especially in poor urban contexts with their multifarious challenges and threats), such as flooding or climate change, but instead building generic adaptive capacities that add resilience to multiple shocks. A general resilience-building approach should also go beyond the physical dimension of slums. Of course addressing housing and infrastructure needs are important, but so too is developing a sense of place in poor urban areas. Resilience-building approaches should tie in with broader development agendas, as well as disaster risk reduction, and social protection. Adaptive capacity needs to become an "intrinsic part

of all development interventions” (Levine et al. 2011). As discussed in Chapter 7, the local resilience-building efforts recommended here will tie in with national imperatives such as addressing employment, governance, and institutions.

Alongside these recommendations that target building resilience in the individuals living within the slum, the results from Chapter 4 suggest green space should be developed and maintained in the areas themselves too. Obviously there are many other infrastructural and service provision developments that are important, but this study is relatively unique in focusing on natural space in a poor urban context and so is emphasised here. Indeed, most discussions on urban green space are around cities such as Phoenix, Stockholm, or if in an African context, relatively more developed cities such as Cape Town and Durban (TEEB 2011; Roberts et al. 2011). Evidently the planning and maintenance of green space might look very different in slum environments, but the findings here suggest that they will be important for building a local sense of place and local resilience. Given institutional failures, it might be hard in an African context and will require that these areas are valued beyond socio-economic opportunities or current ecosystem service valuations (Schäffler & Swilling 2013). However the case should be made for even having small amounts of green space or lone trees amongst slum areas, as this study suggests that they will build place, social cohesion and perhaps even a sense of ‘village’ within slum communities. Similarly where urban agriculture is not prevalent but shows potential, barriers such as perceptions should be addressed, opportunities and innovations for household farming made available, and communal agriculture considered where possible. Innovative interventions such as these would not only build sustainability and livelihood options, but also a sense of place and identity in an area.

It is anticipated that acting on these policy and practice recommendations will greatly increase the resilience of poor urban areas. Measuring adaptive capacity prior to development interventions will make policies and plans

more appropriate and effective, as well as locally owned, and will make sure that particularly vulnerable groups are not excluded further. Building on those specific capacities that are locally significant for the adaptive capacity of slum residents will also be a more effective strategy. Finally as well as building a sense of place and social cohesion, green space within slums will greatly help improve the liveability and resilience of the area.

8.7 Concluding Remarks

In some contexts, resilience has been criticised for being an elegant theory but that is difficult to apply, certainly in cities where there is 'no emergency yet', i.e. where disasters or severe disruptions to livelihoods are not commonplace (Stumpp 2013). Obviously this is not the case in the rapidly growing slums of Africa and Asia and beyond, where daily challenges and threats make resilience a critical attribute for individuals and communities. This study has demonstrated that by breaking down resilience into its components at an individual level, a resilience approach can be an effective way of understanding urban (slum) systems.

Slums and informal settlements are certainly going to be around for many years to come. They represent some highly vulnerable and exposed places to live, and proactive efforts must be put in place regarding service and infrastructure provision. It is critical meanwhile that the capabilities and heterogeneities of these places are recognised, as well as the 'lived vitalities' that I had the privilege of experiencing. Efforts to understand local dynamics must be integrated into higher-level policies and plans. Given the size of the challenge, every effort from research and practice should be put into ensuring these become liveable, safe places for a vast proportion of the world's population to live. With the right interventions and governance environment, it is believed that potential 'slums of despair' can truly become 'slums of hope'.

Appendix 1: Questionnaire

CODING	Questionnaire number	
	Checked: Date:	
	Complete?	Complete [] Incomplete []

Data entered:

Date:

Hello,

I am and this is JJ from the University of East Anglia in England and also working at Makerere University here in Kampala. He is studying what life is like here on the edge of the city, and how it is changing. We would like to ask some questions about your livelihood activities and what you think about your local area. We would also like to ask about some of the benefits as well as the problems here, and how people cope with these.

Please note that all information we collect will be treated confidentially. Please feel free to say exactly what you want, as your name and personal details will not be used in the study's report or communicated to anyone else.

Are you willing to spend some time with use to answer these questions?
The questions will last 30-40 minutes. And do you mind if I tape you just in case there is a mistake that I need to go back to? Thank you.

