Equity, Sustainability and Incentive-Based Conservation Measures. Community Reflections from Mt. Elgon, Uganda

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Thesis Abstract

Incentive-based measures are increasingly being employed as a strong motive to encourage conservation yet the evidence that they are generating sustainable resource-use, improving rural livelihoods or aiding biodiversity protection remains inconclusive. To provide empirical evidence to this discourse, in this study the McDermott et al (2013) equity framework is used to explore how different benefit-sharing arrangements have shaped twenty-five years of Integrated Conservation and Development projects (ICDP) neighbouring the Mt. Elgon National Park, Uganda.

Applying a self-reported, post-hoc, quasi-experimental design, a time-series of participatory mapping activities revealed that despite the willingness of targeted groups to adopt 'green' technologies (distributional equity), maintaining and up-scaling these activities remained limited at the landscape level. Social network analysis uncovered that limited knowledge, restricted access (contextual equity) and the lack of inclusion in decision-making (procedural equity) impeded this development. Tracking the Mt. Elgon Regional Eco-System Conservation Programme (MERECP) as a specific case study, the analyses then showed that wealthier members of society and the political elite were the principle beneficiaries of conservation inputs. In the cases where these institutionalised hierarchies were purposely sidestepped (a measure to ensure marginalised stakeholders gained funds), cases of conflict and resentment arose.

Overall, communities that had loose, expansive conservation networks adopted the greatest number of simple technologies. Nevertheless, those that have built a high level of trust both amongst one another and with supporting organisations resulted in the most socially equitable and biologically efficient outcomes. Portraying a future rich in sustainable land-use practises, communities do aspire to protecting their natural resources. Whilst this may be a time-consuming, expensive process, building sound adaptive 'co-management' relationships that respect cultural norms, provide suitable alternatives and maximises local knowledge is the key to implementing incentive-based conservation measures across Mt. Elgon.

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Acknowledgements

People do Ph.D.'s for several different reasons. For me, I was looking for an adventure. To place myself in a new culture and gain a real insight into the realities of tropical forest conservation. Whilst I still haven't lost all my enthusiasm in believing that the win-win goals of biodiversity conservation and sustainable development can eventually become a reality, nothing or nobody could have prepared the twenty two year old me for the experience I signed myself up to. Certainly without the guidance and support of some very special people, this research would not have been possible.

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Author's Declaration

I declare that the work contained in this thesis is my own and has not been submitted for any other degree or award. Colleagues who contributed in a supervisory role are included as co- authors on the respective chapters, wherein the nature of their contributions are detailed. However, I played the dominant role in all study design, data collection, data analysis, interpretation and writing.

Chapter One

Introduction

Introduction

Covering more than 15% of the earths terrestrial surface (Franks and Schreckenberg, 2016), Protected Areas (PAs) remain one of the most effective measures in conserving different species and habitats across the globe (Gray et al., 2016). Yet when discussing their social impacts we are addressing a global inequity problem. Typically degraded by wealthier individuals, too often restricted access disproportionally affects the most vulnerable. Characterised by rapidly growing populations living in extreme poverty, people-free parks can cause severe socio-economic hardship (Spiteri and Nepalz, 2006) and numerous cultural losses (Martin, Gross-Camp and Akol, 2015) that current management approaches are struggling to adequately distribute the costs and benefits of (Franks and Schreckenberg, 2016).

Aspiring to ease these opposing environmental and development pathways, since the 1992 Convention of Biological Diversity (CBD) policy thinking has shifted away from the reactive and *ad hoc* approach of protecting individual species to a more proactive and holistic one. By integrating the management of land, water and living resources to encourage sustainable resource use (MEA, 2005), the conference devised the 'ecosystem approach.' This was the first attempt to put human needs at the centre of biodiversity management (Raffaelli and Frid, 2010)[1]. On the grounds of achieving democratic accountability and reducing dependency on protected resources, these have now been promoted under the umbrella of decentralisation approaches that included building adaptive co-management relationships under community-based conservation and promoting Alternatively Livelihood Projects (ALPs) (Wright et al. 2015).

At the 2007 G8 Postdam summit, a strong emphasis was then placed on the need for environmental valuation to drive the ecosystem approach (Pokorny, Johnson, Medina and Hoch, 2012). Stemming from Coasean economics (Pascual, Muradian, Rodríguez and Duraiappah, 2010), by integrating global value chains and the payment of non-market forest services, it is hoped that the numerous environmental and cultural

[1] Principle 1,4 and 5 of the Rio Declaration "Human beings are at the centre of concerns for

services offered by nature will be valued (Wilson and Guéneau, 2004). Essentially improving economic efficiency and providing real financial incentives for local actors to conserve them (Engel, Pagiola and Wunder, 2008). Directing such efforts in the global south, the application of market-based incentive mechanisms, including Payment for Ecosystem Services (PES) and the United Nations Reduced Emissions from Deforestation and Degradation (REDD+) policy, have been growing (Gómez-Baggethun and Muradian, 2015; Hejnowicz, Raffaelli, Rudd and White, 2014). The aim of which has been to alleviate poverty whilst encouraging the growth of green economies: what has been termed a triple-win for ecosystem conservation, financial investors and the rural poor alike (McAfee and Shapiro, 2010). Further justifications have, however, included their ability to reduce information asymmetries and provide policy makers with price signals (Gomez-Baggethun and Ruiz-Perez, 2011).

Reflecting mainly on the existing PES and Integrated Conservation and Development Projects (ICDP), sceptics are not only questioning the practicalities of such interventions but the legitimacy of introducing neoliberal-policies in the marginalised global south (McAfee and Shapiro, 2010; Bremer, Farley and Lopez-Carr, 2014; Corbera, Brown and Adger, 2007; Krause, Collen and Nicholas, 2013; Gómez-Baggethun, de Groot, Lomas and Montes, 2010). Having the potential to reproduce existing power asymmetries found in markets, they also have the ability to undermine the rights of poor communities whilst crowding out their intrinsic motivations to conserve nature (Kosoy and Corbera, 2010; Muradian et al., 2013).

Problem Statement

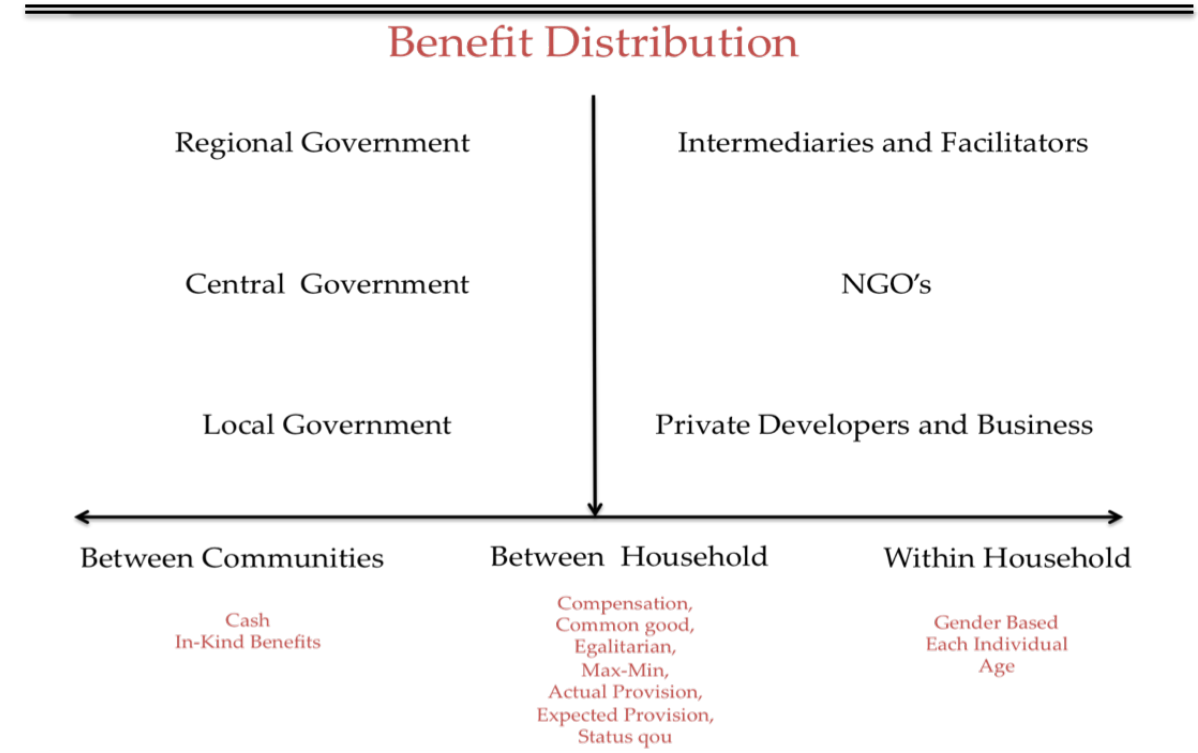
The Role of Benefit-Sharing in Public Participation

As highlighted by Muradian et al. (2013), in practise very few interventions are founded on pure markets. These schemes are policy interventions trying to motivate widespread behavioural changes which in turn largely depend on whether individuals have the 'eligibility, ability and willingness' to do so (Pagiola, Arcenas and Platais, 2005; Pascual et al., 2010). From a stakeholders perspective one would only engage in conservation if a) the benefits outweighed the opportunity and transaction costs and b) if these benefits were perceived to be legitimate and distributed in a fair manner (Dunlop and Corbera, 2016; Pascual et al., 2010).

Consequently, one of the most crucial questions that needs addressing is how can the benefits, be it in the REDD+ context or not, be distributed in an 'efficient, effective and equitable' manner (Angelsen, Brockhaus, Sunderlin and Verchot, 2012; Wong et al., 2016)? To date, there is no one-size-fits-all mechanism for the channelling of finances (Hoang et al., 2012; Madeira et al., 2012). Instead individual projects have been structured according to the host country and site-level circumstances (a nested approach) with different beneficiaries and costs associated with the sharing process.

Who, why and what you receive depends on the different agreements reached between the context specific stakeholders (Hoang et al. 2012; Lindhjem et al. 2011; Mwayafu, Kimbowa & Graham 2012; Peskett 2011). This is known as benefit-sharing and there are two dimensions that underpin it (Fig 1). The first is the transparent and efficient distribution of from national level to the community (vertical). These can be considered incentives that drive good governance and external support i.e actors from different government agencies or intermediary organisations. Linked to environmental performance, instruments such as 'Ecological Fiscal Transfers' can be used for intergovernmental flow of benefits, particularly towards lower level administrators (Wong et al. In Prep). The second is the distribution of funds that provide customised and legitimate financial incentives to alter land-use change in favour of sequestration and storage (horizontal). Such incentives can be direct payment to communities whilst others can be in-kind benefits such as technology, education and healthcare services (Mwayafu, Kimbowa and Graham, 2012).

Figure 1. Benefit-sharing distribution pathways and their potential recipients. Adopted from Ellis-Jones in Lindhjem et al. (2011) and Pascual et al. (2010)



Dimensions of Fairness, Equity and Justice

Given that stakeholders users are not homogenous, the design and implementation of a benefit-sharing scheme will affect stakeholders differently and change over time; not least because their perceptions of what fairness will vary (Kaye-zwiebel and King, 2014; Krause, Collen and Nicholas, 2013).

Distributional Equity

Traditionally, economic fairness may be seen as the equal division of benefits amongst all possible individuals (egalitarian) but since it is subjective, numerous fairness criteria can be applied (Pascual et al. 2010). Deciding why certain stakeholders should benefit, such as whether they should be compensated for restrictions to community rights/resource access, awarded for environmental stewardship (merit-based), or prioritised due to their authority, status or control, are some such rule-based principles to consider (Le et al., 2016). Then targeting who should benefit, i.e. upstream or downstream users, individual households,

Community Based Organisations (CBO's) and whether these divisions should be based on factors such as gender, wealth and age all have important ramifications on equity and consequently ecological outcomes. The type of benefit is equally as important. A study by Fisher et al. (2011) showed that deforestation avoidance payments to communities could increase the value of firewood whilst providing no liable fuel alternative making it an inefficient incentive. In other words the fairness criteria adopted by any scheme will impact distributional equity, that being the dispersal of burdens, benefits, risks and responsibilities (Pascual et al., 2014), and in changing these dynamics this now becomes a question of justice (Sikor, 2013). It is, however, the ideologies of social justice, those of needs, rights, merits and interest that underpin fairness criteria (Gregorio et al., 2013).

Procedural Equity

With that in mind, perceptions of fairness are not only guided by distributional equity, but through the political process in which they have been implemented (McDermott, Mahanty and Schreckenberg, 2013). Known as procedural equity, the level of participation, like being able to freely voice one's personal opinions and question the decision-making process (Luintel, 2016), is a critical component of stakeholders acceptance of the distributional outcomes (Scholsberg, 2009). For example, when irrigation communities in Australia were faced with the possibility of losing water resource allocations to deal with sustainability issues, their inclusion in the democratic decision-making process overrode economic considerations in what they believed were significant judgements of fairness in their reallocation (Syme, Nancarrow and Mccreddin, 1999). Individuals are therefore not motivated by economics alone (Sommerville et al. 2010), achieving improvements in procedural equity helps create legitimacy and is prerequisite for addressing effective distributional outcomes in practice (Gregorio et al., 2013; Wong et al., 2016).

Contextual Equity

Termed equity in access by Brown and Corbera (2003) or contextual equity by McDermott et al (2012), context-specific capabilities and power dynamics bring together dimensions of procedural and distribution equity (Kosoy, Corbera and Brown, 2008; Muradian et al., 2013). More specifically, Ribot and Peluso (2009) argue

that one's ability to access benefits principally depend on the existing social relationships and institutional arrangements, then to a lesser extent capital, labour, market technology and information. Here, power is seen as a function of the relationships between different people, including the knowledge and authority they choose to share. Unequal power in a socio-ecological setting will (re) produce inequity yet in practice changing it is exceptionally difficult as you risk the potential of redistributing power to those who undermine conservation, mismanage finance and reduce stakeholder participation.

Vertical benefit-sharing agreements in conservation often target state owned forests, many of which who fail to recognise customary rights of their resource users (Sikor, 2013). Such is the case with the Batwa indigenous communities in Uganda who continue to be inadequately compensated for their historical economic and cultural marginalisation (Martin, Gross-Camp and Akol, 2015). In the creation of protected areas, biological corridors, forest reserves and sustainable forest management zones, governments may not only prohibit community use or completely evict peoples from such area, they may justify finance going into their management, essentially increasing state control (Lyster, 2011). As shown in a review across Nepal (Adhikari, Kingi and Ganesh, 2014), decentralising natural resource management without the capabilities, downward accountability and/ or sufficient powers could threaten equity targets (Ribot, 2003). With regards to financial outcomes, Pascual et al. (2014) warn nepotism, corruption, fraud, and elite capture are very realistic outcomes in settings that lack real transparency amongst their stakeholders.

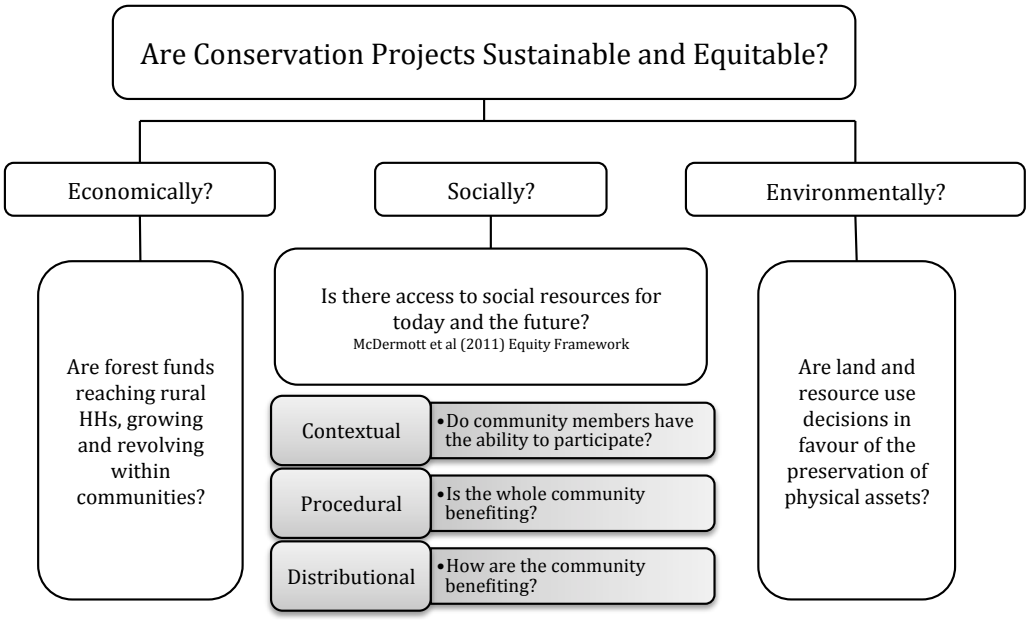
Attempting to overcome some of the key equity and rights challenges, international policy makers have designed a number of environmental and social safeguards that could help guide the implementation of incentive-based projects on the ground (Fontana and Grugel, 2016; Mahanty and McDermott, 2013). They call for full, transparent, non-discriminatory, respectful and effective stakeholder participation, especially with the most marginalised stakeholders that are lacking clear legal rights and identities over their traditional land. This means formally recognising the rights of indigenous and other affected peoples by ensuring Free, Prior, Informed, and Consent (FPIC) from the on-set of the intervention (Mahanty and McDermott, 2013).

Research Need and Theoretical Approach

Overall, the academic literature makes a strong argument to include equity dimensions in incentive-based policy instruments (Calvet-Mir et al., 2015; Franks and Schreckenberg, 2016; Gross-Campi, Few and Martin, 2015; Martin, Gross-Camp and Akol, 2015; Schroeder and McDermott, 2014; Wong et al., 2016). It emphasises that widespread consultation, consideration of distributional designs and carefully factorising enabling conditions can help improve their effectiveness (Assembe-Mvondo, Brockhaus and Lescuyer, 2013; Loft, Gebara and Wong, 2016). Nevertheless, realistic about the trade-offs, they highlight that including such dynamics can increase transaction and implementation costs (Tjajadi, Yang, Naito and Arwida, 2015). As early lessons from the REDD+ come trickling in (Dunlop and Corbera, 2016; Hoang et al., 2012; Yang et al., 2015) and conservation science starts to focus on these dimensions (Baylis et al., 2015), more evidence can tease out characteristics of failure or success and more importantly the environments in which they occur (He and Sikor, 2015; Martin, Gross-Camp and Akol, 2015; Pelletier, Gélinas and Skutsch, 2016).

With this in mind, a *post-hoc* evaluation of conservation interventions across the Mt. Elgon ecosystem is preformed through an equity and sustainability lens. Looking at all three sustainability pillars: economic, social and environmental, here three major questions are addressed throughout the research using the equity framework developed by McDermott et al. (2013) (Fig 2). The first is centred on social sustainability. It seeks to investigate whether the implementation process (procedural equity) and beneficiaries of (distributional equity) is accessible to current and future community members (contextual equity). The second explores environmental sustainability, more specifically focusing on whether projects have or are encouraging sustainable livelihood strategies (mitigation). The final question considers whether current interventions have truly created long-term financial support systems that makes these communities resilient to the effects of poverty in the future (adaptation).