Questionnaire details	CODE NUMBER:	AUDIO RECORDER NO:
	Date:	
	Time:	
	Area:	
	Zone:	
	HOUSE NUMBER (if there):	
	GPS NUMBER:	
	DESCRIPTION:	
Respondent's details	Name (initials): (PUT NAME IN NOTEBOOK)	
Interviewer's details	Name:	
	Language spoken:	
JJ present?	Yes [] No [] Partly []	

If questionnaire not completed, reason why (detail if poss):

Refusal to answer []

Not possible/suitable []

Other []

Questionnaire

1. Background

NB – Ethics

- Ask for consent first, once they have agreed **note down name AND CODE OF INTERVIEW** in exercise book and start the recording. Then note initials on coversheet.
- Each interviewer needs a separate notebook code number and name.

Basics:

1. Sex: Male Female
2. And may I ask roughly how old you are?
3. Who is the head of this household – **in relation to you?**
4. How many others live in this household? - And how many are children? – AGES?

.....

5. How many work?
6. And how many rooms are there (that you use)?
7. When did you move here?
.....
8. Where did you live before (which district if outside Kampala), and how long were you living there?

PLACE: HOW LONG LIVED THERE:

.....

a. And if you last moved from Kampala, where were you before that?

PLACE: HOW LONG LIVED THERE:

.....

PLACE: HOW LONG LIVED THERE:

.....

9. Was the place you lived before:
Rural Urban – formal residential Urban – informal sett

10. What was your main reason (or reasons) for moving here?
(number if more than 1 reason)

1. Moved with family	<input type="checkbox"/>
2. Eviction from previous residence	<input type="checkbox"/>
3. To search for a job/money/do business	<input type="checkbox"/>
4. Affordable rent	<input type="checkbox"/>
5. Closeness to work	<input type="checkbox"/>

6. Closeness to markets	<input type="checkbox"/>
7. Marriage	<input type="checkbox"/>
8. To live near/moved with relatives	<input type="checkbox"/>
9. To live in this place	<input type="checkbox"/>
10. Other (specify)	

11. Did you know anyone when you first came here? Yes No
 a. If yes, who (in relation to you) – friend, relative etc?

.....

12. Do you live here all year round? If not, how many months of the year?
 months or All year [circle]

OR – How often do you go back to the village?

Once a week Twice a month Once/month A few times a year Once a year

13. Overall, how is it to live here? – [circle which one]
 Very bad Bad Ok Good Very good

14. Have things changed here for better or worse since you have been here?
 [circle which one]
 Got worse Stayed the same Got better

15. If it has changed, how?

.....

16. And do you own, rent etc?
 1= Owned
 2= Rented (Normal)
 3= Rented (subsidized)
 4= Belongs to neighbour (supplied free/rent paid)
 5= Belongs to family (supplied free/rent paid)
 6= Supplied free by employer
 7= Other (specify)

17. How much do you spend on rent every month?
 (or just figure??)
 shillings per month
 NB – shared between how many people?

17. Whose land is this?
 1= Private – other
 2= Communal
 3 = Municipal
 4 = Government
 5 = Private – THEIR OWN

2. ECOSYSTEM SERVICES

18. Where do you get your food from?

- a. Local market
- b. Mainly shops
- c. Supermarket only
- d. Shops & market
- e. Kiosks / 'hotels'

19. Do you grow any of your own food here? (circle)

None Some Half Lots All

20. Or keep chickens or pigs? If yes, for your own consumption or for sale?

No Yes – to eat Yes – to sell If yes, how many:

.....

.....

21. Do you get any food from the village that is brought here – if so how much of what you consume?

None (go to Q20) Some Half Lots
All

a. Do you go back to the village yourself to collect the produce?

Yes No

b. Is this food from your land in the village, or a friend/relative's land?

Own land Friend/relative's

22. Do you sell any fruit, vegetables, coal or other natural produce? (in the markets)

Yes No

What.....

23. What is the main source of water for drinking for your household?
(and is it private or shared?)

- 1= Private connection to pipeline
- 2= Public taps
- 3= Bore-hole
- 4= Protected well/spring
- 5= River, stream, lake, pond
- 6= Vendor/Tanker truck
- 7= Rain water
- 96= Other (specify)

24. And where do you get water for washing/bathing etc?

(use categories above)

25. What is the main source of lighting in your dwelling?

- 1= Electricity-Grid
- 2= Electricity-Generator
- 3= Paraffin lantern
- 4= Tadooba
- 5= Firewood
- 6= Candle
- 96= Other (specify)

26. What type of fuel do you use most often for cooking?

- 1= Electricity-Grid; 2= Electricity-Generator

- 3= Firewood
- 4= Charcoal
- 5= Paraffin/kerosene
- 6= Gas
- 96= Other (specify)

27. Is there anything natural (“obutonde bwa ensi”) /God created that you enjoy in this place?

.....

28. Have there been any changes in the weather during the last few years? For example, is there more rain, less rain, getting hotter or cooler, or more variable etc?

Yes No

What.....

3. Impacts and ways of responding

29. This past year have you had problems with water coming into your home? If so, how much damage is caused?

Severe/loss of life Much damage Little damage Annoyance None

30. And has flooding caused any problems in your area at all?

.....

31. Have there been any changes in the local area that have affected **flooding**?

.....

32. What about infectious disease?

.....

33. Do you ever run out of food or water?

FOOD Yes No
 WATER Yes No

a. If yes, how often:

Once a week Twice a month Once/month A few times a year Once a year

b. If yes, why?

.....

34. This last year (or since you lived here) what are the good things that have happened to you here?

Prompt needed

.....

35. *This last year (or since you lived here), have any things happened in your life that have seriously negatively affected you? What are they?*

Prompt needed

.....

Responding to the Issues

FIRST SECTION: PAST IMPACTS & HOW YOU DEALT WITH THOSE PROBLEMS

*'Please think **about the way that you dealt with these problems such as.... (you have just mentioned) this last year.** Please tell me how much you agree with each of the following statements, either strongly disagree, disagree, agree, or strongly agree. If you cannot answer a statement then please leave it and we will move on.'*

<i>A main problem for me has been flooding.</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"When problems came, I tried to do something about it."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I have learned from other people in my community how to deal with these problems."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I have tried to help other people around here when problems came for them."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I have not talked much about ways to improve life with others in my area."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"When problems came, I shifted back to the village / left the city."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"When problems came, I got help from my friends or relatives."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"When problems came, I just had to stay here and deal with it."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>The main problems have been when you have lost a relative or a close friend.</i>	Strongly disagree 1 2 3 4 strongly agree
<i>Sickness has been a main problem for me.</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"When problems came, I got help from my neighbours."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"When problems came, I shifted to somewhere else in the city."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"When problems came, I just dealt with them on my own, without the help of others."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"When problems came, I just gave up."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"When problems came, the only thing I could do is take care of the problem myself."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>A main problem for me has been lack of money.</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"When problems came, there was nothing I could do except pray to God and let Him handle the situation."</i>	Strongly disagree 1 2 3 4 strongly agree

SECOND SECTION: THE CURRENT SITUATION

36. And what are the main 3 issues or challenges you face at the moment in this place?

a. Are they getting better, worse or the same?

1.	Got worse	Same	Got less
2.	Got worse	Same	Got less
3.	Got worse	Same	Got less

'Please now think about your current situation and how much you agree with these statements.'

<i>"I believe this place will get better."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I am learning new ways to survive problems in this area."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I believe I can change my life for the better."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I am not ready to deal with the problems when they come."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"My current job/what I do is all I know how to do."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I will never leave this place."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I do not think the situation will improve here."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I am always thinking of new ways to earn money and survive."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I am prepared for when problems come in the future."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I am ready to move if life get worse here."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I do not think there are things I could do to improve life here."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I don't want to change how I am living."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I am ready to try a new job if there is an opportunity."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I will cope with problems only when they come."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I have many other things I can do to earn some money."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I do not think I can improve my life here."</i>	Strongly disagree 1 2 3 4 strongly agree

THIRD SECTION: A BIT ABOUT YOU AND YOUR LOCAL AREA

'Again, please tell me how much you agree with these statements about you and your local place.'

<i>"I won't move from here unless I have a big problem."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I am proud to tell people I live here."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I have some strong friendships and relationships in this neighbourhood."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I do not feel like I belong to this community."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I enjoy living here because it is crowded."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I do not have the abilities to do another job."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I would prefer to live in the village."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I enjoy living here because there is enough space."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I support my local community in every way I can."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I want to look after my local natural environment."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I enjoy my job/what I do for a living."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I would change job if I was offered a different one."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"If I had the money I would leave this place."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I socialise with lots of different people in the community."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I only socialise with those people living around me."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I do not care about my local environment."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I am willing to learn new skills or learn a new trade."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I am proud of my job/what I do."</i>	Strongly disagree 1 2 3 4 strongly agree
<i>"I am glad I am here rather than being in the village."</i>	Strongly disagree 1 2 3 4 strongly agree

4. Social Network Analysis Questions

Consider now those impacts you mentioned above that affected your life [name most significant negative impact]. When there are times of difficulty, people sometimes get help from others; PLEASE THINK ABOUT THE PEOPLE WHO HELPED YOU OUT WHEN YOU HAD PROBLEMS, THIS LAST YEAR AND NOW.