Figure 2. Conceptualisation of research questions through a sustainability and equity framework



Targeting a single protected area (Chapter two), the research begins by looking at the promotion of conservation agriculture in Mt. Elgon Uganda (Chapter three), and the resulting landscape changes from a community perspective (Chapter four). Thereafter, a more detailed analysis of the Mt. Elgon Regional Ecosystem Conservation Programme (MERECP) Cash Revolving Fund Benefit-Sharing Scheme is used to explore equity issues in more detail (Chapter five). To meet this aim, the following four objectives will be addressed: -

<u>Objective 1.</u> To characterise monetary and non-monetary benefits associated with conservation interventions and consequently how these have impacted livelihoods.

The purpose of this objective is to understand who and how different stakeholders are benefiting from conservation interventions (distributional equity). Since it would be misleading to directly attribute changes to specific projects, the perceived impacts are collated.

<u>Objective 2.</u> To understand how different socio-political processes are driving the implementation and use of conservation inputs across Mt. Elgon.

Evaluating a Cash Revolving Fund benefit-sharing Scheme where each of the participating (CBO's) set their own criteria for lending, along with differing terms and conditions of repayment, this objective seeks to understand how institutional arrangements, participation and decision-making has led to the current benefit-sharing outcomes. The focus here is to explore contextual equity, looking at knowledge, representation, inclusion and voices. The strengths and weaknesses of such conditions will then be explored by participating stakeholders, compared to those that have not.

Objective 3. To identify the success conditions and further action that is required to upscale CRF activities in Mt. Elgon.

Objective three asks the question what if. If participating communities had the freedom, how, where and why would they do it differently? If neighbouring communities had access, which types of activities would they like to engage in, where and what is hindering them from doing so? The purpose of this objective is to try and capture the conditions people need to engage in benefit-schemes (contextual equity).

Objective 4. To frame the advantages and disadvantages of using CRF in relation to other benefit-sharing schemes.

Drawing on the previous three objectives, the final element of the research is to compare and contrast CRF to other benefit-sharing schemes in order to form strategic policy recommendations. Key questions to address here are whether CRF financing mechanisms are different to other Integrated Conservation Development Projects (ICDP), and if so do they provide a more sustainable, long-term financing mechanism?

Thesis Outline

This thesis is split into five further chapters.

Chapter Two: ***Taking A Case Study Approach: Protected Area Management Across Mt. Elgon Ecosystem, Uganda.***

With a rich history of forest use, ethnic conflict and differing forest management regimes, this chapter provides a historical overview of the Mt.Elgon Ecosystem. Starting with the importance of the ecosystem services it harbours, it goes on to

describe the conservation initiatives introduced to date then finishes with a summary of the MERECP project and correspondingly the selection of field sites.

Chapter Three: ***Promoting Conservation Agricultural Production Systems: How the Structure of Information Sharing Networks Influences Technology Adoption Across the Mt. Elgon Ecosystem, Uganda.***

At the centre of the Mt. Elgon conservation agenda is agricultural innovation, especially the promotion of conservation agricultural production systems. Before delving into the specific MERECP intervention, a broader overview of the types of knowledge and collaborative arrangements occurring between smallholder farmers and supporting organisations has been mapped out. Using Crowe's (2007) analytic framework, the analysis reveals that different network structures are suited to different styles of innovation, but above all, external personal and the relationships they maintain with smallholder farmers are crucial to their on-farm development.

Chapter Four: ***Mapping Intervention Induced Livelihood Changes and Future Aspiration for Conservation: Capturing Community Perceptions from Mt. Elgon, Uganda.***

Many conservation and restoration efforts in developing countries are increasingly recognising the 'multifunctionality' of landscapes (Gimona and Van der Horst, 2007). After years of rigid protected area management of the Mt. Elgon National Park and the numerous government/private led conservation interventions, little has been done to document the landscape and consequently livelihood impacts of these interventions. Often working with rural farmers through Community Based Organisation's, this chapter therefore independently asks members and non-members to spatially depict how their landscapes have been changed by conservation interventions and their future livelihood aspirations. As one of the most widely used approaches in understanding livelihood dimensions of the rural poor (Adato and Meinzen-dick, 2002; Schreckenberg et al., 2010), the Chambers and Conway (1992) Sustainable Livelihood (SL) framework was then applied to assess how these mapped outcomes translate into assets enjoyed. As active citizens, CBO members showed greater awareness, access and willingness to adopt conservation practises, indicating that they are enjoying significantly more benefits than their neighbours. Despite the

widespread uptake of conservation technologies, this has not prevented habitat degradation and consequently communities unified in their aspirations for greener technologies. Practitioners now need to maximise on these opportunities, building better-informed participatory land-use planning, tailored livelihood strategies and the right incentives to help make this a reality.

Chapter Five: ***Equity in Access: Using Network Analysis to examine the role of Social Capital in the Participation of the Mt .Elgon Regional Eco-system Conservation Programme.***

With training in micro-finance, 20 CBO's were told to design and implement a Community Revolving Fund to finance income-generating activities on their farms. Devolving ownership to the grass-roots level, the process of horizontal benefit-sharing was therefore controlled by the executive CBO members within these communities. In this chapter a combination of focus group discussions, well being ranking and Social Network Analysis (S.N.A) are used to assess how differing socio-political dynamics drove the implementation and use of CRFs across Mt. Elgon. Akin to previous studies measuring participation, the political and social elite dominated this process with limited community involvement. However, building from chapter three, the relationships established with external organisations proved essential in achieving more efficient and equitable outcomes.

Chapter Six: ***Concluding Discussion. Are Community Revolving Funds a Sustainable and Equitable Method of Slicing Forest Capital? A Case Study from Mt.Elgon, Uganda.***

In conclusion this chapter focuses on bringing together the findings of previous chapters. Here I discuss whether the evaluation of conservation interventions can be seen as sustainable and equitable. An examination of whether projects have adopted full and effective participation using free, prior and informed consent and if the outcomes of the programme were non-discriminatory and transparent. To conclude, project specific recommendations are given in relation to the boarder benefit-sharing literature.

Adopting a Mixed Methods Approach

Identifying and choosing the right worldview before data collection is important to guide the study and ensure the right type of knowledge is derived (Creswell, 2009; Creswell and Clark, 2011). Working with under-privileged demographic groups, this research is chiefly exploring political concerns; focusing on issues surrounding equity, empowerment and advocacy (Creswell and Clark, 2011). Consequently adopting a participatory worldview is the most appropriate i.e one that is oriented towards inquiry and an action agenda.

More specifically, this research will use the level of participation referred to by Briggs (1989) as contractual participation. Contractual participation simply asks stakeholders to share their views and knowledge. This form of participation aims at advancing the agenda by improving participants consciousness of the projects and voicing their opinions to the relevant institutions and policy makers (Creswell, 2009). Arnstein (1969) refers to this participation as a degree of 'tokenism' as the process itself does not aim to bring about change or ensure follow-through. It is important to highlight this level of participation to avoid raising community expectations about the research.

Using semi-structured interviews, it will start with a positivist view of measuring knowledge. It is positivist in the sense that the open questions will narrow down the topics discussed, directing inquiry to decision-making and participation (Creswell and Clark, 2011). It will look for patterns of reality, causes and consequences of interventions by extracting social data in a quantitative manner (Denscombe, 2010). As the methodology develops, it will, however, shift into a more constructivist and participatory worldview. The use of mapping exercises will provide a freer platform for interviewees to express different viewpoints (Creswell and Clark, 2011). The overall aim is to create a collective learning process by which 'interviewers' have a 'natural conversation' with 'informants,' therefore everyone learns through knowledge exchange (Schreckenberg et al., 2012).

Combing both positivist and constructivist modes of inquiry is referred to as pragmatism in social sciences. Hailed as the foundations of mixed methods research (Pansiri, 2005), rather than focusing on a philosophy, pragmatism looks at employing

strategies of inquiry that address the research question, more often than not involves combining more than one outlook (Creswell and Clark, 2011; Denscombe, 2010). It sees knowledge as provisional, changing over time, affected by cultural and historical contexts (Denscombe, 2010). While this research hopes to have more participatory outcomes, it ultimately holds a pragmatic worldview to data collection and analysis.

Chapter Two

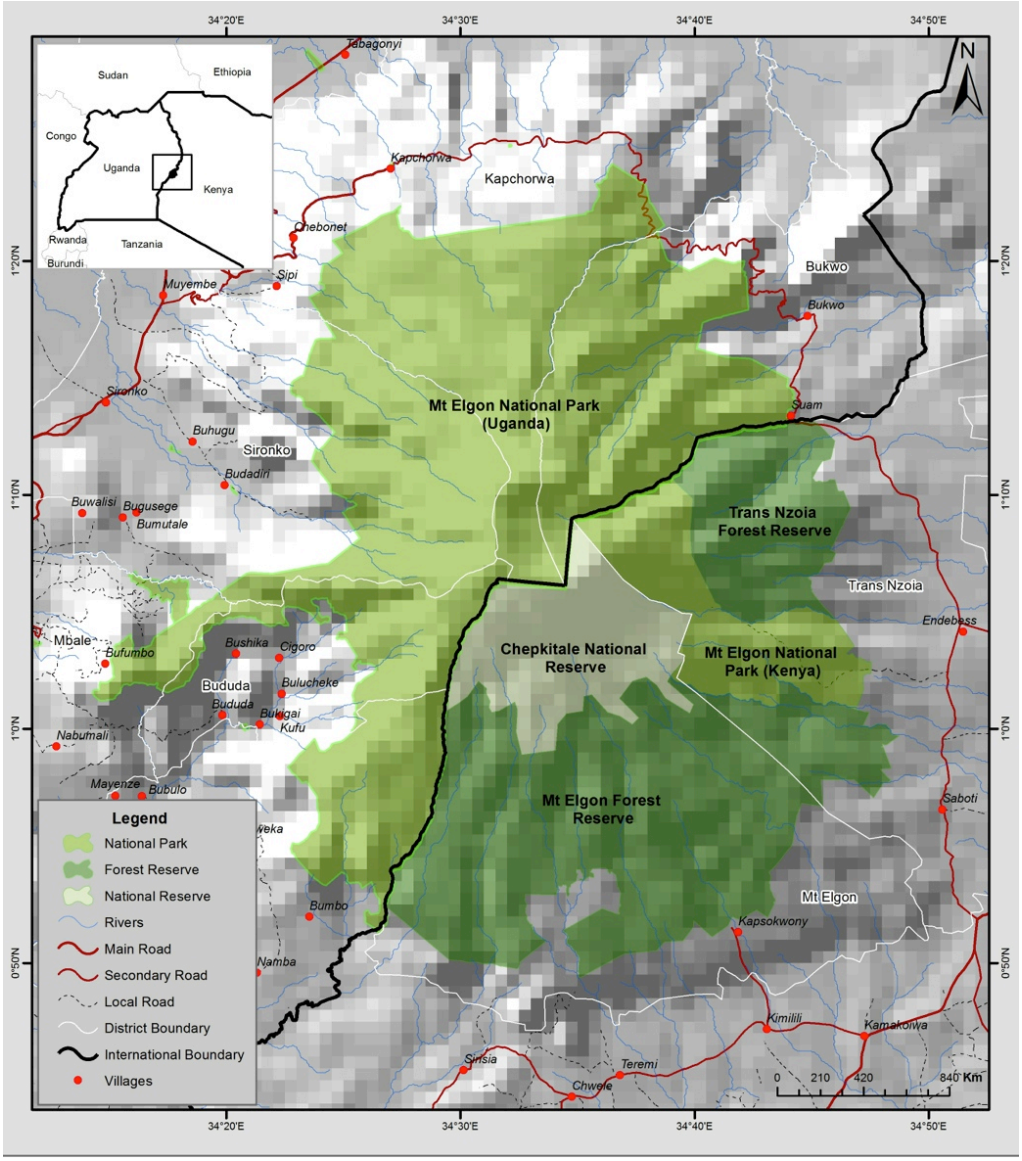
Taking A Case Study Approach: Protected Area Management Across Mt. Elgon, Uganda

The Mount Elgon National Park and Landscape

Protruding 4321 meters above sea level, Mt. Elgon is the oldest and largest solitary, volcanic mountain found in the rift valley (Sassen, Sheil, Giller and ter Braak, 2013). Bisecting the Kenya-Uganda boarder 100 km northeast of Lake Victoria (Himmelfarb, 2005), the central area of this extinct volcano now hosts a Protected Area (PA) of largely disturbed tropical montane forest interspersed with large stands of bamboo (*Arundinaria alphina*) with heathers (*Philippia* spp) and moorland (*Senecio* ssp., *Alchemilla* ssp.) at higher elevations (Hitimana, Kiyiapi and Njunge, 2004). Cutting across eight different Ugandan districts (Fig 3), many rare Afromontane species can be found within the 110,971 ha PA, including 150 forest bird species and 39 endemic vascular plants (Muhweezi, Sikoyo and Chemonges, 2007; Sassen et al., 2013).

Driven by dry north-easterly and moist south-westerly winds, the climate is moist to moderately dry with the mean annual temperature averaging 23°C (Claessens et al., 2007; Scott, 1994). While rain can fall at any time of the year, typically the drier seasons fall between July-August and December-February (Reed and Clokie, 2000; Claessens et al., 2007; Sassen et al., 2013). The average rainfall across the mountain is 1800 mm yr^{-1} (Claessens et al., 2007; Scott, 1994) with the heaviest precipitation falling in western and south westerns slopes at about 2000-3000 m altitude (IUCN, 2005; Sassen et al., 2013). The unique climate and extensive forest cover powers one the most important water catchments in the area. Feeding three lakes: Kyoga, Victoria and Turkana, as well as the wider Nile system - keeping this catchment intact is thus clearly of international significance (Chhetri, Mugisha and White, 2003; IUCN, 2005; Oonyu, 2009).

Figure. 3 Map of Mt. Elgon, Uganda and Kenya. For anonymity, exact location of selected study sites is not revealed



Adapted using data on Mt. Elgon boundaries and forests from Sassen et al (2013). Protected Area Boundaries from (UN EP-WCMC).

Having faced extensive erosion in the past, parts of Mt. Elgon have long, ash rich, gentle (averaging 4°) slopes characterised by young, fertile soil perfect for agriculture (Baumann, 2011). Consequently of the 772,300 ha included in the Mt. Elgon region, 550,899 ha has been converted in farmland, settlements or another form of non-

forest use (Moyini, 2007). The inhabiting communities are mainly small-scale farmers, using low technology and growing crops such as beans, maize, wheat and potatoes (Nakakaawa et al., 2015). Introduced in 1912, coffee once made the farmers of Mt. Elgon amongst the richest in Uganda. Booming in the 1950's, political unrest during the 1970's and 1980's soon diminished this market (Sassen et al., 2013) and today only 3% of agricultural land is used as cash crops (LVBC, 2012).

Supporting over two million people (Pétursson and Vedeld, 2015), this region has become one of most densely populated areas in East Africa (Lamb et al., 2015). The average landholding is 0.8 ha per capita (Muhweezi, Sikoyo and Chemonges, 2007; Sassen et al., 2013), where 20% of population own no land (LVBC, 2012). As this trend continues to grow at a rate of 3.4 % per year (Nakakaawa et al., 2015), escalating human pressure has seen encroachment into marginal and ecologically fragile areas such as steep slopes (above 80%), swamps and river-banks (Claessens et al., 2007; Knapen et al., 2006; Muhweezi, Sikoyo and Chemonges, 2007). In a landscape with soil properties and topography are already prone to landslides, the result has been increasing fatalities and losses due to soil degradation, water pollution and homelessness (Claessens et al., 2007).

Along with its diverse landscape, the people of Mt. Elgon are multi-ethnic and fairly heterogenic both within groups and between them (Nakakaawa et al., 2015). Arriving in 1500 AD, the Sabiny integrated with indigenous people and came to dominate the whole Elgon population. Stemming from the Nilo-Hamitic cluster (Kalenjin), the Sabiny separated into two ethnic sub-groups: the plain living Soishek or Soi and the highland living Moso, Benet, Ndorobo and Kony. Originally practising nomadic pastoralism, the forest inhabiting Benet supplemented their diet with herd and forage from within the forest (Himmelfarb, 2005). While the Benet considers themselves the indigenous people, they have maintained long cultural and economic exchange with the Soi. Interrupting the Sabiny rule, the Bagishu of Bantu origin took over the southern more fertile slopes, clearing land for agriculture and pushing the Sabei North and East. Thought to have arrived around 1700 AD they have been ethnic rivals ever since (Pétursson, 2011). Despite these differences, both tribes have longstanding

cultural (burial and circumcision sites) and use (wood, medicine and food) values associated with the forests of Mt. Elgon (Nakakaawa et al., 2015).

Management Overview and History

Resettlement and Conflict: The Result of Exclusionary Protectionism

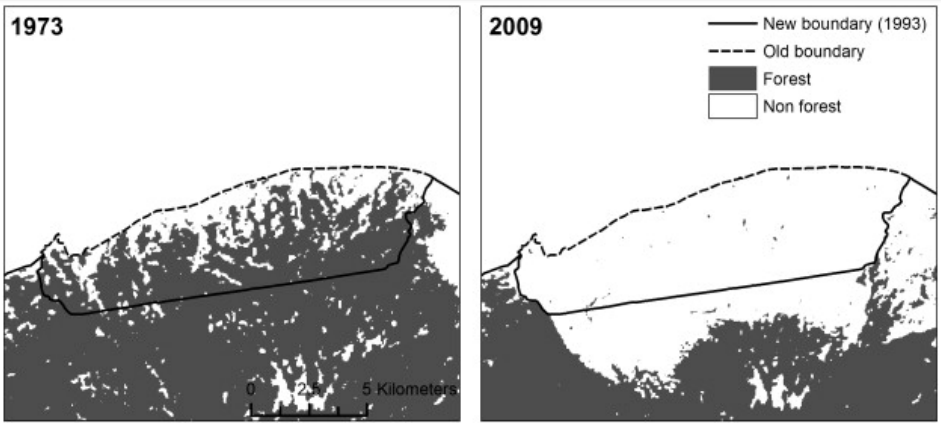
The first formal management of the Mt. Elgon ecosystem began in 1929 when the British Colonial Forest Department took control of a large forested area. Adopting an exclusionary protectionism philosophy (Himmelfarb, 2005), park boundaries were solidified into a forest reserve in 1937, cultivation up the slopes was prevented and the forest was primarily managed for timber extraction (Hitimana, Kiyiapi and Njunge, 2004; Norgrove and Hulme, 2006). At this time, surrounding farmers continued to hold their land, primarily under customary tenure without formal land titles - a system that is still in place today (Pétursson, 2011). The years to follow were shaped by many legal changes to the forest status. In 1938 the forest went from Crown-owned to a Central Forest Reserve where there was a period of deforestation for Cypress and ensuing pine plantations occurred in the North-East. Resident cultivation systems were established and independence from Britain (1968) led to centralisation of forest management with officially demarcated boundaries (Sassen et al., 2013).

During Idi Amin's rule (1971-1979) forest governance then fell apart. Bribes to expand agriculture practices within the forest boundary were common place (over 25,000 ha of the forest reserve was lost), as part of the 'economic war' on poverty resettlement within park boundaries was encouraged and the use of forest products increased (Norgrove and Hulme, 2006; Petursson and Vedeld, 2017). With the greater availability of military weapons, political unrest prevailed after the fall of Idi Amin's government (1978). Once using bow and arrows, cattle raiding groups like the Karamojong and Pokot were now using firearms on the plain living Soi (Himmelfarb, 2005). This resulted in hundreds of households migrating up the mountain slopes towards the forest boundary. Having once served in Amin's Army themselves, the heavily armed Benet subsequently attacked their long rivals the Bagishu. After continuous fighting, the weaker Bagishu eventually retreated to the forested lands in

the south, further amplifying deforestation in these areas (Pétursson, Vedeld and Sassen, 2013).