Person	Name (initials)	How much help (0-4) & Type -M,O,B		Known for (1-4)	Relationship	Same Place? (Y/N)	Stay where? (1-4)	Job Title/ what they do	A	B	C	D	E	F	G	H	I	J
A																		
B																		
C																		
D																		
E																		
F																		
G																		
H																		
I																		
J																		

37. Please list all the people or who helped you out, in or outside your household, this last year when these things happened <say impact>, even if they only helped you once. Please just tell me first name or initials; if you don't know their names please still include - as Person A, Person B etc.

38. Please tell me how much each of them helped you that time.

0= Not at all, 1= A little, 2= Some, 3= A lot, 4= Essential help given.

39. What type of help was it?

M = money +/- or material goods; F=food; O =other e.g. emotional; B=both

40. *How long have you known each person?*
life

1= under a year; 2 = 1-5 years; 3= 5-10 years; 4= 10+ yrs/all my

41. *What is your relationship to each person that helped you?*

42. *Are each of them originally from the same place as you?*

43. *Where do they stay now?*
country

1= Same place, 2=same city, 3=another city/village, 4= another

44. *What job do they do?*

45. *What is the relationship between those people who helped you?*

0 = Stranger, 1 = just friends, 2= especially close

5. Ending Questions

46. Do you do paid work of any kind? Formal Informal
 Neither

47. What is your main source of income (job)?

48. Do you have one or more jobs/ways to earn money?
 None One Many

49. Does anyone send you any money? Yes No

If so, who? 1. 2. 3.

How much each month?ShSh
Sh

50. And do YOU send anyone money? Yes No

If so, who? 1. 2. 3.

How much each month?ShSh
Sh

51. Do you have any savings? Yes No

52. What was the highest grade of education you achieved?

53. What do you like about here where you stay?
 [write down as much as you can]

54. What do you dislike about here where you stay?
 [write down as much as you can]

55. Have you ever thought of leaving this area? Yes No
 Already made plans

c. Where would you go?

d. Why didn't you go?

56. What would you do to change this place, if you could?

THANK YOU SO MUCH FOR YOUR TIME AND YOUR HELP. I AM VERY GRATEFUL.

Appendix 2: List of Statements Used in the Questionnaire

Section I: ADAPTIVE STRATEGIES

i) Adaptive mobility

- "When problems came, I shifted to somewhere else in the city."*
"When problems came, I shifted back to the village / left the city."
"When problems came, I just had to stay here and deal with it."

ii) Help

- "When problems came, I just dealt with them on my own, without the help of others."*
"When problems came, I got help from my neighbours."
"When problems came, I got help from my friends or relatives."

iii) Self-efficacy

- "When problems came, I just gave up."*
"When problems came, the only thing I could do is take care of the problems myself."
"When problems came, the only thing I could do is pray to God and let Him handle the situation."

iv) Learning from others

- "I have learned from other people in my community how to deal with these problems."*

Section II: ADAPTIVE CAPACITIES

i) Feelings of control

- "I believe I can change my life for the better."*

ii) Belief in local change – Alpha = 0.740

- "I believe this place will get better."*
"I do not think the situation will improve here."
"I do not think I can improve my life here."
"I do not think there are things I could do to improve life here."

iii) Readiness to leave – Alpha = 0.622

- "I am ready to move if life get worse here."*
"I will never leave this place."
"If I had the money I would leave this place."
"I won't move from here unless I have a big problem."

iv) Innovation

- "I am always thinking of new ways to earn money and survive."*

v) Job flexibility

- "I am ready to try a new job if there is an opportunity."*

vi) Options to change

- "I have many other things I can do to earn some money."*

vii) Planning & reorganisation

- "I am prepared for when problems come in the future."*

Section III: SOCIAL SENSITIVITY

i) Appreciation of local area (cultural services) – Alpha = 0.629

- "I want to look after my local natural environment."*
"I do not care about my local environment."

ii) Attachment to place – Alpha = 0.647

- "I am proud to tell people I live here."*
"I do not feel like I belong to this community."

iii) Feelings for village – Alpha = 0.705

- "I would prefer to live in the village."*
"I am glad I am here rather than being in the village."

iv) Attachment to occupation – Alpha = 0.700

- "I am proud of my job/what I do."*
"I would change job if I was offered a different one."
"I enjoy my job/what I do for a living."

v) Networks – strength

- "I have some strong friendships and relationships in this neighbourhood."*

vi) Networks – wide – Alpha = 0.813

- "I socialise with lots of different people in the community."*

"I only socialise with a people living around me."

vii) Employability – individually

"I do not have the abilities to do another job."