The complexity of land ownership and conflict was further complicated by the relocation of the Benet from their traditional moorlands to the lowland forests 1983 (Sassen et al., 2013). Whilst a specific area of the forest was degazetted for their resettlement (6000 ha), without a clear demarcation process, land was seized by neighbouring groups and the political elite. With a further 1500 ha of land being degazetted than initially planned, the Benet were still left with unclear status, residing within the forest reserve (Pétursson, 2011). In 1986 when President Yoweri Museveni came to power, a brief period of peace then followed. Funded via donor agency USAID, a countrywide reform in PA governance then took place (Petursson and Vedeld, 2017). Coupled with the implementation of internationally-funded Mount Elgon Conservation and Development Project (MECDP), rehabilitation of the protected area began (Oonyu, 2009). Nevertheless, seven years later, institutional change from the Forest Department to the Uganda Wildlife Authority (UWA) resulted in the forest officially being regazetted into the Mount Elgon National Park (its current status) and instability returned to region once again. Reverting back to a more 'coercive,' centralised management style, the demarcation of new park boundaries, along with restricted resource-use, saw the disintegration of indigenous forest management systems with high-politicised evictions involving likely more than 100,000 people creating more violent battles over land and boundaries (Gosalamang, Vedeld and Gombya-Ssembajjwe, 2008). Claims that land was illicitly allocated, both in terms of landholdings and whom they were distributed to, have yet to be resolved. This includes the land of the Benet, whose relocated land in 1983 was gazetted back into the National Park in 1993 (Fig 4).

Figure 4. Forest cover in 1973 and 2009 in and around the Benefit resettlement area, Uganda. Taken from Pétursson Vedeld & Sassen (2013)



Delineating solid boundaries using GPS technology in 2001, this on-going conflict still lead to a further 1700 ha of forest loss (Pétursson, Vedeld and Sassen, 2013). A factor that was made worse when UWA received further leverage and resources from a Dutch NGO to implement the Forest Absorbing Carbon Emissions (FACE) foundation reforestation and carbon offsetting scheme. Now with governments and donor agencies (mainly USAID) in accordance with the 'fortress' discourse, formal institutions were prohibiting access without compensation (Petursson and Vedeld, 2017). Coupled with the harsh methods adopted by UWA to restrict forest access, including beating and raping, local communities adopted numerous resilience tactics towards UWA management (Norgrove and Hulme, 2006). Non-co-operation, feigned ignorance, false oral histories, leaving roads in bad conditions, bribery, threats of violence and mobilising illegal activities were just some of the strategies used by local communities in retaliation (Norgrove and Hulme, 2006).

Introducing 'Community Conservation'

In an effort to ease such community tensions, from 1999 onwards, UWA introduced community collaboration approaches including participatory park management strategies and setting up numerous resource-use, beekeeping and boundary management agreements. As one of the only PA regimes to allow community access under specific conditions, by 2011 more 66 agreements were in place in 26 different parishes around the park (Sassen, 2014). Funded by the Government of Norway and

implemented under International Union for the Conservation Nature (IUCN), programmes like Mt. Elgon Conservation and Development Project (MECDP) played an instrumental in developing these relationships. They sensitised communities with environmental education then helped them develop alternative livelihoods, build revenue sharing schemes from ecotourism, create environmental plans and rehabilitate degraded areas. Given the fluctuating coffee prices and increasing demands on Mt. Elgon natural resources, promoting Conservation Agricultural Production Systems (CAPS) was at the forefront of most interventions, especially promoting soil and water conservation techniques, agroforestry and energy-saving technology (Oonyu, 2009). Over the past twenty-five years, many different NGO's have partnered up with different government agencies to work on similar themed projects. For example, by building on community innovation skills and empowering woman, over the past thirteen years the Kapchorwa District Landcare Chapter (KADLACC) has been supporting smallholders in managing their natural resources more sustainably. Since 2012, the Environmental Conservation Trust (ECOTRUST) has been implementing an agroforestry focused carbon project under Trees for Global Benefits (TGB). Developed in Partnership with the UN Development Project (UNDP) and UN Environment Program (UNEP) with a total budget of 1,475, 271.65 US dollars, in 2013 the Territorial Approach to Climate Change established a small grants programme to fund activities that build climate resilience (Rijal and Langoya, 2014). NGO's like HIEFER International have also played a key role, promoting biogas technology by assisting on-farm enterprise mixing. Although with great success in some areas, some communities who have faced recurrent evictions and continue to dispute park boundaries have been less co-operative (Sassen et al., 2013). A chronological evolution of these MENP is summarised in Table 1.

Table 1. A chronology of evolving MENP governance from 1986 to 2012. Sourced Petursson and Vedeld 2017.

Date	**Event in park governance on Mt. Elgon**
Pre 1986	Mt. Elgon Forest Reserve Established in 1930s. Laissez-faire approach to local people under Forest Department (FD) governance for long. Collapse of governance structures under the Amin and Post Amin period from 1971 to 1986.
1986	Civil unrest ends and Uganda comes from long conflict that dismantled most structures of government, including governing natural resources.
1988	A GoU decision to implement a proposal of turning forest reserves into national parks. In Mt. Elgon the area above tree line would remain forest reserves. The Ministry of Environment enters the Mt. Elgon Conservation Development Project (MECDP) through NORAD funding with IUCN as implementing agent. FD recognized the need for collaborative management and started pilot projects in Mt. Elgon.
1991	FD carried out inventories in many Tropical Forests with an aim to determine what percentage should be set aside as strict nature reserves. The President instructed his prime minister to direct parliament to turn the remaining parks of Mt. Elgon, Rwenzori and Bwindi into national parks. Elgon Forest reserve upgraded to forest park within FD.
1993	The forest reserve on Elgon formally converted to national park MENP with a "fortress" approaches to governance.
1995	Community conservation starts with CFM pilot schemes in two Parishes with support from the Mount Elgon Community Development Programme (MECDP). Formalized in 1996.
1996	The Uganda Wildlife Statute established UWA as a new organization with a merge of the Game Department (GD) and the Uganda National Parks (UNP).
2002	Transboundary conservation project ideas promoted by IUCN and brought to NORAD and East African Community (EAC).
2004	A transboundary PA pioneer for East Africa signed. Mount Elgon Regional Conservation Program (MERECP) takes off, funded by NORAD implemented by IUCN. EAC has the ownership.
2008	IUCN withdraws after ca. 20 years work on Elgon. East African Community mandated as implementing agency of MERECP.
2010	Cash Revolving Fund benefit-sharing scheme undertaken with communities.
2012	The funding of MERECP from NORAD stops. Is currently run by EAC that recognizes that the transboundary work needs a longer timeframe.

MERECP: Working Towards a Trans-boundary Ecosystem Approach

As a single region administered under two separate national governments, the East African Community secretariat soon recognised the importance of developing harmonised conservation goals between Kenya and Uganda (Larsen, Kamugasha and Karani, 2008). Building on an East African Memorandum of Understanding (MoU), a novel trans-boundary management agreement was created. Taking fours years of

negotiations and using the participation of numerous stakeholders (both public and private), the agreement resulted in the Mt. Elgon Regional Eco-system Conservation Programme. The ambition of which was to improve the work carried out by previous ICDPs, whilst streamlining institutional arrangements to improve their capacity in ecological monitoring, law enforcement and community outreach. With a jointly funded budget of 4,869,501 US dollars by the governments of Norway and Sweden, in February 2004 the project launched a four-year inception phase where it undertook comprehensive consultations with stakeholders, baseline surveys and pilot studies.

After issues surrounding ownership, high administration costs and funds not reaching target communities (less than 20%), this phase of the project achieved very little in meeting these targets. With the aid of the Lake Victoria Basin Commission (LVBC), the project was re-designed in 2008. Ownership was shifted to national governments and funds to Protected Area Management Institutions (PAMI), which in turn distributed them to Focal Point Ministries (FPM) in what is known as vertical benefit sharing. To improve the efficiency of the programme, its redesign also included a mixture of horizontal benefit-sharing arrangements with rule-based principles embedded in their distribution. Like the UWA-FACE project, one of the agreements looked at restoring degraded parts of the NP. Aspiring to plant 400 ha of indigenous trees, and successfully planting 331 ha, the purpose was to sell the generated carbon credits, whilst allowing communities to enjoy their provisioning, regulatory and cultural services. Created through a deforestation fund, another project was founded on merit-based sharing, where two communities who had collaborated well with UWA in protection of the forest received 7000 USD for their environmental stewardship. In final two agreements, the Community Revolving Fund (CRF) and the Livelihood Plantation, communities were compensated for restrictions of forest use and access. The CRF initiated this processes via technical and financial inputs, whereas the ambition to plant 1200 ha of fast growing timber species, referred to be MERECP as livelihood plantations, was designed to meet short-term household demands i.e. timber, poles and fuel and prevent use of forest products from the NP.

Based on the concept of micro-finance, the purpose of CRF was to give households the economic freedom to invest in sustainable Income Generating Activities (IGA). Having channeled 10,000 USD as a start-up fund to each group, participants of CRF were expected to take a loan, invest in an activity, and then pay the sum of money with some small interest. After being repaid, money is then directed back into the fund and made available to be loaned again. It is, therefore, not a shrinking fund (Mwayafu et al., 2012) but a revolving one. Providing technical training to three executive members, each of the Community Based Organisation's ((CBO's) explained in more detail below) were given the freedom to set up their own criteria, building terms and conditions for repayment that would suit their local realities. CBOs carried out a diverse range of IGA's with varying levels of success in terms of management and loan repayment (Hoefsloot, Kahata and Nsita, 2011). With only 31.8 % of the targeted area being planted, the livelihood plantation scheme was less successful (Hoefsloot, Kahata and Nsita, 2011). A combination of land ownership issues, poor suitability of designated planting areas and the delayed payment from the bureaucratic government to PAMI's lead to these outcomes.

Evaluating the Cash-Revolving Fund

As an on-going, pioneer, transboundry, natural resource management programme, the CRF uses a combination of decentralised management and financial incentives, two of the widely-used and growing approaches in conservation (Wright, Andersson, Gibson and Evans, 2015a), making it an interesting case study to explore the themes of equity in benefit-sharing (Mwayafu, Kimbowa and Graham, 2012).

In an area that has numerous institutions working on similar goals, disentangling the specific MERECP narrative, however, has not only been challenging but could be misleading. Firstly, implementing organisations rarely make any effort in monitoring livelihood impacts, particularly carrying out baseline studies at the onset. Secondly, the same communities are targeted by different organisations making it even more difficult to attribute a specific cause and effect relationship. There are numerous reasons why this happens in practise, some include CBO's being good at marketing themselves and in other cases, political relationships, community willingness and access have driven these selections. Thirdly, little co-operation between agencies to

differentiate their goals and impacts have been made. Coupled with the lack of information sharing, it has been difficult to document exactly who has worked in the area and what changes these interventions have driven. For example, the Territorial Approach to Climate Change, (TACC) financed CBO's to invest low emission climate-resilient development strategies that were very similar to the IGA (tree-planting, biogas, water conservation) that MERECEP used (UNDP, 2010). More recent IUCN interventions have sought to implemented performance-based payments, whilst ECOTRUST has begun paying small scale farmers for carbon offsetting based on the Plan Vivo standard (Ecotrust, 2012). Amongst these players, the social network analysis and focus group discussions with the targeted smallholder farmers will be used to provide a *post-hoc*, users overview of who has worked in the area and how these interventions have shaped their livelihoods.

Study Sites

All bordering the NP, the four study sites were selected in regions where MERECP participating Community-Based Organisation's (CBO's) had been established (see Appendix 1. B). These CBO's are nonprofit groups that work at the local level to improve the life of their residents by engaging in human, environmental, public safety and other community needs. For ease of communication and management, most interventions target these organisations for community level engagement, although individual farmers voluntarily choose to participate in different programmes.

With over 500 organisations found across Mt. Elgon alone, there were many variations in terms of their size and structure. As prerequisite for MERECP selection, all the studied groups were registered with proper governance structures in place including codified constitutions and bank accounts. To understand how different contextual realities are impacting CRF outcomes, selection was made to include communities from different districts and tribes (see Table 2). In the last study site (community 4) individuals came from one specific village. In the rest there were those found under more than one administrative unit. In rural areas this hierarchical five-tier administrative system consists of village (governed by an LC1), Parish (LC2), Sub-County (LC3), County (LC4) and District (LC5).

Ideally standardising factors such as group size and distance to external markets would have allowed more robust statistical analyses, however, pragmatically the selection was confined to existing realities where each group had unique characteristics (Table 2). This included the size of their membership, the Alternative Livelihood Activities (ALA) they have implemented and the external programmes that have provided incentives (i.e cash, technological inputs, training etc). The final selection was ultimately based on their willingness to participate in the research.

Table 2. Summary of CBO Activities

Community	Ethnicity	Main Cash Crop	CBO Activities	CBO Membership	Cash Rewards
1	Bagishu	Coffee	-Energy saving cook-stoves -Horticulture seedlings -Tree nursery -Zero-grazing -Trench digging -Napier grass Planting	146 members from 17 different villages in 2 across sub-counties	-World Wildlife Fund (WWF) -Territorial Approach to Climate Change (TACC) -MERECP-Cash Revolving Funds
2	Bagishu	Coffee	-Horticulture seedlings -Zero-grazing -Bee-keeping -Tree nursery -Trench digging -Napier grass planting -Bee-hives	500 members from 12 different villages across 2 sub-counties	-World Wildlife Fund (WWF) -Territorial Approach to Climate Change (TACC) -MERECP-Cash Revolving Fund
3	Sabiny	Coffee	-Bamboo demonstration -Fish pond demonstration -Trench digging -Bio-gas -Woodlots -Dairy cows -Bee-hives -Tree nursery -Coffee pulping machine -Infrastructure -Napier grass planting -Zero-grazing	411 members from 7 villages across 1 sub-county	-MERECP - Deforestation Avoidance Fund & Cash Revolving Fund -HIEFER International (co-funding biogas units).
4	Bagishu	Coffee	-Woodlots -Dairy Cows -Apiary -Coffee nursery -Trench Digging -Napier grass planting	25 members from one village	-MERECP-Cash Revolving Funds

Chapter Three

Promoting Conservation Agricultural Production Systems: How the Structure of Information-Sharing Networks Influences Technology Adoption Across the Mt. Elgon Ecosystem

Promoting Conservation Agricultural Production Systems: How the Structure of Information-Sharing Networks Influences Technology Adoption Across the Mt. Elgon Eco-System

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Abstract

In an effort to improve agricultural conservation, routes to achieving its innovation have received considerable academic attention. Often focusing on how individual attributes affect a household's ability to adapt, in this chapter the composition and arrangement of agrarian information networks is analysed instead. Using data collected from four geographically isolated communities, following Crowe's (2007) analytical framework an evaluation of the type of relational ties and technologies producers have acquired was conducted surrounding the Mt. Elgon National Park. The results suggest that there is no single network structure that promotes efficiency however; that there are particular characteristics are more suited to certain innovation strategies. More cohesive communities tend to have the levels of trust and co-ordination required in managing more complex agri-ecological practices, yet have also shown to occur at the expense of exclusion. On the contrary, loose, expansive networks that cut across different sects lead to the effective dissemination of simpler technologies. In all accounts, the presence of organisational ties was the key in driving change. This study therefore, advocates for further collaboration between those promoting agricultural conservation and smallholder farmers. In particular, establishing meaningful relationships that respect the cultural norms of their participants and maximises local knowledge.

Introduction

Protected Areas (PA) tend to be intricate socio-ecological systems not bound by human-made jurisdictions or administrative boundaries (Bodin and Crona, 2009).

Often surrounded by multiple-actors competing for their use, their valuable common pool resources now face serious threat of depletion- especially in the 21st century where demands are ever increasing (Hardin, 1968). Consequently, attempting to fine-tune resource management with sustainability has reached its most challenging period (MEA, 2005). After the failure of 'exclusionist protection arrangements' (Adams et al., 2004), practitioners have now sought to build alternative livelihood pathways with an emphasis on redistributing management responsibilities towards local level institutions (McDougall and Banjade, 2015; Ribot, 2003).

At the forefront of this agenda is agricultural innovation, aiming to reduce extractive pressures whilst improving smallholder household income (Böhm and Collen, 2015; Pretty, Toulmin and Williams, 2011). Initiatives over the past twenty years have promoted sustainable intensification through conservation of agricultural production systems and climate smart technologies (Lamb et al., 2015). Across Mt. Elgon this has included a range of on-farm management practices such as soil and water conservation, crop diversification (including new varieties) and energy saving technologies (Moore et al., 2014).

Analysing Social Networks

In a dynamic ecosystem responding to human and climate related biophysical drivers of change access to information and resource networks is required in the development and upscaling of these management practices (Isaac and Dawoe, 2011; Lamb et al., 2015). The structural patterns, types of actors, as well as the number and length of social relations found in these networks (Rogers, 2003; Valente, 1995) all affect the technical knowledge, power, willingness and capacity of smallholder farmers in adopting the right conservation technologies (Barnes-Mauthe et al., 2013; Isaac, 2012; Klerkx, Aarts and Leeuwis, 2010). In other words, governance, which Strassburg et al. (2012) define as 'any attempt to co-ordinate human actions, usually directed towards particular goals' is fundamental to this process. As the recent body of literature shows (Bandiera and Rasul, 2006; Isaac, Erickson, Quashie-sam and Timmer, 2007; Isaac, 2012; Isaac and Dawoe, 2011; Lamb et al., 2015) analysing informal social networks can help determine which structures facilitate or inhibit the governance of agricultural innovation. For example, the density of a network is a

powerful metric that exposes whether all members in the network are receiving/providing agrarian knowledge (Isaac and Dawoe, 2011). More cohesive networks, indicating high degrees of trust, cooperation and reciprocity (Putnam 1993) have been shown to yield higher levels of economic development in contrast to loose, expansive networks with cliques (Crowe, 2007). Similarly denser networks can result in homogenisation of knowledge reducing the range of adaptation responses of farmers to resource restrictions and/or the impacts of climate change (Gray, Chan, Clark and Jordan, 2012).

Network configuration, particularly the extent to which a network is organised around focal actors, also affects knowledge dissemination. Highly centralised networks (where only one or two powerful actors exist), tend to have better co-ordination and control therefore making it easier to have unified goals (Kowalski and Jenkins, 2015). In a complex landscape that involves diverse actors from different institutional boundaries, such individuals can be targeted to act as cross-scale brokers, bridging information flows and voicing community concerns at higher management levels (Barnes-Mauthe et al., 2013). Seen as a cost-effective, time-saving approach; targeting certain actors can be risky as the network may break into isolated sub-groups if they are removed or fail to communicate with and include other cliques. The literature, therefore argues that communication within and between communities forms broader and more resilient networks (Berman, Quinn and Paavola, 2014).

To contribute to the growing empirical base that adopts Social Network Analysis (S.N.A) methods, the goal of this study is to examine emerging communication patterns in a context where numerous different stakeholders are implementing conservation agricultural production systems. More specifically it aims to identify the key players and in turn deduce how social relationships at the grass-roots level affect extension services. Appreciating these dynamics can then provide practitioners with better strategies to upscale their efforts across Mt. Elgon.

The analysis begins by mapping three types of ties: (1) bonding (2) bridging and (3) cross-scale linkages (Barnes-Mauthe et al 2013) and uses them to construct the structure of different networks. Whilst there are numerous opposing definitions of

these terms in the literature (Crowe, 2007), here bonding capital is taken as the relational links between like-minded farmers at the community level. Thereafter, bridging ties are those formed between different groups within the community (Portes, 1998) and cross-scale between farmers and external organisations of higher management (Pretty and Smith, 2004). The role of individual actors in controlling information networks/resources is then investigated using betweenness and eigenvector centrality measures (detailed description below) and used to test whether power relations or heterogenic information results in better adoption of technologies. Accordingly, the specific hypotheses are tested:

H_1: Communities with relatively closed, cohesive associational networks adopt a higher number of conservation technologies.

H_2: Communities whose associational networks are loosely connected, with diverse actors, share more heterogenic agrarian knowledge.

H_3: Networks about incentive-based initiatives have a higher level of cross-scale linkages than networks about pre-existing practices.

Along with these hypotheses, the results work towards comparing and contrasting the connections made between pre-existing practices and ones introduced through incentive-based initiatives. The chapter then finishes by discussing the implications of network composition on the facilitation of technology transfer and adoption.

Study Site

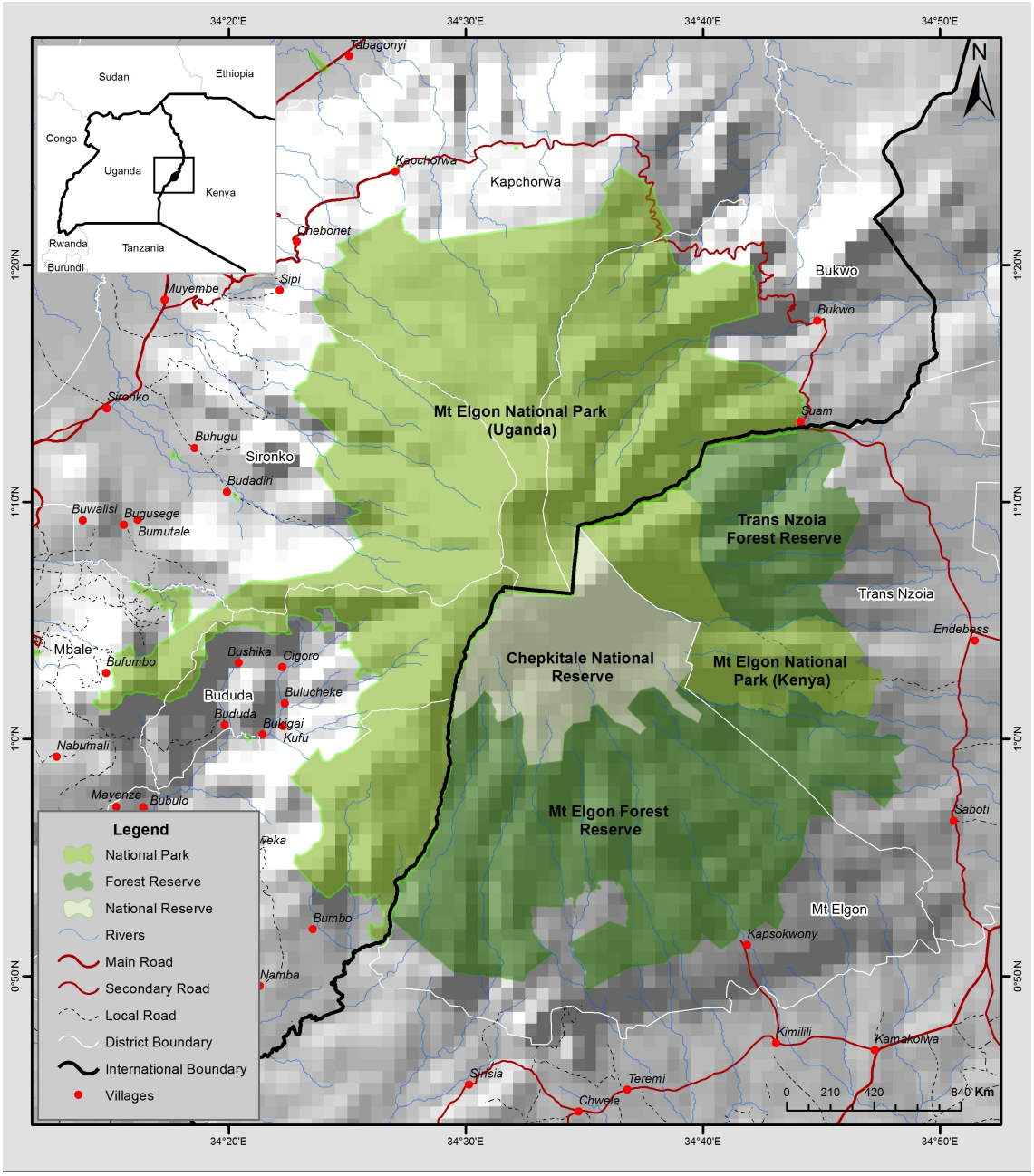
Bisecting the Uganda/Kenya border is the extinct Miocene volcano, home to the Mt. Elgon PA. Rich in closed canopy tropical hardwood, bamboo and heath moorlands high in endemic flora, this forest ecosystem hosts some seventy six threatened species of global conservation value (Nakakaawa et al., 2015). Protected under different jurisdictions (Fig 5), in Uganda, a single 1120 km^2 National Park (NP) is administered by the Uganda Wildlife Authority (UWA) (Sassen et al., 2013).

Below these demarcated boundaries smallholder farmers have converted the landscape into intensively managed crop production sites intertwined with animal rearing and *Eucalyptus* woodlots (Hitimana, Kiyiapi and Njunge, 2004; LVBC, 2012). The abundant rains, fertile soils and access to the parks environmental incomes and services have made this one of most populous (1.6 million people) and rapidly growing regions (3.4% per year) in east Africa (Nakakaawa et al., 2015).

Inside a landscape where soil properties and layering are naturally prone to landslides, escalating human pressure is causing severe soil degradation, habitat loss, water pollution and homelessness (Claessens et al., 2007). In a bid to reconcile such hostile relationships and build sustainable livelihood strategies, over the past twenty years several conservation initiatives and resources agreements have been put into place (Oonyu, 2009). Aided by international funding, their main agenda has been to reduce deforestation and promote habitat restoration through the development of on-farm diversification.

All bordering the NP, several focus group discussions with MERECP participating CBO's lead to the selection of four study sites (Appendix I. B). The groups were spread across four different districts and varied in geographical cover (village, parish through to sub-county level), access to roads and markets, CBO membership size and number of organisations supporting them.

Figure 5. Map of Mt. Elgon, Uganda and Kenya. For anonymity, exact location of selected study sites is not revealed.



Adapted using data on Mt. Elgon boundaries and forests from Sassen et al (2013). Protected Area Boundaries sourced from UN EP-WCMC

Three of the study-sites were predominately from the Bantu ethnicity and one from the Sabiny, a proportion that reflects the broader ethnic composition of the ten MERECP participating CBO's. Historically, the Sabiny and Bagishu practiced very different livelihood strategies. The forest dwelling Sabiny were nomadic pastoralist, supplementing their diet with herd and forage from within the forest (Himmelfarb, 2005), whereas the Bagishu cleared land for agriculture. Despite their differences, both tribes have longstanding cultural (burial and circumcision sites) and use (wood, medicine and food) values associated with the park (Nakakaawa et al., 2015). Today, the main cash crop for all the sampled communities was coffee, however, horticulture is a rapidly rising alternative. Planted crops vary seasonally but trend to include maize, beans, cassava and potatoes.

Methods

Data Collection

A single data collection period was conducted between September 2013 to March 2014. In each of the respective sites, this began with a focus group discussion introducing the community to the research team and objectives. Commencing with a randomly selected household from a list of CBO members, a total of 132 in-depth, semi-interviews at the household level and 31 at the expert were conducted across all the study sites (see Appendix 1 for survey guidelines). Using one set of household interviews, two separate network questions were asked. With some of the same actors listed in both, this chapter only focuses on the first surrounding general agrarian information, however, it is the second, looking at MERECP networks (chapter five), which provided the focus of the study-site selection.

Following an egocentric design, i.e. one in which an ego and their alters are mapped as opposed to a complete network (Prell, 2012), a five actor free recall name generator technique was used in the household interviews to identify "to whom do you talk to for farmer knowledge?" The farmers listed within the community became the further study participants, also referred to as snowball sampling (Prell, 2012). The fact that "A" mentioned "B" does not necessarily imply that "B' mentioned "A"

therefore a directional, binary, actor-by-actor matrix is derived (García-Amado et al., 2012).

Without a natural frontier, a combination of relational and positional approach was taken in defining the network boundary. Executive members of the CBO and local leaders (culturally important) were purposively sampled (positional), however, the sampling in each study site finished when the same names were continuously repeated (relational). It is not possible to track down the full still of network nodes involved in the agrarian networks, instead the analysis focuses on quantifying micro-level social support networks developed through community relations. It is, therefore, beyond the scope of this study to look at feedback loops occurring between higher management and amongst different organisations. The ties that respondents mention beyond the community (31 expert interviews) will simply be used to cross-check information given by communities and explain contextual realities (García-Amado et al., 2012). As a result of these factors the size of networks sampled varied between the different study sites. Given the different network sizes, no direct comparison between villages can be made, however a qualitative comparative interpretation of which network structures are associated with better adoption of technologies can be made (Berman, Quinn and Paavola, 2014; Crowe, 2007).

In addition to sources of agricultural knowledge, participants were asked to identify which types of information they received from each actor (common knowledge), their membership to organisations and, socio-demographic statistics (Isaac et al., 2007). With permission of the survey respondent, interviews were tape recorded, transcribed verbatim and thematically coded following a discourse analysis approach (Weiss, Hamann, Kinney and Marsh, 2012).

Typology of Actor Roles

To help identify the types of actors, the management role or social status of each actor was identified according to their position within Uganda's hierarchical five tier administrative system. Having experienced one of the most transformative decentralisations seen throughout sub-Saharan Africa (Cooper & Wheeler 2015), this categorisation system was introduced in the 1980's and is based on geographical,

rural-urban divisions where specific legislative, financial and administrative roles are assigned to each tier. Starting with the smallest and least powerful at the rural level, the LC1 governs at the village tier. This system then goes to parish (LC2), sub-county (LC3), county (LC4) up to the parliamentary candidate that represents the whole district (LC5) (Nakakaawa et al. 2015). Other stakeholders, such as chiefs, NGO's and private developers were also included.

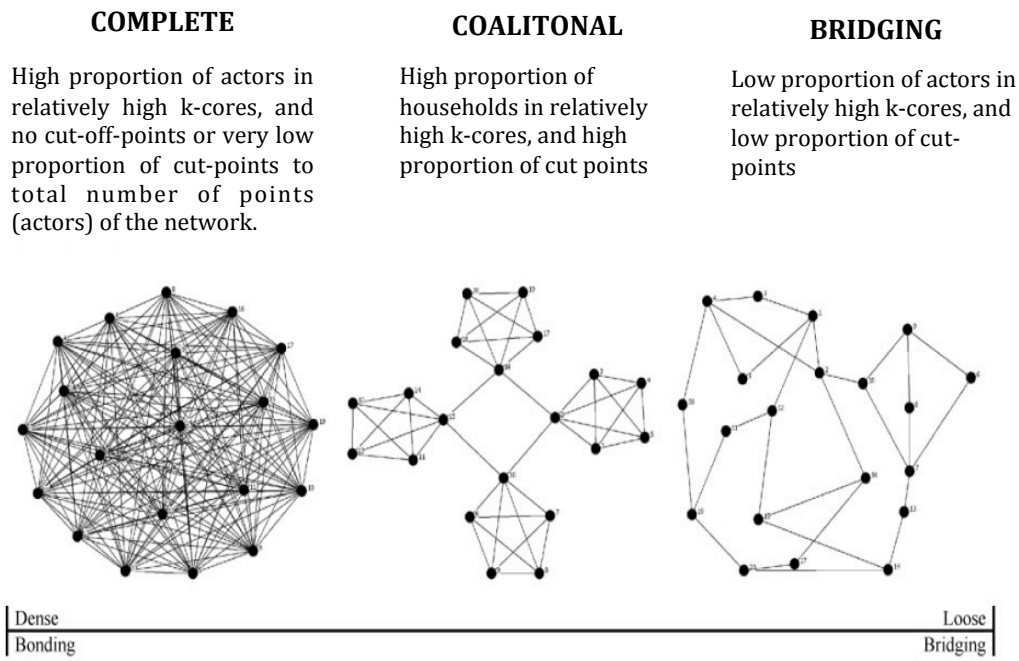
Data Analysis

Data were analysed using UCINET Social Network Analysis Version 6 (Borgatti, Everett and Freeman, 2002). Respondents who failed to list alters and were not mentioned by any other egos were removed from the network. Egos that listed an alter with no information flow were included in the overall visualisation of the network, however, they were removed from the analysis on information networks.

All visualisations were created using NetDraw (Borgatti, 2002) where a multidimensional algorithm was used to lay out actors based on their similarity in geodesic distances (shortest path lengths) to other actors (Weiss et al., 2012). The size of the nodes reflects the actors betweenness, a statistic that measures gate-keepers in a network by calculating the proportion of actors which frequently lie on the shortest path between all pairs on actors in the network (Freeman, 1979).

With the interest in understanding how network structure impacts information flows and technology adoption (like Ramirez-Sanchez and Pinkerton (2009), Barnes-Mauthe et al (2013) and Berman et al (2014)), the analysis adopts Crowe's (2007) framework to determine the levels of bonding and bridging in a network. Here a combination of component, K-core analysis and cut-off points are loosely used to categorise each network as either complete, coalition, or bridging (for definition see Fig 6). More specifically, an ANOVA density model is used to test whether smallholder farmers are more likely to share information with one-another, or whether they are receiving it directly from higher management (cross-scale linkages). Below these statistics are explained in more detail.

Figure 6. Example of Crowe's typology of complete, coalitional and bridging network structures defined through k-cores and cut-off points. Adapted from Crowe (2007) and Ramirez-Sanchez and Pinkerton (2009)



In this context K-core analysis builds on the density measure of social cohesion. The higher the K-core, that being a subgroup in which each actor connects to at least K other actors (Seidman, 1983), the more cohesive a network (Barnes-Mauthe et al., 2013; Berman, Quinn and Paavola, 2014; Crowe, 2007; Ramirez-Sanchez and Pinkerton, 2009). In contrast, cutoff point analysis is used to reflect the level of fragmentation within a network. By removing key actors, this analysis indicates how many subgroups, termed blocks, would form. The proportion of cutoff points to total points is reported here and ultimately used to signify structural holes or weakness in a network (Hanneman and Riddle, 2005). In some networks, isolated subgroups (i.e. a cluster of actors that are not connected to the main network) exist. By coding key words and phrases, content analysis was used to calculate the number of separate subgroups (called components), which is another measure of how fragmented the network is.

Adopting an evolutionary approach to coding (Mayring, 2002), from the semi-structured interviews 13 main types of agrarian knowledge across the four study sites were deduced. According, the 13 knowledge types were collapsed into 2 major

networks depending on whether they were based on: (1) pre-existing practices or (2) Incentive-based initiatives (Table 3). By ranking the actors with the highest eigenvector centrality within both networks, a measure that captures how well connected an actor is in addition to how well connected the actors they have ties to are (explained in more detail below) (Bonacich, 1972), the type of actors involved in pre-existing networks were compared to those of incentive-based initiatives using an ANOVA density model of variable homophily.

Table 3. Collapsed agrarian knowledge types found across all four networks

Pre-existing Practices	Incentive-based Initiatives
Species Selection	Dairy Management
Planting Patterns	Market/Income Generating Activities
Pest Control	Soil and Water Conservation
Animal Husbandry	Agroforestry
Coffee Management	Apiary
Nutrients, Fertilizers and Manure	Fish Farming

After grasping the overall level of cohesion within the four networks, the role of individuals in shaping them was then investigated using eigenvector and betweeness centrality. In SNA theory, it is assumed that the number and type of relational ties you maintain is an indication of the power you occupy. For example, an actor may have a few ties, but these ties are established with actors who are well connected to others, i.e. at the core of the network (Barnes-Mauthe et al., 2015) that will thereby derive a high eigenvector centrality (Bonacich, 1972). In this analysis, it is assumed that higher scoring actors hold greater influence within their network (Prell, 2012). Subsequently the specific individuals, who are bridging different groups, including cross-scale links, were also presented in the socio-grams (network visualisations). At the micro-level this is the extent to which an actor falls on the shortest geodesic path length between two others who are not directly connected (Freeman, 1979).

Finally, I acknowledge that there are potentially many factors that could be included in this analysis, such as membership to CBO, wealth, education and so on, all of which could influence smallholder networks, but here I decided to run a linear regression to

see whether knowledge (taken as number of information types exchanged) or power, (using eigenvector centrality figures) by themselves were positively associated with number of adopted technologies.

Results

Each of the study sites sampled had very different network characteristics but showed that farmers are connected to a wide range of individuals and organisations across a range of sectors including private businesses, NGO's and government officials (Table 4). Network 1 (the largest) had the biggest number of actors listed however, relatively similar diversity in the types of actors as compared to smaller networks 2 and 3 (Table 4). Whilst a comparable number of interviews were conducted in network 2 and 3, network three received more agrarian knowledge from actors within the community and from local government structures (sub-county and district), therefore, has proportionally less household interviews than network 2 (Table 3). In contrast network 2 received more funds and quoted more interactions with external NGO's than network three.

Network 4 was substantially smaller than all the other networks with participants only coming from one village. This CBO has only worked with one NGO (MERECP) with the main sources of information exchange occurring from supporting government officials. Given its small size, it would be misleading to form any judgments on density and centralization from this network as fewer actors means the likelihood that actors will connect to a higher proportion of other actors is higher in this network (Prell, 2012).