Appendix 3: Correlations of Scores between Adaptive Capacities (Section II statements) and Adaptive Strategies (Section I statements)

		Shift elsewhere	Shift back to village	Not stay here	Get help generally	Get help from neighbours	Get help from friends or relatives	Did not give up	Take care of problem myself	All I could do is pray to God	Learned from others
FEELINGS OF CONTROL	Pearson Correlation	-.039	-.053	-.032	.103**	.031	.119**	.258**	-.081*	.038	.164**
	Sig. (2-tailed)	.306	.163	.390	.006	.405	.002	.000	.031	.308	.000
	N	706	707	706	709	707	708	708	708	705	709
BELIEF IN CHANGE	Pearson Correlation	-.089*	-.025	-.046	.056	.107**	.147**	.025	.056	.163**	-.032
	Sig. (2-tailed)	.022	.516	.234	.147	.006	.000	.520	.153	.000	.413
	N	657	658	657	660	658	659	659	659	656	660
READINESS TO LEAVE	Pearson Correlation	-.007	.018	-.016	.008	-.006	.020	.031	-.003	.127**	.053
	Sig. (2-tailed)	.850	.632	.677	.823	.864	.603	.418	.936	.001	.160
	N	700	701	701	703	701	702	702	702	699	703
INNOVATION	Pearson Correlation	-.041	-.078**	-.046	.059	-.012	.161**	.191**	-.061	.055	.249**
	Sig. (2-tailed)	.270	.037	.223	.112	.749	.000	.000	.103	.145	.000
	N	712	713	712	715	713	714	714	714	711	715
JOB FLEXIBILITY	Pearson Correlation	.037	-.003	-.008	-.103**	-.097**	-.034	-.028	.110**	.084*	-.056
	Sig. (2-tailed)	.323	.946	.840	.006	.010	.370	.454	.003	.026	.136
	N	709	710	709	712	710	711	711	711	708	712
OPTIONS TO CHANGE	Pearson Correlation	-.043	.031	.041	.002	.153**	.104**	-.126**	.096*	.029	-.128**
	Sig. (2-tailed)	.256	.414	.273	.965	.000	.005	.001	.011	.442	.001
	N	711	712	711	714	712	713	713	713	710	714
PLANNING & REORGANISATION	Pearson Correlation	-.041	.026	.033	-.004	.054	.046	-.105**	.069	-.065	-.195**
	Sig. (2-tailed)	.276	.489	.375	.911	.147	.219	.005	.064	.083	.000
	N	709	710	709	712	710	711	712	711	708	712

Table showing results of multiple (Pearson) correlations between scores for each individual on adaptive capacities (left-hand column) and scores for adaptive strategies (top row); n = roughly 720. Data derived from presentation of statements and agreement or disagreement on a Likert scale, as described in the Methods section. ** indicates correlation is significant at the 0.01 level (2-tailed), * that is significant at the 0.05 level. However as described above, Bonferroni corrections were applied so even stricter p-values were in fact used to determine which results were significant.

Appendix 4: Correlations of Scores between Social Sensitivities (Section III statements) and Adaptive Strategies (Section I statements)