Table 4. The type of actors listed across all four networks

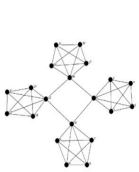
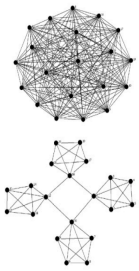
Type of Actor	1	2	3	4
Village	Small-Scale Farmer Ordinary CBO Member Executive CBO Member	Small-Scale Farmer Ordinary CBO Member Executive CBO Member	Small-Scale Farmer Ordinary CBO Member Executive CBO Member	Small-Scale Farmer Ordinary CBO Member Executive CBO Member
Local Council (Village and Parish)	LC1 LC2	LC1 LC2	LC1 LC2	LC1
Sub-County Council	LC3 Agricultural Extension Officer Sub-County Chief Community Development Officer Veterinary Officer National Agricultural Advisory Services (NAADs)	LC3 Sub-County Chief Community Development Officer Veterinary Officer Agricultural Extension Officer National Agricultural Advisory Services (NAADs)	LC3 Sub-County Chief Veterinary Office National Agricultural Advisory Services (NAADs)	LC3
District Government	Agricultural Extension Officer Community Development Officer Forest Officer Production Officer Procurement Chair National Agricultural Advisory Services	Community Development Officer Forest Officer Agricultural Extension Officer National Agricultural Advisory Services (NAADs)	Agricultural Extension Officer Ecraft NARO Kapchorwa District Landcare Chapter (KADLACC) National Agricultural Advisory Services (NAADs) Natural Resource Officer Northern Uganda Social Action Fund (NUSAF) Veterinary Office	National Agricultural Advisory Services (NAADs) Agricultural Extension Officer Community Development Officer Entomologist Natural District Resource Officer
Private Developer/Business	Coffee-a-Cup Kyagalanyi Coffee	Bugisu Co-operative Union Coffee-a-Cup Uganda Limited	Kawacom Uganda Limited KACODA Uganda Limited	
Faith-Based Organisation	Reverend	Planning, Development and Rehabilitation Mbale Diocese (Church of Uganda)	Reverend	
NGO	Center for International Forest Research (CIFOR) Mount Elgon Regional Eco-system Conservation Porgramme (MERECP) International Union for Conservation of Nature (IUCN) WARF	Banana Wild Integrated Rural Development Initiative (IRDI) Kulika Uganda Mt. Elgon Conservation and Development Project (MECDP) Territorial Approach to Climate Change (TACC) Students Partnership Worldwide (SPW) Mount Elgon Regional Eco-system Conservation Programme (MERECP)	Mount Elgon Regional Eco-system Conservation Programme (MERECP)	Mount Elgon Regional Eco-system Conservation Programme (MERECP)
National Government	Member of Parliament	Uganda Wildlife Authority (UWA)	Uganda Wildlife Authority (UWA)	Uganda Wildlife Authority (UWA)

Note: *There may be more than one actor listed under the same title, some of which work at different governance levels*

The results of Crowe's analysis reveals that network 3 and 4 were the most cohesive networks as they had relatively high K-cores with a high proportion of actors falling within them (Table 5). The high indegree reported in network 3, especially in comparison to the similarly sized network 2, confirms that proportionally more agrarian knowledge was exchanged within this network. Nevertheless, the larger proportion of cut-off points and isolates suggests that there are also some structural holes and fractional characteristics (bridging ties) within network. The surprisingly low adoption of conservation technologies at the household level compared to CBO level means certain cliques are not receiving information and/or access to conservation technologies. This could also point towards more of a core-periphery structure where central actors, through bonding ties, are highly connected and excluding those at the periphery. Consequently, in line with the theory and hypothesis one, this case-study shows closed, cohesive groups, at the community level, have adopted the most technologies.

As the biggest network, network 1 had the highest order of K-cores and blocks but it was the larger proportion of cut-off points to total points (0.31) and relatively low indegree (15.7%) that lead to its classification as coalitional. Despite the fact that the number of K-cores was relatively lower in network 2, it is the lower proportion of actors in the K-core (0.49) and cut-off points (0.25) that indicate it has some bridging characteristics. The large numbers of external organisations cited in this network also signify the multi-level ties common in this community. Assuming that diversity in actors results in more heterogenetic information flows, when comparing network features with technology adoption levels, network one confirms hypothesis two that looser, more expansive networks results in more heterogenic information flows. In combination with the level of bonding (farmers with common interests), bridging (farmers from different groups) and linking ties (external organisations tend to have connections to outside markets and businesses) these features have lead to the most widespread uptake of technologies at the household level.

Table 5. Descriptive summary of organisations, networks and conservation activities.

	1	**2**	**3**	**4**
Number of Actors	112	87	72	**28**
Types of Actors	22	22	18	**12**
Number of Ties	194	135	137	**48**
Largest Component				
No. of actors in largest Component	108	87	67	**28**
Isolated actors	4	0	5	**0**
Indicators of Network Closure				
Indegree (%)	15.7	15.82	25.85	**31.84**
Largest k-core	4	3	4	**3**
No. of actors in largest k-core	14	25	14	**12**
Proportion in 2-core and higher	0.49	0.49	0.6	**0.68**
Indicators of Structural holes				
Nº of cut-points	35	22	20	**6**
Nº of blocks	57	45	28	**10**
Proportion of cut-points to total points	0.31	0.25	0.28	**0.21**
Measures of Collective Active				
Proportion of conservation technologies adopted at HH level	0.46	0.41	0.36	**0.41**
Nº. of conservation activities implemented at the CBO level	5	6	12	**6**
	Coalitional	Bridging	Complete/ Coalitional	Complete
Estimated Network Configuration				

Of all the information shared, species choice and their appropriate planting requirements were the most frequent, accounting for over forty percent of all exchanges (Fig 7). Within the broad category of farmer knowledge, a variety of conservation and income generating activities were cited, yet this only accounted for a third of all interactions. Soil and water conservation was the most recurrent technology mentioned (Fig 8), making up nearly a half of all conservation/market exchanges (14. 78 % of total ties), and fish farming the least (0.41% of total ties). Notably, in the only network to be sampled from the Sabiny ethnicity, there were a larger proportion of information exchanges based around animal husbandry and dairy management (Network 3). On the other hand, in all of the Bagishu tribes (Network 1, 2, 4), agroforestry exchanges were more prevalent.

Figure 7. Frequency of total information exchanges according to pre-existing knowledge types across all four communities.

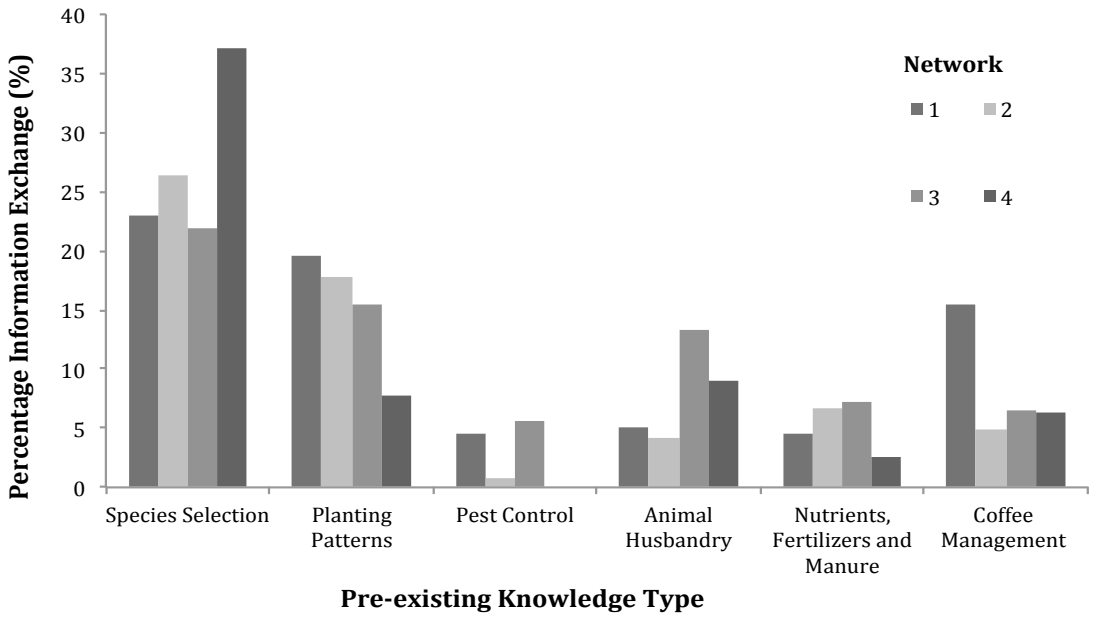
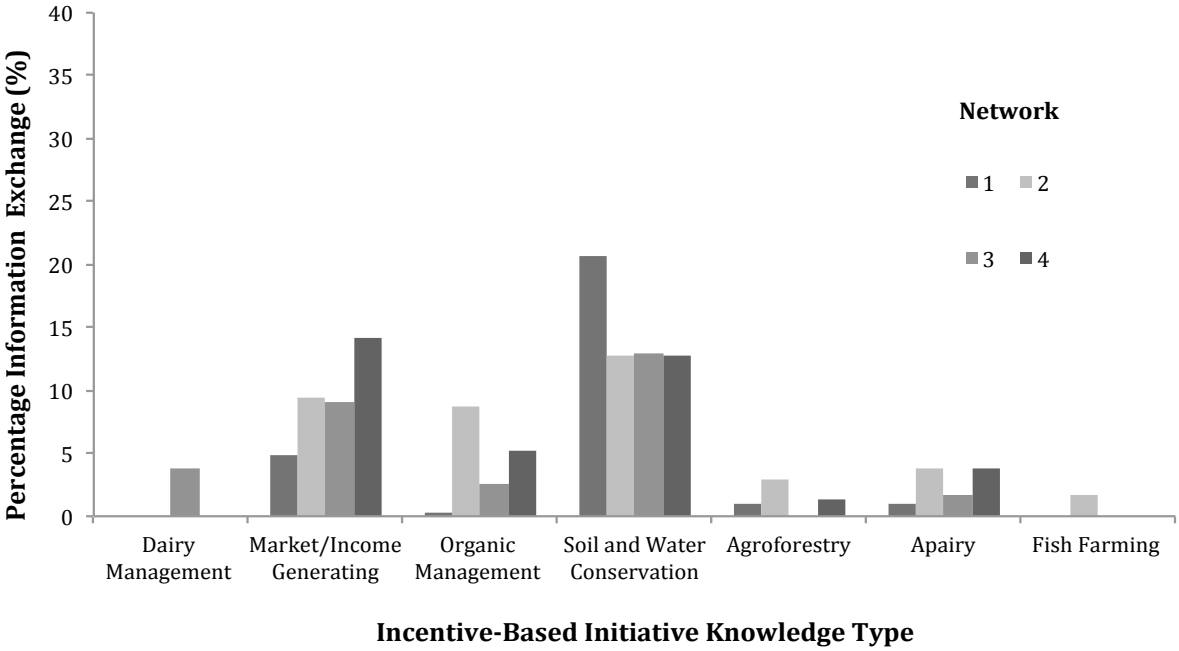


Figure 8. Frequency of total information exchanges according to incentive-based initiative knowledge types introduced across all four communities.



Cross Scale Linkages

To gain an understanding of how cross-scale linkages are impacting information sharing, I explored whether farmers were gaining agrarian knowledge from one-another or had direct access to external actors using an ANOVA density model of variable homophily (Table 6). With the exception of network 1, the within group tie density was lower than with external organisations suggesting low tendencies towards homophily (hence low adjusted r-square values for the model showing only a small proportion of the variance is accounted for by within-group ties). The significance level (< 0.05) of all these tests indicate that they are not random (due to chance). Farmers were more likely to receive information from higher order organisations than one another that indicating that either a) there are high levels of external support b) there is hierarchical governance system that would lead smallholders to list superiors above their neighbours and/or c) that smallholder farmers value external information sources above their peers. Overall these results falsify hypothesis three, demonstrating that external organisations such as National Agricultural Advisory Services (NAADs) and Coffee-a-Cup Limited play an equally important role in supporting pre-existing practices as NGO's do in incentive-based initiatives. In contrast, the bigger, less fragmented structure of pre-existing practices (Socio-gram's A) indicate that incentive-based knowledge is not as embedded in smallholder practices as conventional farming methods. Overall, the lack of external support, and subsequently small size of network four, demonstrates the significance of these organisations in driving agrarian knowledge.

Table 6. Density of ties found between actors sharing knowledge within the community and actors gaining knowledge from outside the community, separated into pre-existing practices and incentive-based initiatives networks. **Figures highlighted in bold are not significant at 5% level.**

Community	Network	External	Within	Adj R-square	P-Value
1	Pre-existing Practices	5	19	0.01	<0.00
	Incentive-based Initiatives	4	2	0.05	<0.02
2	Pre-existing Practices	5	3	0.01	<0.00
	Incentive-based Initiatives	4	2	0.01	<0.00
3	Pre-existing Practices	9	3	0.02	<0.00
	Incentive-based Initiatives	10	2	0.03	<0.00
4	Pre-existing Practices	10	7	0.02	<0.04
	Incentive-based Initiatives	1	12.5	0.01	**<0.21**

Notwithstanding this association, the composition of the different networks did not infer that external organisations were directly responsible for the widespread dissemination of knowledge. In network 1, the most expansive, smallholder farmers were more likely to source information from their neighbours than the numerous personal listed. Then in the second largest network, network 2, the main knowledge mediator (agricultural extension officer Table 8), was once a focal farmer within their community. Following this argument but from the opposite perspective, in network 3, (which had a small, dense core-periphery structure), more weighting was given to external organisations, particularly NGO personnel (Table 7). With the fact that eigenvector centrality statistic gives more weighting to individuals who have well-connected ties, this result also points to external personnel working with a hand full of principles members, as oppose to the broader community. Considering these dynamics in relation to technology adoption, the findings show that forming cross-scale links through a trustworthy broker can improve knowledge dissemination.

Indeed, taking a closer look at which specific individuals holds power in a community (Table 7, 8 & 10), the role of external organisations becomes even less pronounced and the political and social elite start to dominate. When comparing land and management networks to conservation networks, the same trend emerges with the same central actors taking control. Conservation networks are, therefore, capitalising on existing governance structures to implement their agenda. Again, this could reflect a hierarchal governance system where specific individuals take ownership or alternatively that practitioners are working through pre-existing governance systems. Certainly the sampling strategy that stemmed from CBO's, and the fact that they are often used as a forum to work with smallholders, explains why their members featured in some top centrality rankings.

Figure 9. Socio-grams for knowledge exchange networks in community 1 where **A)** is the pre-existing practices network and **B)** is the incentive-based initiative network. The size of each node correlates with the betweenness value for each actor (larger node indicates higher betweenness). Arrows indicate directional relation. Nodes coloured in light purple are actors found within the community and those in green are external organizations. The shape of the node indicates the level the actor comes from (actor key). Refer back to **Table 4** for more information about the actor types.

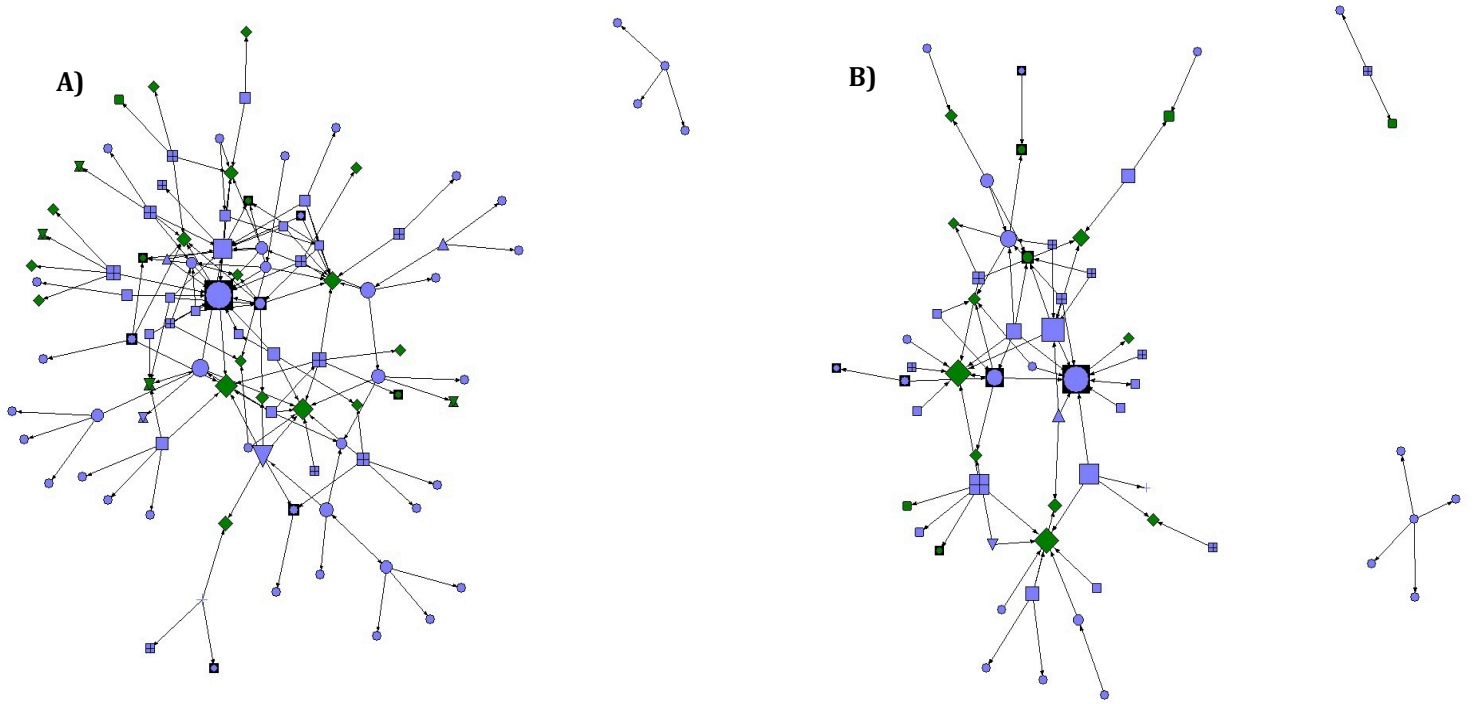
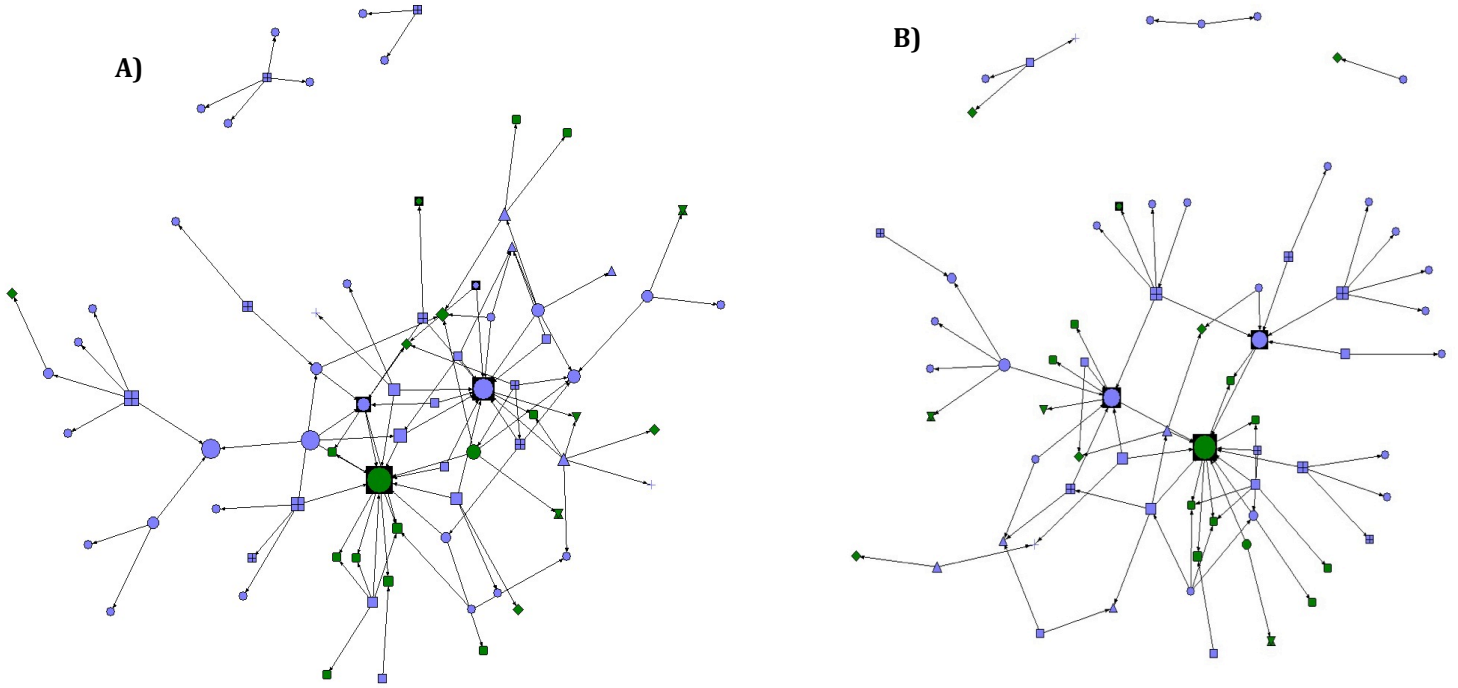


Table 7. The top three types of actors with the highest normalised eigenvector centrality in community one.

Pre-existing Practices			Incentive-based Initiatives		
Rank	**Type of Actor**	**Centrality**	**Rank**	**Type of Actor**	**Centrality**
1	Sub-county Chief	69.90	1	Sub-county Chief	61.73
2	Executive member	41.86	2	Executive member	51.25
3	LC3	36.89	3	Ordinary member	44.80

Figure 10. Socio-grams for knowledge exchange networks in community 2 where **A)** is the pre-existing practices network and **B)** is the incentive-based initiative network. The size of each node correlates with the betweenness value for each actor (larger node indicates higher betweenness). Arrows indicate directional relation. Nodes coloured in light purple are actors found within the community and those in green are external organizations. The shape of the node indicates the level the actor comes from (actor key). Refer back to **Table 4** for more information about the actor types.



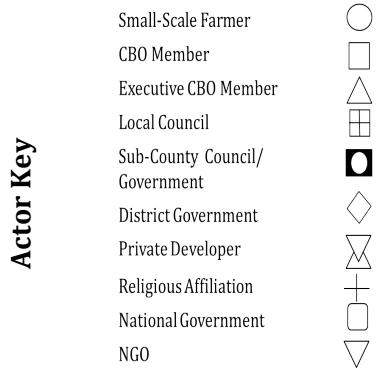


Table 8. The top three types of actors with highest normalised eigenvector centrality in community two

Pre-existing Practices			Incentive-based Initiatives		
Rank	**Type of Actor**	**Centrality**	**Rank**	**Type of Actor**	**Centrality**
1	Agric Ext Officer	66.26	1	Agric Ext Officer	81.51
2	LC3	53.81	2	LC3	55.50
3	LC3	38.67	3	Farmer	38.25

Figure 11. Socio-grams for knowledge exchange networks in community 3 where **A)** is the pre-existing practices network and **B)** is the incentive-based initiative network. The size of each node correlates with the betweenness value for each actor (larger node indicates higher betweenness). Arrows indicate directional relation. Nodes coloured in light purple are actors found within the community and those in green are external organizations. The shape of the node indicates the level the actor comes from (actor key). Refer back to **Table 4** for more information about the actor types.

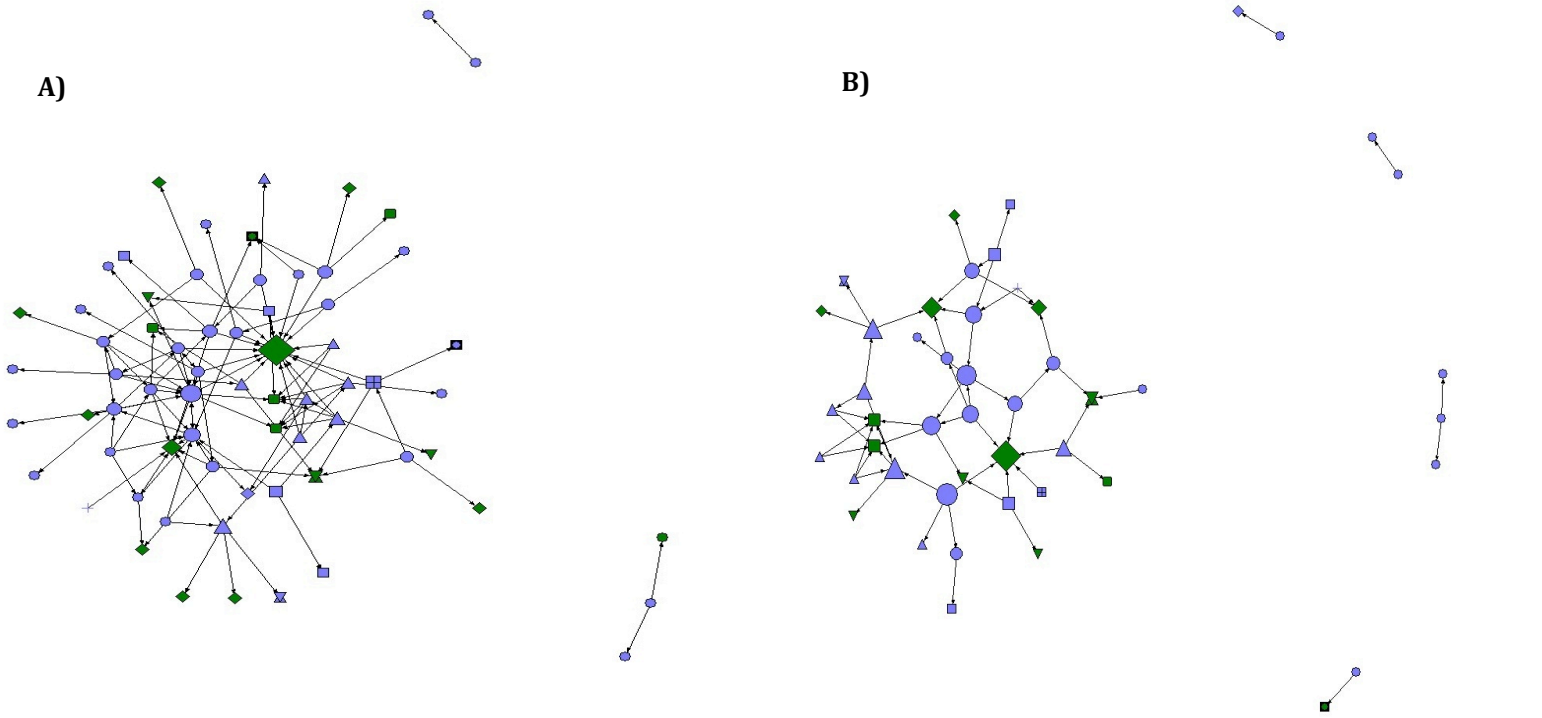
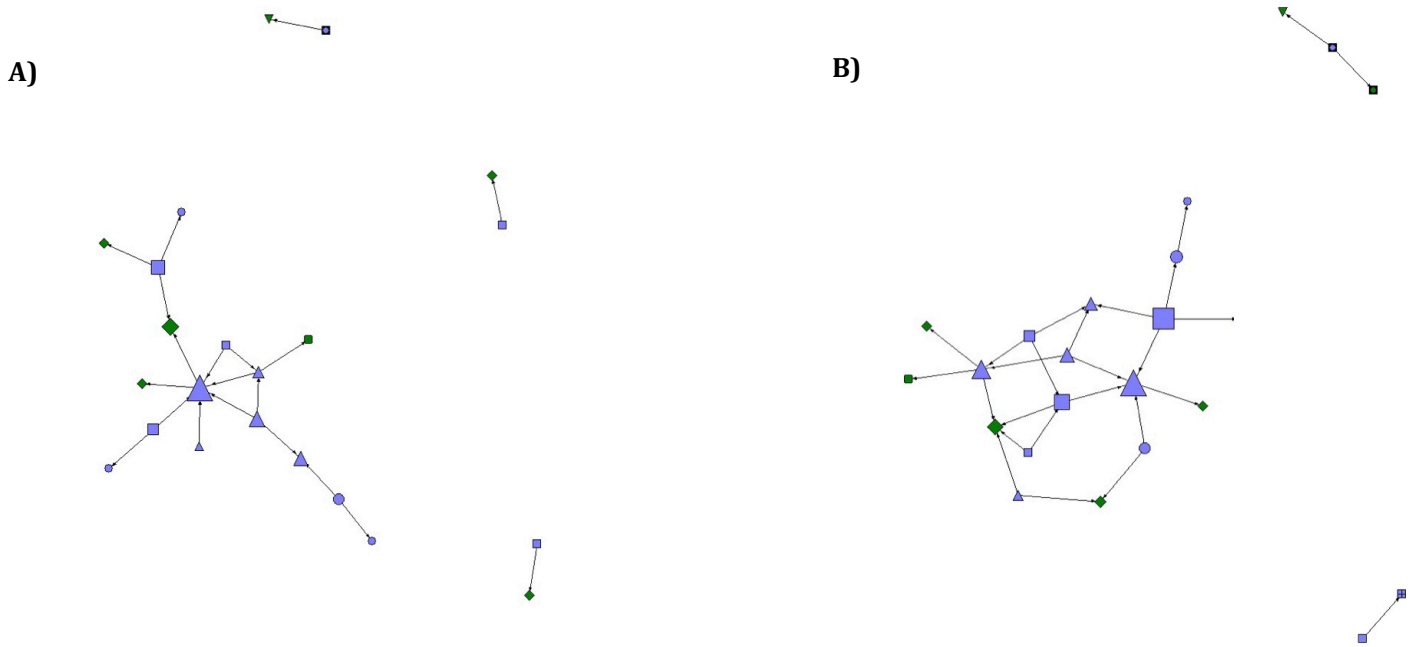


Table 9. The top three types of actors with highest normalised eigenvector centrality in community three

Pre-existing Practices			Incentive-based Initiatives		
Rank	**Type of Actor**	**Centrality**	**Rank**	**Type of Actor**	**Centrality**
1	Executive Member	55.72	1	Executive Member	55.84
2	District Gov	55.50	2	NGO	48.59
3	Farmer	38.25	3	NGO	48.59

Figure 12. Socio-grams for knowledge exchange networks in community 4 where **A)** is the pre-existing practices network and **B)** is the incentive-based initiative network. The size of each node correlates with the betweenness value for each actor (larger node indicates higher betweenness). Arrows indicate directional relation. Nodes coloured in light purple are actors found within the community and those in green are external organizations. The shape of the node indicates the level the actor comes from (actor key). Refer back to **Table 4** for more information about the actor types.



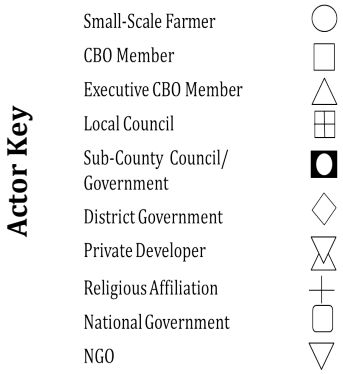
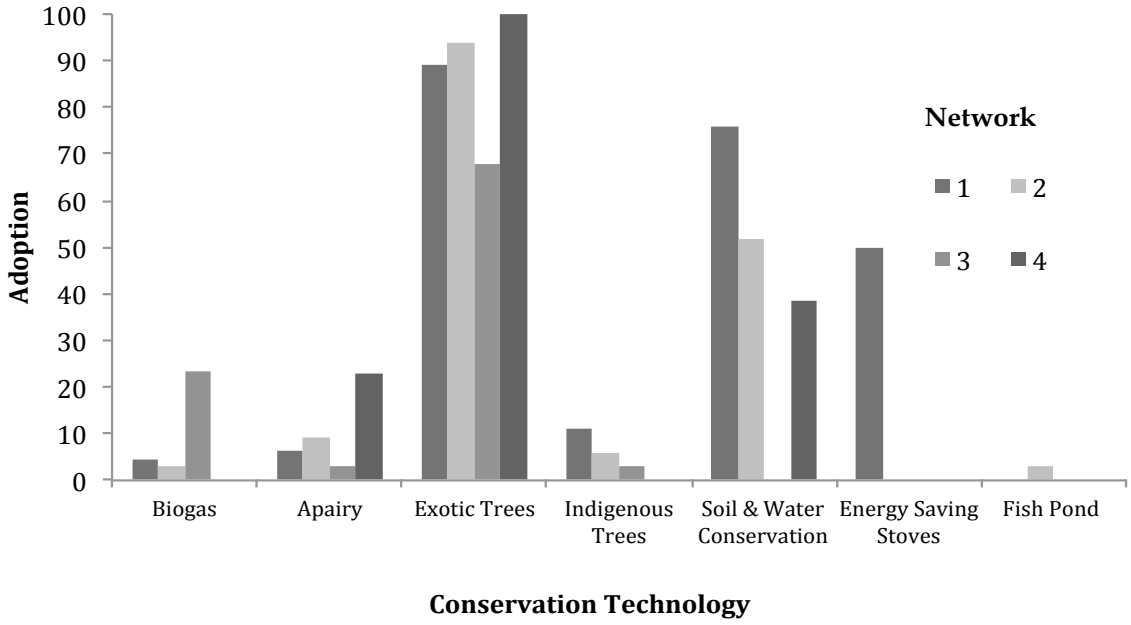


Table 10. The top three types of actors with highest normalized eigenvector centrality in community three

Pre-existing Practices			Incentive-based Initiatives		
Rank	**Type of Actor**	**Centrality**	**Rank**	**Type of Actor**	**Centrality**
1	LC1	84.69	1	LC1	25.47
2	Executive Member	62.77	2	Ordinary Member	19.91
3	Executive Member	51.49	3	Executive Member	15.87

For each of the network, the frequency of adopted conservation at the household level presented in Fig 13. Across the whole Mt. Elgon ecosystem planting exotic tree-species, particularly the fast growing *Eucalyptus grandis* species, is the most commonly adopted agri-ecological technology. Thereafter, soil and water practices were the most frequently cited. Less popular choices included indigenous trees, apiaries and fishponds.

Figure 13. The adoption of different conservation technologies at the household level found across the four communities



Finally, this chapter looked at the role of information and power (eigenvector centrality) in explaining the number of technologies adopted (Table. 11). For all four networks, heterogenic information exchanges had a higher explanatory factor in determining the number of technologies adopted then being in a better structural position to access it. Nevertheless, given that we are dealing with social networks, the adjusted r-square values were fairly high, signifying the importance of both.

Table 11. Linear Regression correlation between power (eigenvector centrality) and information in explaining number of technologies adopted. **Figures highlighted in bold are not significant at 5% level.**

Community	Variable		Adj R-Square	Sig
1	Centrality	**0.01**	0.37	<0.00
	Information	0.92		
2	Centrality	-0.04	0.68	<0.00
	Information	1.10		
3	Centrality	**-0.01**	0.49	<0.00
	Information	1.21		
4	Centrality	**0.04**	0.55	<0.00
	Information	0.40		

Discussion

This chapter found that communities with relatively closed, cohesive associational networks adopted a higher number of conservation technologies. Equally those that are loosely connected, with diverse actors, share more heterogenic agrarian knowledge. Nevertheless, not many patterns of homophily emerged within communities with a high level of cross-scale linkages emerging both for incentive-based and pre-existing information flows.

Network Composition and Agricultural Innovation

Agricultural innovation is rarely uniform in its evolution (Knowler and Bradshaw, 2007). Its potential is site specific, depending on biophysical, socio-economic and political factors (Giller, Witter, Corbeels and Tittonell, 2009) that the inconclusive studies statistically correlating individual attributes to technology adoption show well. Following Crowe (2007) the results advocate that certain network structures lend themselves to specific agricultural development goals more than others and success can only be valued by the path in which you choose to implement it (Muñoz-Erickson and Cutts, 2016). Akin to Bandiera & Rasul (2006); Isaac (2012) and Shiroyama et al. (2012). These findings show that knowledge is undeniably the key to change, yet realistically there are limitations to the scope of disseminating agro-ecological agendas. A trade-off, therefore, presents itself. Are you aiming to make marked differences with a handful of smallholders, which shown in the next chapter

can make significant environmental gains, or piecemeal changes with the masses? This study has demonstrated that both types of development are occurring across Mt. Elgon. Influenced by the actors and the relationships they maintain, this discussion explores the merits and drawbacks of both.

In the first community, the formation of an expansive network across loosely connected actors has resulted in the widespread uptake of technologies at the household level. As previous studies have also shown (Isaac, 2012; Krishna, 2001; Newman and Dale, 2007; Pretty, Toulmin and Williams, 2011), in this scenario, heterogeneity (i.e. a more coalitional network structure) has proven effective. Reaching the optimal dynamic between bonding, bridging and linking capital has facilitated the democratic governance, economic efficiency and levels trust needed in agricultural innovation (Szreter, 2002). More specifically, bridging and cross-scale ties have been found to be important by increasing smallholders access to resources (Berman, Quinn and Paavola, 2014), whereas the underlying bonding ties have provided the foundations for sharing, those of common values and goals. Here, less formal, local management has compensated for barriers to specialised support (Harvey et al., 2014), where trust amongst neighbours and the operational role of the knowledge broker (in this case the sub-county chief) was central in up-scaling activities. Efforts in lobbying and translating change in political terms has been particularly successful in this network (Hermans, Stuiver, Beers and Kok, 2013).

Given the large number of NGO's/Government programmes that have and are functioning across Mt. Elgon, it is difficult to draw a direct cause and effective relationship between information/resources shared by a specific intervention and the frequency of uptake. Nevertheless there are some clear correlations between the technologies promoted and those adopted. Working with TACC, WWF and MERECP funding, community 1 chose to focus on installing energy-saving cook stoves. After a free bio-gas demonstration by MERECP, with the aid of HIEFER Interactional co-funding scheme, several households in community three reported the installation of biogas units. Having signed an agreement with UWA, at the periphery of the NP thirty beehives were established in community 4.

In a landscape where communities are skeptical about the motivations of external organisations, in network 2, using a trustworthy mediator from within the community was also a successful way of disseminating agro-ecological knowledge. As a well-respected farmer from within the community, the now agricultural extension officer worked as a neutral party in communicating the messages of the Uganda Wildlife Authority (UWA) and International Union for Conservation of Nature (IUCN) after tensions arose when community members were evicted from the NP in 1993. His small farm at the periphery of the park was used as a trial site to introduce new conservation technologies and train local farmers (personal communication, 2014). Unfortunately in the absence of bonding ties, this did not translate into the sustained adoption of conservation technologies. After receiving a diploma in organic management from Reading University (U.K), the agricultural extension officer now works across the whole of East Africa limiting his availability within his community and thus causing the efforts both on his personal farm and with friends to diminish. Ultimately this shows that centralisation of power to specific gatekeepers does not always create resilience in socio-ecological systems, particularly when farmers are not relying on one-another for agrarian support nor are they working together (low bonding capital).

Shown in network 1, capitalising on the right actors is fundamental in bringing communities together. In Uganda, under the deployment of good manners (in what is known as 'Kiganda'), respect towards social hierarchies is ingrained within the culture regardless of whether these individuals promote resource-sharing (Berman, Quinn and Paavola, 2014; Roncoli, Orlove, Kabugo and Waiswa, 2011). Affirming ties to the political elite, like the local council leaders in this network, could therefore be a reflection of the power they hold, not necessarily their value in promoting innovation. In fact, cases of corruption are not uncommon in the agricultural sector in Uganda. For example, in Mbarara, Cooper & Wheeler (2015) have documented the misappropriation of NAADs inputs by the local elite. Under such circumstances forming bridging and cross-scale ties through pre-existing governance systems may not build the positive rapport that would encourage or even allow positive development.