		Shift elsewhere	Shift back to village	Not stay here	Get help generally	Get help from neighbours	Get help from friends or relatives	Did not give up	Take care of problem myself	All I could do is pray to God	Learned from others
APPRECIATION OF LOCAL ENVIRONMENT	Pearson Correlation	-.094 [*]	-.079 [*]	-.106 ^{**}	.061	.006	.045	.175 ^{**}	.006	.172 ^{**}	.202 ^{**}
	Sig. (2-tailed)	.013	.036	.005	.106	.868	.234	.000	.872	.000	.000
	N	704	705	704	707	705	706	706	706	703	707
ATTACHMENT TO PLACE	Pearson Correlation	-.073	-.019	-.016	.044	.142 ^{**}	.100 ^{**}	-.009	-.022	-.036	-.047
	Sig. (2-tailed)	.053	.617	.675	.238	.000	.008	.819	.564	.340	.214
	N	709	710	709	712	710	711	711	711	708	712
FEELINGS FOR VILLAGE	Pearson Correlation	-.072	-.105 ^{**}	-.042	-.021	.011	.053	-.056	.076 [*]	.139 ^{**}	.001
	Sig. (2-tailed)	.056	.005	.264	.579	.763	.161	.135	.042	.000	.982
	N	708	709	708	711	709	710	710	710	707	711
ATTACHMENT TO OCCUPATION	Pearson Correlation	-.032	.054	.014	.016	.109 ^{**}	.043	-.041	-.049	-.154 ^{**}	-.001
	Sig. (2-tailed)	.394	.152	.711	.673	.004	.251	.276	.191	.000	.987
	N	699	701	699	702	700	701	701	701	698	702
NETWORKS STRENGTH	Pearson Correlation	-.061	.004	.039	.105 ^{**}	.296 ^{**}	.126 ^{**}	-.055	-.103 ^{**}	-.137 ^{**}	.078 [*]
	Sig. (2-tailed)	.106	.915	.295	.005	.000	.001	.140	.006	.000	.037
	N	712	713	712	715	713	714	714	714	711	715
NETWORKS - WIDE	Pearson Correlation	-.066	-.040	-.033	.042	.162 ^{**}	.101 ^{**}	-.091 [*]	-.052	-.007	.061
	Sig. (2-tailed)	.077	.287	.383	.268	.000	.007	.016	.168	.843	.105
	N	709	710	709	712	710	711	711	711	708	712
EMPLOYABILITY	Pearson Correlation	-.052	-.074	-.032	.030	-.008	.026	.101 ^{**}	-.043	.027	.002
	Sig. (2-tailed)	.165	.050	.393	.431	.836	.497	.007	.254	.475	.968
	N	708	709	708	711	709	710	710	710	707	711

Table showing results of multiple (Pearson) correlations between scores for each individual on social sensitivities (left-hand column) and scores for adaptive strategies (top row); n = roughly 720. Data derived from presentation of statements and agreement or disagreement on a Likert scale, as described in the Methods section. ** indicates correlation is significant at the 0.01 level (2-tailed), * that is significant at the 0.05 level. However as described above, Bonferroni corrections were applied so even stricter p-values were in fact used to determine which results were significant.

Appendix 5: Correlations of Scores between Ego-Network Measures and Adaptive Strategies (Section I statements)

		Shift elsewhere	Shift back to village	Not stay here	Get help generally	Get help from neighbours	Get help from friends or relatives	Did not give up	Take care of problem myself	All I could do is pray to God	Learned from others
Number of Helpers	Correlation Coefficient	-.079*	-.030	-.088*	.161**	.076*	.160**	.137**	-.140**	.008	.178**
	Sig. (2-tailed)	.036	.424	.020	.000	.044	.000	.000	.000	.824	.000
	N	701	702	701	704	702	703	703	703	700	704
Total Amount of Help Given	Correlation Coefficient	-.118**	-.064	-.107**	.114**	.046	.171**	.135**	-.098**	.071	.201**
	Sig. (2-tailed)	.002	.093	.005	.003	.222	.000	.000	.009	.061	.000
	N	701	702	701	704	702	703	703	703	700	704
Number of Helpers Giving Material Help	Correlation Coefficient	-.038	.014	-.062	.168**	.075*	.155**	.144**	-.156**	-.011	.111**
	Sig. (2-tailed)	.311	.719	.102	.000	.046	.000	.000	.000	.772	.003
	N	701	702	701	704	702	703	703	703	700	704
Total Time Helpers Known for	Correlation Coefficient	-.119**	-.039	-.047	.140**	.115**	.197**	.095*	-.109**	.019	.082*
	Sig. (2-tailed)	.002	.308	.216	.000	.002	.000	.012	.004	.622	.030
	N	701	702	701	704	702	703	703	703	700	704
Number of Helpers from the Same Place of Origin	Correlation Coefficient	-.111**	-.008	-.045	.129**	.047	.163**	.039	-.090*	.060	.051
	Sig. (2-tailed)	.003	.829	.233	.001	.216	.000	.299	.017	.114	.179
	N	701	702	701	704	702	703	703	703	700	704
Number of Helpers currently living in the Same Place	Correlation Coefficient	-.120**	-.067	-.094*	.120**	.118**	.074	.077*	-.119**	-.011	.140**
	Sig. (2-tailed)	.001	.075	.013	.001	.002	.051	.042	.002	.781	.000
	N	701	702	701	704	702	703	703	703	700	704