Directly establishing individual ties, as seen in network 3, may be a more pragmatic way to overcome these obstacles (Tindall, 2008). Strong connections with a core of proactive farmers, i.e. those characterised by bonding ties, show a greater level of trust and co-operation amongst their neighbours making the facilitation of collective action easier and hence observing a higher number of technologies at the community level. In particular, more complex technologies require these levels of social capital as specialised, issue-specific knowledge flows and access to resources are needed. Members that form these dense relationships with external organisations have done so at the expense of those with the broader community (García-Amado, Ruiz Pérez and Barrasa García, 2013; Ernstson, Sörlin and Elmqvist, 2008) and is the most likely explanation of the low level of technologies reported within households. In future, extension personnel should continue to support more pro-active farmer groups like these, but perhaps make a more concentrated effort in ensuring equitable outcomes are achieved with greater number of community members.

Knowledge Acquisition and the Obstacles in Adaptation

What is clear from this study, and others across Sub-Saharan Africa, is that the lack of information is still a key barrier to technology adoption (Bandiera and Rasul, 2006; Barry, Steyn and Brent, 2011). This includes perceptions of the advantages and opportunities of using conservation technologies (Giller et al., 2009; Prasad and Visagie, 2005). The smaller, more fragmented nature of conservation networks and lack of responses detailing their techniques suggest farmers are still not as knowledgeable about their benefits. In some cases it is the long timeframes before notable changes occur or poor understanding of conservation agriculture that is limiting this viewpoint. Giller et al (2009) clarifies that although physical control measures to reduce soil erosion will improve Soil Organic Matter (SOM) in the long-run, the amounts of organic mattered returned to the soil (through crop residues, manure or compost) is the primarily factor that controls their levels in soil. So whilst farmers often reported taking action to prevent soil erosion (high number of exchanges and adoption), the lack of exchanges surrounding nutrients, fertilisers and manure could mean they are not returning SOM into the soil and fertility will consequently remain low.

Considering the scientific reasoning behind introduced technologies is still poorly understood by the communities, it is not unsurprising that they are not adapting. In some interviews respondents believed that god controlled rainfall patterns in the region, taking no acknowledgement that deforestation of the park or external factors such as climate change could have impacts upon precipitation. In Kibale, a successful partnership with NAADs extension officers helped improve knowledge of the changing rainfall patterns, resulting in improved farming methods (Hartter et al., 2014). Information networks, therefore, need to work on establishing scientific foundations before they can promote innovation. Furthermore, although conservation strategies are capitalising on agricultural networks at the grass-roots level, there is scope for further collaboration between different NGO's and government seeking a conservation agenda.

Constrained by barriers such food security, income, land availability and access to markets, farmers simply may not have the capacity to implement these technologies without seeing short-term returns (Giller et al., 2009). Equally, the maintenance in their upkeep can also discourage farmers (Barry, Steyn and Brent, 2011). In a remote, resource poor landscape, accessing and affording materials can limit the scope and upkeep of introduced technologies (Roncoli et al., 2011). As mentioned above, this was a particularly recurrent theme in network 2, where several respondents highlighted that after IUCN stopped supporting farmers, they could no longer finance biogas repairs or restock the fish ponds they introduced. This has resulted in the observed expansive, heterogenic network yet with low reporting of technologies. These observations draw attention to several points. The first is that this study only reflects a snapshot of the agricultural innovation occurring across Mt. Elgon (Muñoz-Erickson and Cutts, 2016). Related to the first, the second is that introduced techniques are not always self-sustaining, therefore, there is a dependency culture where new enthusiasm and people are constantly required for success (Geels and Raven, 2006). Thirdly, or alternatively, farmers are not getting adequate support to implement these technologies. Previous studies exploring agricultural knowledge sets across Mt. Elgon have highlighted that like the findings presented here intercommunity variations exist between and within communities (Moore et al.,

2014) that would make facilitating the collaboration required in implementing technologies even harder.

Accordingly, trends associated with culture were clearly noticeable in the results. Being the only network sampled from the Sabiny ethnicity, a historically pastoralist tribe that grazed cattle within the national park (Himmelfarb, 2005), the significance of cattle in their social relations and ritual activities (high frequency of exchanges surrounding animal husbandry and dairy management) is reflected through their preference towards biogas. Similarly, the Bagishu's long history of farming with trees may account for the high level of agroforestry practices found within these communities. Given the heterogenic knowledge and beliefs systems that exist, perhaps promoting practices that are more sympathetic to these differences would be more successful. Nevertheless, the development of agricultural technologies remains a predominantly top down, linear process where knowledge is produced at universities, disseminated through extension services and then shared amongst farmers (Hermans et al., 2013; Klerkx, Aarts and Leeuwis, 2010). Such an approach functions on the assumption that scientific knowledge is optimal, yet evidence from studies such as Pretty et al. (2011) show that developing crop varieties with local plant and animal material, using traditional knowledge positively influenced adoption. Alternatively put, collaborative arrangements with built in feedback loops achieve efficiency. Both Moore et al. (2014) and the evidence from this analysis support this argument as communities that had weak ties with NGO's/exention services (network 2) showed low adoption rates, yet those with frequent interactions (network three) showed higher uptake. Finally, Hermans et al. (2013) argues that it is also the collaborative process with interactive learning and knowledge co-production that leads to the creation of new information and practices amongst smallholders.

Conclusion

Mt. Elgon is a valuable East African ecosystem facing numerous socio-economic and environmental stresses (Sassen et al., 2013). Characterised by a rapidly growing population, a significant shift towards sustainable agricultural intensification is vital to its ability in continuing support these livelihoods (Lamb et al., 2015; Moore et al.,

2014). Despite becoming a hotbed for environmental NGO's and government programmes alike, by and large the extension required in up-scaling their activities remains weak, a trend seen across the whole of Sub-Saharan Africa (Barry, Steyn and Brent, 2011).

Through the construction of social networks, this study has provided further empirical evidence in how the relationships formulated between different actors can impact innovation. More specifically, that societies are heterogenic and require more tailored styles in delivering and building new production systems. In the network characterised by weak bonding ties, more emphasis needs to be placed on the type of training that brings farmers together, working on improving the levels of trust and co-operation. Developing farmer field schools, that complement information provided by traditional extension services may be useful, as would deploying, simpler more robust technologies that require minimal maintenance (Barry, Steyn and Brent, 2011). Conversely, in cohesive groups, promoting more ownership and the installation of more complex technologies may be possible, however, care needs to be taken to ensure that a more inclusive progress occurs. It would be very difficult to work with a large number of individuals and effectively deliver the same level of training. Transferring power to a local champion, one that promotes efficiency and equity, is the key to up-scaling here (Hermans et al., 2013).

Overall, what is clear from this study is that the adequate knowledge surrounding the purpose, benefits and upkeep of technologies remains low, as are the relationships required to access resources and external markets. Better quality training and delivery of equipment needs to persist amongst the numerous organisations functioning in the region. With regards to policy efforts and projects agendas, better co-ordination amongst these actors could help in the delivery of these projects as would creating adaptive technologies that legitimise distinct cultural knowledge differences seen in Mt. Elgon.

Chapter Four

Mapping Intervention Induced Livelihood Changes and Future Aspirations for Conservation: Capturing Community Perceptions from Mt. Elgon, Uganda

"Passing the Stick" during Participatory Mapping in Kapchorwa, Mt. Elgon.

Mapping Intervention Induced Livelihood Changes and Future Aspirations for Conservation: Capturing Community Perceptions from Mt. Elgon, Uganda

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Abstract

After more than five twenty years of using Alternative Livelihood Projects (ALP), little has been done to document their effectiveness across Mt. Elgon (Boedhihartono and Barrow, 2008). Consequently, using a quasi-experimental design, a self-reported evaluation of how conservation interventions have been shaping the cultural landscapes of their principal beneficiaries (CBO's) was compared with their neighbours. Through a time- series of participatory mapping activities, a retrospective baseline, visualisations of the present day outcomes and visioning activities were used to quantify livelihood diversification, the changes in capital assets alongside the future aspirations of these communities. Having depicted more coherent storylines, CBO members showed greater awareness, access and willingness to adopt conservation practises, indicating that they are enjoying significantly more benefits (particularly in household income and avoided deforestation) than their non-member counterparts (two sample t-test, $p < 0.05$). Nevertheless, the portrayal of continued habitat degradation with time suggests that these alternatives are failing to meet growing human demands. Concerned about the productivity of their farms, communities, converged in their aspirations for sustainability, portraying a future rich in green technologies, improved agricultural techniques and built capital. Better-informed participatory land-use planning, tailored livelihood strategies and the right incentives could help make this a reality.

Introduction

Moving away from the protection of stark, standalone national parks, field conservation activities are increasingly operating at larger spatial scales,

encompassing a mosaic of different habitat types and the people that depend on them (Sayer et al., 2007). Known as the 'landscape' approach, this more holistic management style seeks to balance the needs of various different stakeholders whilst maintaining the numerous eco-system services their environments provide (Reyers, O' Farrell, Nel and Wilson, 2012). Through the integration of sectors such as water, agriculture and housing, practitioners have now been working towards creating sustainable landscapes where 'multiple win locations' or 'activity hotspots' are prioritised through the deliberation of their trade-offs (Garnett, Sayer and Toit, 2007; Gimona and Van der Horst, 2007; Opdam et al., 2016).

In the areas where the rural poor survive on a small asset base (and granted access through social, political and institutional processes), such conservation strategies have focused on diversifying livelihoods away from protected resources to those that improve household income, integrate community management and reward environmental stewardship (Roche, 2007). In particular, three main tools have been used to motivate behavioural change: demonstrating alternatives, funding compensation and providing incentives (Wright et al. 2015).

Under the alternatives umbrella one can a) completely substitute the resources being exploited, for example by encouraging local people to farm fish as an additional source of protein, b) partially substitute resources, such as providing energy saving cook stoves and/or c) promote sustainable income generating activities that are not detrimental to the environment e.g. bee-keeping (Roe et al., 2014). Typically implemented under Integrated Conservation and Development Programmes (ICDP's), these interventions became popular throughout the tropics in the 1990's.

Functioning under the same principles, and in some cases using the aforementioned techniques, incentive and compensation tools only differ in the conditions in which they are offered (Wright et al. 2015). Moving towards the economic valuation of nature (thus appealing more to utilitarian values), these engagements see participants enter a more formalised agreement where they are paid (cash or in-kind) to adopt a specific activity e.g. planting trees that sequester carbon (Mahanty, Suich and Tacconi, 2013) or are compensated for the lack of access to natural resources.

As the investments for incentive-based initiatives continue to grow (predominantly

under the Reduced Emissions from Deforestation and Forest Degradation policy), the evidence that the win-win goals of biodiversity and sustainable economic development are materialising remains inconclusive (Bauch, Sills & Pattanayak 2014; Brooks et al. 2006; Naughton-Treves, Holland & Bradon 2005; Wright et al. 2015). Within Tanzania surveyed communities neighbouring the Tarangire National Park (Mcdowell, 2012) vocalised that income generating programmes generated positive conservation perceptions, encouraging further participation and a greater willingness to co-operate with managing authorities. Comparable views were also quoted by richer landowners partaking in Butterfly farming initiatives introduced across the East Usambara Mountains (Morgan-Brown, Jacobson, Wald and Child, 2010). Residents near the Selous Game Reserve (Gillingham and Phyllis, 1999) and Mnazi Bay-Ruvuma Estuary Marine Park (Katikiro, 2016) claimed that inadequate inclusion, insufficient substitutions and the unequal sharing have limited similar successes in their areas.

In practise, international development agencies rarely circulate documents demonstrating rigorous empirical evaluations (Brooks et al., 2006) and peer reviewed academic publications are few typically focusing on the state of species deliverables or measuring a specific impact area. As Sommerville et al. (2010) highlighted in Madagascar, documenting positive changes in attitudes does not necessarily demonstrate that participants have made the behavioural changes needed to protect biodiversity. More emphasis needs to be made on capturing livelihoods adaptations (for example a 43.1 % increase in the adoption of energy saving cook stoves) then matching these changes to conservation gains (23.7% reduction in fuel wood felling) as DeWan et al. (2013) showed with the Sichuan Golden Snub-Nosed Monkey Campaign in Yuje Nature Reserve China.

The lack of available baseline records and little integration of counterfactuals (i.e an unaffected area) have made these relationships hard to correlate (Morgan-Brown et al. 2010; Sainsbury et al. 2015). Furthermore, when several external factors can influence project outcomes accounting or predicting their specific influences can be tricky. In an evaluation of a homestay project in Northern Guatemala the author quantified a 39% decrease in detrimental cultivation activities surrounding the Maya Bioreserve, quoting that two-thirds of participants were less dependant on the forest

since the onset three years prior (Langholz, 1999). Heavily reliant on visitor numbers and security (guerrilla activity), Langholz went on to warn that changes to these factors could easy reverse these trends. Certainly a review of non-timber forest product trade across Asia, Africa and Latin America demonstrates how conditions practitioners have less control over (secure tenure, market access etc), drive positive conservation and development outcomes (Kusters, Achdiawan, Belcher and Pérez, 2006).

The latest systematic map of reviewed APL's found nine positive conservation stories, nine neutral ones and two negative (Roe et al. 2014). Consequently, more evidence is needed to assess whether APL's are an effective conservation tool and which factors lead to success (Nilsson, Baxter, Butler and Mcalpine, 2016).

Using Participatory Mapping and Visioning Exercises to Evaluate Changes in Livelihood Assets

With this deficit in current knowledge, four communities surrounding the Mt. Elgon National Park, Uganda were given the opportunity to provide self-reported evaluations of how alternative livelihood projects have been shaping their cultural and physical landscapes (Abunge, Coulthard and Daw, 2013; Boedhihartono, Endamana, Ruiz-Perez and Sayer, 2015). As a powerful yet simple tool, participatory mapping exercises were used to visualise the links between local values and human use of the natural environment (Plieninger, van der Horst, Schleyer and Bieling, 2014). Here interpretations of elements such as content, use of colour and clarity in the drawings (Bell and Morse, 2013), were taken to represent the awareness, attitudes and behavioural changes (Baird, Leslie and McCabe, 2009).

As one of the most widely used approaches in understanding the complexities of rural livelihoods in developing countries (Adato and Meinzen-dick, 2002; Schreckenberg et al., 2010), the capital asset approach (Fig. 14) from the Chambers and Conway (1992) Sustainable Livelihood (SL) framework was then applied to see how the mapped features translated into livelihood benefits (Sayer et al., 2007). Whilst not aiming to directly quantify asset changes, by sampling members of community-based organisations (the stakeholders often targeted by implementing agencies) and their

non-member counterparts, the aim of this chapter is to provide an overview of community experiences of the interventions from the past twenty-five years. It reflects major trends, provides a storyline of how well the system is working and having been given the opportunity to vision their desired futures, to gauge whether communities aspirations include elements of environmental sustainability or some other development pathway. Pragmatically, it represents local stakeholder voices, provides a platform for developing an integrated vision of the future and opens the doors to building more adaptive co-management relationships in the future (Brown, 2003) .

Figure 14. The capital asset framework based on Bebbington (1999)

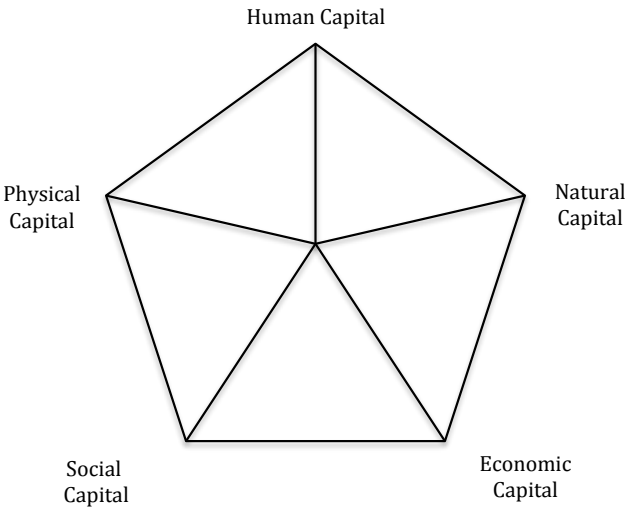
Human capital (i.e. the amount and quality of knowledge and labour)

Natural capital (i.e. the quality and quantity of natural resources, ranging from fisheries to air quality)

Financial capital (i.e. savings and regular inflows of money)

Physical capital (i.e. the infrastructure, tools, and equipment used for increasing productivity)

Social capital (i.e. social resources, including networks for cooperation, mutual trust, and support)



Study Area

Bisecting the Uganda/Kenya border is the extinct Miocene volcano home to the Mt. Elgon Protected Area (PA). Rich in closed canopy tropical hardwood, bamboo and heath moorlands high in endemic flora; this forest eco-system hosts some seventy six threatened species of global conservation value (Nakakaawa et al., 2015). Protected under a different jurisdiction in Uganda, a single 1120 km^2 National Park (N.P) is administered by the Uganda Wildlife Authority (UWA) (Sassen et al., 2013).

Below these demarcated boundaries smallholder farmers have converted the landscape into intensively managed crop production sites intertwined with animal rearing and *Eucalyptus* woodlots (Hitimana, Kiyiapi and Njunge, 2004; LVBC, 2012). The abundant rains, fertile soils and access to the parks environmental incomes and services have made this one of most populous (1.6 million people) and rapidly growing regions (3.4% per year) in east Africa (Nakakaawa et al., 2015).