Table showing results of multiple (Spearman-rank) correlations between measures of each individual's ego-networks (left-hand column) and scores for adaptive strategies (top row); n = roughly 720. Data derived from ego-network analysis (see Methods section & Appendix 2) as well as presentation of statements and agreement or disagreement on a Likert scale. ** indicates correlation is significant at the 0.01 level (2-tailed), * that is significant at the 0.05 level. However as described above, Bonferroni corrections were applied so even stricter p-values were in fact used to determine which results were significant.

Appendix 6: Comparison of Adaptive Capacity Determinants across Three Slum Areas Using a Kruskal-Wallis Test

IMPACTS								
	Flooding	Money	Loss of life	Sickness				
Chi-Square df	411.003 2	16.565 2	11.865 2	17.239 2				
Asymp. Sig.	.000	.000	.003	.000				
ADAPTIVE RESPONSES								
	Shift Elsewhere	Shift village to	Did not stay here	Got help	Help from neighbours	Help from friends / relatives	Did not give up	Learned from others
Chi-Square df	.557 2	.364 2	27.846 2	46.833 2	11.316 2	2.583 2	1.192 2	5.797 2
Asymp. Sig.	.757	.834	.000	.000	.003	.275	.551	.055
ADAPTIVE CAPACITIES								
	FEELINGS OF CONTROL	BELIEF IN CHANGE	READINESS TO LEAVE	INNOVATION	JOB FLEXIBILITY	OPTIONS TO CHANGE	PLANNING & REORGANISATION	
Chi-Square df	.845 2	11.146 2	5.091 2	12.548 2	16.727 2	5.996 2	19.581 2	
Asymp. Sig.	.655	.004	.078	.002	.000	.050	.000	
SOCIAL SENSITIVITIES								
	APPRECIATION OF NATURE	ATTACHMENT TO PLACE	FEELINGS FOR VILLAGE	ATTACHMENT TO OCCUPATION	NETWORKS STRENGTH	NETWORKS - WIDTH	EMPLOYABILITY	
Chi-Square df	11.618 2	3.032 2	2.044 2	2.848 2	3.343 2	31.453 2	12.970 2	
Asymp. Sig.	.003	.220	.360	.241	.188	.000	.002	

Table showing results of Kruskal-Wallis analysis to test differences in scores across various aspects of social resilience in three study areas. These facets were measured using a method of presentation of statements and agreement or disagreement on a Likert scale. Significant results are shown in bold.

Appendix 7: Comparison of Ego-Network Measures across the Three Slum Areas Using a Kruskal-Wallis Test

	Duration of Residence	Number of Helpers	Amount of Help	No. Helpers giving material help	Time Known	% of Helpers from Same Origin	% of Helpers living in Same Place
Chi-Square	3.917	41.518	30.085	25.442	15.088	13.354	20.874
Df	2	2	2	2	2	2	2
Asymp. Sig.	.141	.000	.000	.000	.001	.001	.000

a. Kruskal Wallis Test

b. Grouping Variable: Area

Table showing results of Kruskal-Wallis analysis to test differences in scores across various measures of ego-networks of individuals in three slum areas. These were measured using questions found in Appendix 2. Significant results are shown in bold

Appendix 8: Correlation of Adaptive Capacity and Social Network Scores with Duration of Residence Values

		ADAPTIVE STRATEGIES									
		Shift elsewhere	Shift back to village	Not stay here	Get help generally	Get help from neighbours	Get help from friends or relatives	Did not give up	Take care of problem myself	All I could do is pray to God	Learned from others
DURATION OF RESIDENCE	Correlation Coefficient	-.215**	-.151**	-.100**	.008	.127**	.037	-.055	-.051	-.009	.110**
	Sig. (2-tailed)	.000	.000	.008	.830	.001	.330	.145	.182	.816	.004
	N	690	691	691	693	691	692	692	692	689	693
		CAPACITIES									
		FEELINGS OF CONTROL	BELIEF IN CHANGE	READINESS TO LEAVE	INNOVATION	JOB FLEXIBILITY	OPTIONS TO CHANGE	PLANNING & REORGANISATION			
DURATION OF RESIDENCE	Correlation Coefficient	.002	-.004	-.202**	-.011	-.110**	.015	.013			
	Sig. (2-tailed)	.963	.929	.000	.779	.004	.700	.743			
	N	687	639	681	692	689	692	689			
		SOCIAL SENSITIVITIES									
		CULTURAL SERVICES	ATTACHMENT TO PLACE	FEELINGS FOR VILLAGE	ATTACHMENT TO OCCUPATION	NETWORKS STRENGTH	NETWORKS - WIDE	EMPLOYABILITY			
DURATION OF RESIDENCE	Correlation Coefficient	.058	.202**	-.043	.114**	.136**	.124**	-.110**			
	Sig. (2-tailed)	.131	.000	.263	.003	.000	.001	.004			
	N	685	689	689	681	693	690	693			
		SOCIAL NETWORK MEASURES									
		Number of Helpers	Total Amount of Help Given	Number of Helpers Giving Material Help	Total Time Helpers Known For	Number of Helpers from Same Place of Origin	Number Helpers Currently Living in the Same Area				
DURATION OF RESIDENCE	Correlation Coefficient	.069	.070	.047	.218**	-.006	.018				
	Sig. (2-tailed)	.072	.069	.220	.000	.879	.659				
	N	686	686	686	686	636	636				

Table (over the page) in Appendix 8 showing results of multiple (Spearman-rank) correlations between measures of each individual's duration of residence (adjusted to number of days) and various adaptive capacity and social network scores; n = roughly 720 depending on each case. All of the factors of strategies, capacities, sensitivities and social network measures are as they are measured in Chapter 5. Data derived from ego-network analysis (see Chapter 3 & Section 4 of Appendix 1) as well as adaptive capacity assessment – presentation of statements and agreement or disagreement on a Likert scale. ** indicates correlation is significant at the 0.01 level (2-tailed), * that is significant at the 0.05 level. However as described above, Bonferroni corrections were applied so even stricter p-values were in fact used to determine which results were significant.

List of Acronyms

CBD	Central Business District
ENA	Ego-Network Analysis
ESS	Ecosystem Services
FEGS	Final Ecosystem Goods and Services
GDP	Gross Domestic Product
GIS	Global Information System
GPS	Global Positioning System
IUCN	International Union for the Conservation of Nature
KCC	Kampala County Council
LC	Local Councillor
MEA	Millennium Ecosystem Assessment
NGO	Non-Governmental Organisation
ODI	Overseas Development Institute
SAP	Slum Aid Project
SDI	Slum Dwellers' International
SNA	Social Network Analysis
SPSS	Statistical Package for the Social Sciences
TEEB	"The Economics of Ecosystems and Biodiversity"
UBOS	Uganda Bureau of Statistics

Glossary

Adaptive capacity	In general terms, adaptive capacity is the capacity of a system to evolve to external changes and thereby expand the range of variability with which it can cope; in applied terms, it is defined in this thesis as: The preconditions necessary to enable adaptation (to maintain or increase quality of life), including social and physical elements, and the ability to mobilise these elements.
Alter	A person to which the ego is linked, in this case by social support (a “helper”).
Ecosystem services	Ecosystem services are the aspects of ecosystems utilised (actively or passively) to produce human well-being.
Ego	The focal node (individual) at the centre of an individual personal network analysis.
Ego-network analysis	A form of social network analysis (also known as ‘personal network analysis’) that focuses on individuals’ personal networks, rather than analysis the whole of the network.
Exposure	The nature and degree to which a system experiences environmental or socio-political stress.
Peri-urban area	An area at the rural-urban interface, a transition or interaction zone, where there is a mix of urban and rural activities, and landscape features are subject to rapid modifications due to human activities.
Resilience	Resilience is the ability of a system to deal with, and respond to, a spectrum of shocks and perturbations whilst retaining the same structure and function
Slum	A poor area of a city characterised by substandard housing and squalor, inadequate service provision, overcrowding, and lack of tenure security.
Social capital	The social norms and networks that enable people to act collectively.

Social network analysis	A methodological analysis of social networks, incorporating network theory. Social relations consist of <i>nodes</i> (individual actors within the network) and <i>ties</i> (the relationships between individuals).
Social resilience	The ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change.
Social sensitivities	The characteristics of an individual in terms of how they relate to their surroundings – their place, community, and employment, which affects how much certain shocks impact them.
Urban resilience	The ability of a city or urban system to absorb disturbance while retaining identity, structure and key processes.

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