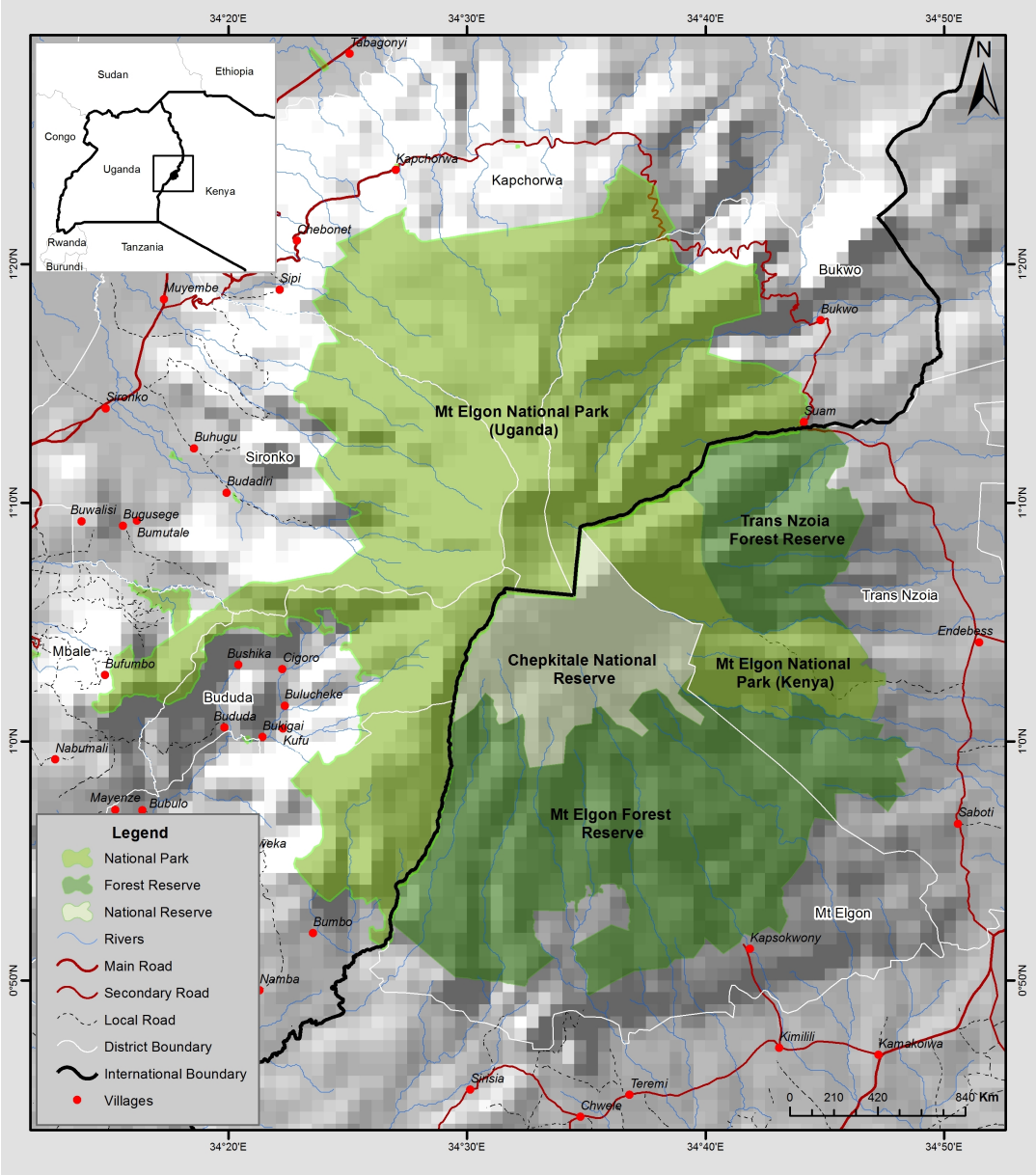
Inside a landscape where soil properties and layering are naturally prone to landslides, escalating human pressure is causing severe soil degradation, habitat loss, water pollution and homelessness (Claessens et al., 2007). In a bid to reconcile such unsustainable relationships and build alterative livelihood strategies, over the past twenty years several conservation initiatives and resources agreements have been put into place (Oonyu, 2009). Aided by international funding, their main agenda has been to reduce deforestation and promote habitat restoration through the development of on-farm diversification. The techniques introduced include: soil erosion measures, agroforestry, tree crops, zero grazing and the introduction of mix-breed cattle and energy saving cook stoves (Muhweezi, Sikoyo and Chemonges, 2007).

Working with CBO's who have participated in at least one ICDP, four communities bordering the N.P were selected to partake in this study (Appendix I. B). Based in four geographically isolated districts of the mountain (Fig. 15), the groups varied in their administrative extent (village, parish through to sub-county level) and the types of projects that have been introduced (Table. 12).

Historically practising different livelihood strategies, the ethnic majority in three of sites was the Bagishu and in one Sebei. Once nomadic pastoralists, the forest dwelling Sebei used to supplement their diet with herd and forage from within the forest (Himmelfarb, 2005), whereas the Bagishu cleared land for agriculture. Having both faced evictions during the creation of the National Park (Jeha et al., Chapter 2), both tribes continue to uphold longstanding cultural (burial and circumcision sites) and use (wood, medicine and food) values associated with the park (Nakakaawa et al., 2015). Today, the main cash crop for all the sampled communities is coffee, however,

horticulture is a rapidly rising alternative. Planted crops vary seasonally but trend to include maize, beans, cassava and potatoes.

Figure 15. Map of Mt. Elgon, Uganda and Kenya. For anonymity, exact location of selected study sites is not revealed.



Adapted using data on Mt. Elgon boundaries and forests from Sassen et al (2013). Protected Area Boundaries sourced from UN EP-WCMC

Table 12. Summary of CBO Activities

Community	Ethnicity	Main Cash Crop	CBO Activities	CBO Membership	Intervention Time Line
1	Bagisu	Coffee	-Energy saving cook-stoves -Horticulture seedlings -Tree nursery -Zero-grazing -Trench digging -Napier grass planting	2 sub-counties 17 Villages 146 members	**1994-** Mt. Elgon Conservation and Development Project (MECDP) **2009**-Mt. Elgon Regional Eco-System Conservation Programme (MERECP) **2010**-World Wildlife Fund (WWF) **2010**-Territorial Approach to Climate Change (TACC) -MERECP-Cash Revolving Fund **2011**- Eco-Trust **Current**- International Union Conservation of Nature (IUCN) **2011**-Uganda Wildlife Authority (UWA) Memorandum of Understanding (M.O.U)
2	Bagisu	Coffee	-Horticulture seedlings -Zero-grazing -Bee-keeping -Tree nursery -Trench digging -Napier grass planting -Bee-hives	2 sub-counties 12 villages 500 members	**1992-** Mt. Elgon Conservation and Development Project (MECDP) **2010**-Mt. Elgon Regional Eco-System Conservation Programme (MERECP) **2011**-Territorial Approach to Climate Change (TACC) **2013**-World Wildlife Fund (WWF)
3	Sabei	Coffee	-Bamboo demonstration -Fish pond demonstration -Trench digging -Bio-gas -Woodlots -Dairy cows -Bee-hives -Tree nursery -Coffee pulping machine -Infrastructure -Napier grass planting -Zero-grazing	1 sub-county 7 villages 411 Members	**1996**-Uganda Wildlife Authority (UWA), Memorandum of Understanding (M.O.U) 2**000-**International Union Conservation of Nature (IUCN) **2009** -Mt. Elgon Regional Eco-System Conservation Programme (MERECP) **2011**- HIEFER International (co-funding biogas units).
4	Bagisu	Coffee	-Woodlots -Dairy Cows -Apiary -Coffee nursery -Trench Digging -Napier grass planting	1 sub-county One village 25 Members	**2010-**MERECP-Cash Revolving Funds **2012**-Uganda Wildlife Authority (UWA), Memorandum of Understanding (M.O.U)

Methods

Participatory Rural Appraisal and Mapping Exercises

Recruited through existing connections with executive CBO members, a two-day Participatory Rural Appraisal (PRA) workshop was held in each of the study sites. Referred to as a 'matching approach' (Richards, 2012), in order to allow for statistical comparison between the principle beneficiaries of interventions to those that are co-located but not directly included (control), two separate groups of members and non-members were assembled. With a maximum of ten people in each group (Table 12), the attendees were from different genders and ages, also varying in their socio-economic backgrounds but represented a purposive sample in terms of their relationship to local interventions.

Fluent in local languages and fully briefed on the data collection protocol (see Appendix II. A for complete guidelines), facilitators began the discussion by asking attendees to describe their community, how they use the resources within them and whether any environmental NGO's/Government bodies have shaped their livelihood practises. In other words, getting local stakeholders to frame the issue. Using a geo-referenced, community-centred aerial image covered in acetate (Lynam et al., 2007), the group were then invited to visualise (through a mapping framework) how these interventions have shaped their current landscape. Offered different coloured pens and a standardised key which they had the freedom to expand upon, facilitators kick-started the drawing activities by helping attendees to locate the major landmark features on the maps (rivers, footpaths, schools etc.) to promote orientation, eventually allowing them to create a spatial 'reflexive comparison' (Schreckenberg et al., 2010) of the landscape before-and-after the interventions (Ferraro and Pattanayak, 2006).

In the absence of baseline data (previous work being lost or difficult to locate with changing staff (Boedhihartono and Barrow, 2008)), on a new sheet of acetate, the group were then asked to repeat the exercise, this time drawing what their landscape was like before the creation of the modern National Park or people-centred interventions had begun operating in their area (approximately twenty five years

ago). Trying to grasp community aspirations, the mapping exercises were then brought to a close by getting attendees to vision their desired future landscapes. Having created a timeline of maps, past-present-and-future, amongst the two different groups resulted in the creation of twenty-four maps across all four study sites.

In the final stages of the workshop attendees were probed to 'interview' their maps. Gathered in a matrix format, through a trend analysis, more detailed explanations and ranking exercises were used to describe (and triangulate) some of the mapped changes (see Appendix II, Tables 1-8 for full results). The open nature of this exercise meant that each group generated their own unique set of indicators to evaluate during this process (Sayer et al., 2007). These typically included describing changes to water quality, household size, landholdings and education over time. A general discussion surrounding resource-use governance issues then summed up the activities.

Throughout the workshop, to ensure everyone had an equal opportunity to engage, special attention was paid to the social relationships ensuring that all attendees had the opportunity to participate (Abunge, Coulthard and Daw, 2013; Boedhihartono et al., 2015; Sletto, 2009). Furthermore, despite the uses of geo-referenced images, attendants and their resultant drawings, were left relatively unguided generally meaning that mapped features were not drawn to scale. In this sense, the maps were closer to 'rich pictures' where participants freely drew their perceptions of their environment (Boedhihartono et al., 2015). The maps do not therefore, provide a definitive assessment of landscape changes, but rather a community-inspired narrative of how interventions are shaping them (Cinderby et al., 2011). The way in which the groups engaged in the exercises, produced the maps and their content will all be used as a reflection of their attitudes and experiences of conservation interventions.

Household Interviews

Without directly measuring intervention impacts (e.g. increase in key number of indicator species or actual changes in household income), additional household data (Table 13) were used to triangulate the findings from the PRA activities. Collected

during a single research period (Jeha et al., Chapter 3), information on adopted technologies and perceptions of livelihood benefits amongst both CBO members and non-members were collated to allow for further comparison. Such triangulation between information sources is an important part of this research, allowing data to be confirmed, refuted and probed (Schreckenberg et al., 2010).

Table 13. Summary of Research Participants

	Household Interviews	Participatory Mapping	
Study Site	**Nº of Interviewees**	**Member**	**Non-Members**
1	47	10	8
2	35	8	8
3	34	6	10
4	16	9	8
Total	**135**	**33**	**34**

Quantifying Livelihood Assets

The maps were converted into GIS data using 2.12.1- Lyon QGIS. Physical and administrative features were digitised into separate shapefiles and livelihood activities into coded point data. For this research it is assumed that the mapped features are outcome indicators, i.e. short-to-medium term behaviour or systematic effects of an intervention (Schreckenberg et al., 2010). In trying to measure the potential livelihood benefits that flow from these outcomes, for each of the twenty-four mapped activities, a set of capital assets that rural farmers could enjoy from each activity was inferred (Table 14). The frequency of the drawn activities was then multiplied by these assets to track changes in livelihood benefits over time (Fig 16).

Whilst a broad range of assets were considered in this analysis, given the landscape approach that focuses on biophysical changes, it fails to capture more intangible cultural and social benefits. Likewise, due to the scale of the National Park, which is measured as an area not in terms of frequency, directly quantifying the benefits that could be enjoyed from them was problematic. Instead, changes of park boundaries (if drawn) and information from other data sources were used as a reference point. Finally, the analysis makes no direct attempt to measure livelihood costs (e.g. loses

from denied access to the park), however, to a certain extent net loses in particular benefits can be used to infer them.

Figure 16. Overview of research methods

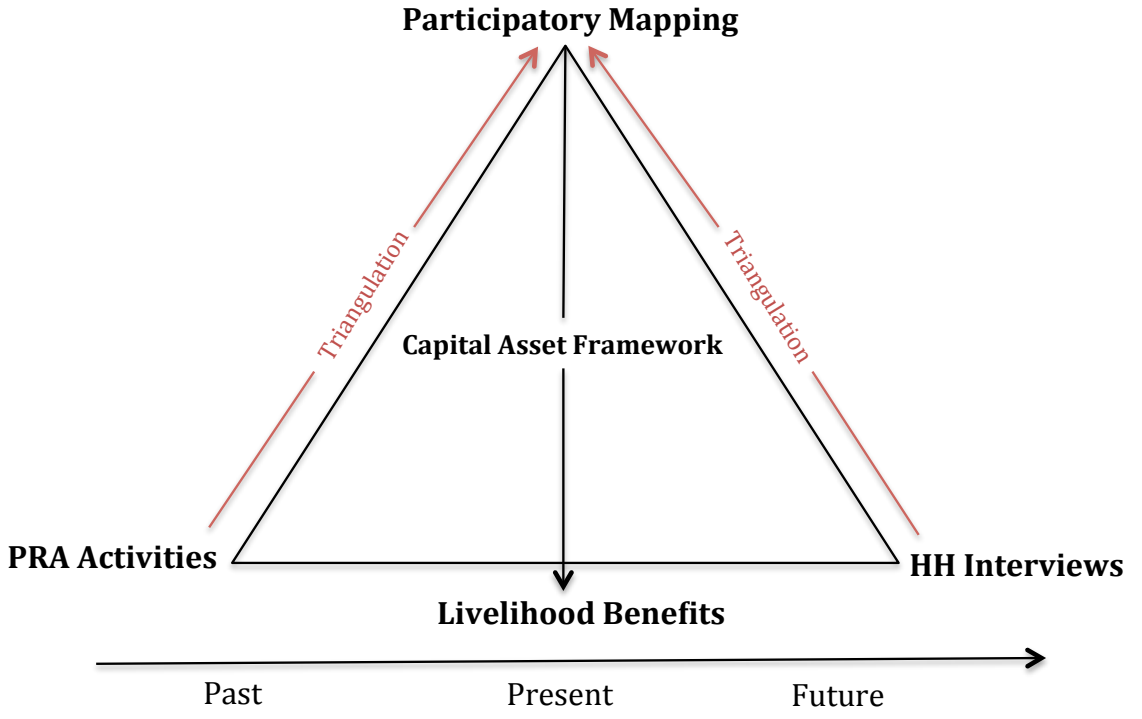
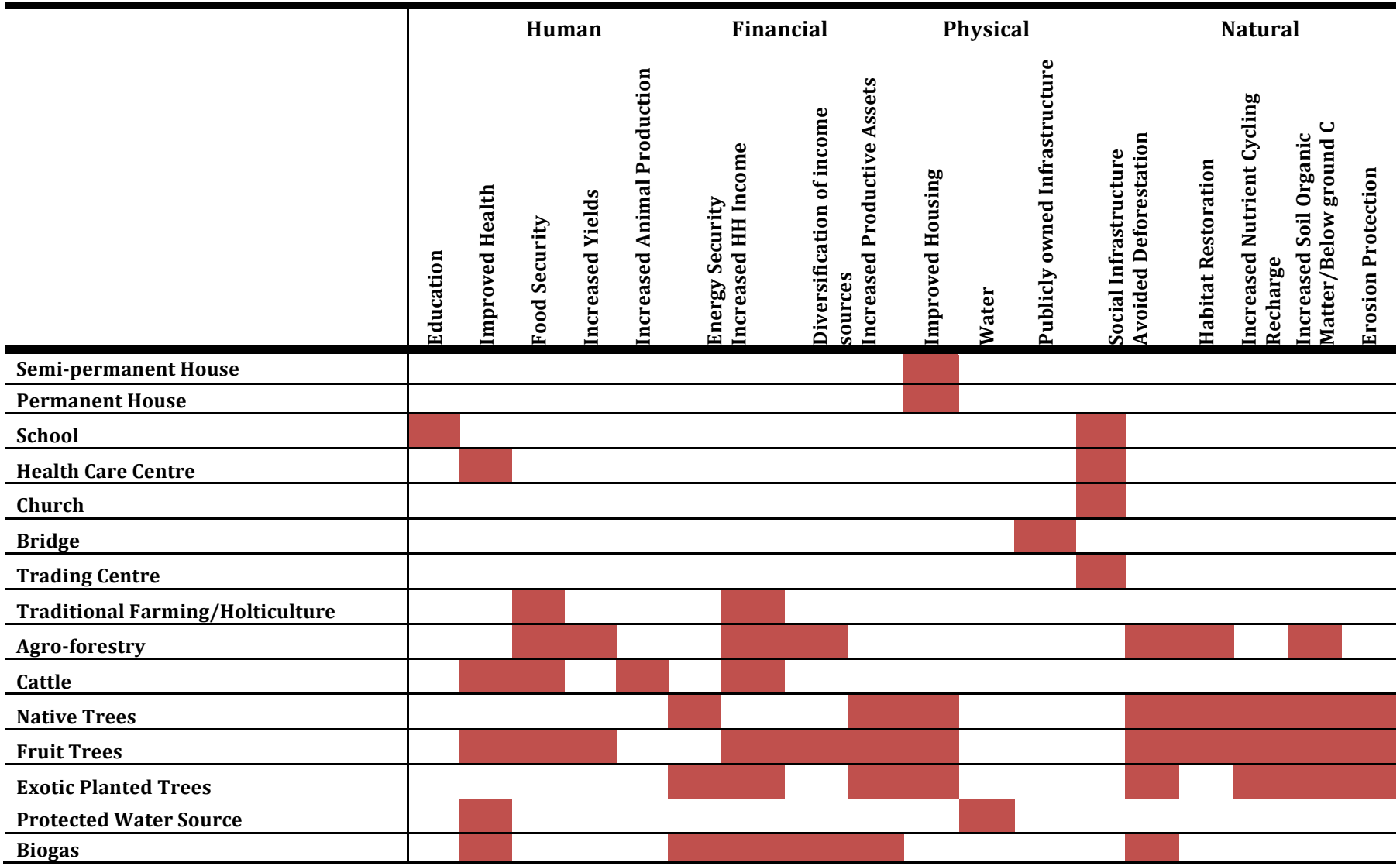
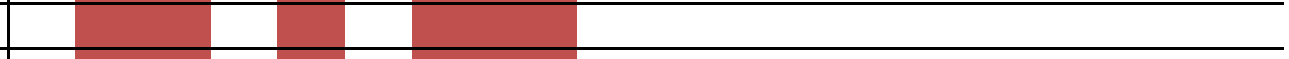
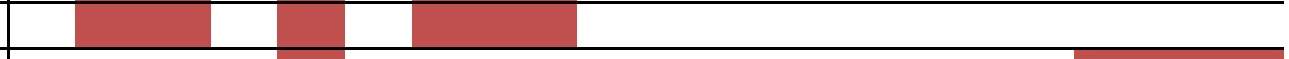
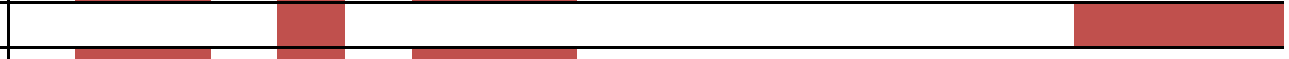


Table 14. Asset benefits associated with mapped livelihood features



Tree Nursery	
Terraces	
Zero Grazing	
Energy Saving Cook Stove	
Bamboo Growing	
Fish Farming	
Poultry Farming	
Piggery	
Elephant grass	
Bee-Keeping	

Results

Presented in Fig 17a to 20f, the digitised maps provide a spatial overview of the varied livelihood strategies and dynamic conservation perceptions found across Mt. Elgon. Apart from the biophysical features used to orientate the map, trees, houses and park boundaries figured in all of the landscapes. Given that coffee is considered the main cash crop amongst all the studied communities, in general more emphasis was placed on representing horticulture suggesting that a) it is overtaking coffee in importance as source of household income and/or b) that conservation interventions have helped develop these farming techniques. On some occasions, rivers, roads and other landmark features were placed in different locations within and between group drawings (see Fig 19a-19f for the most prominent examples). The poor resolution of some of the base-maps may have contributed to these differences; however, in certain circumstances they have been taken as valuing different assets at different points of time. For instance, as confirmed by the trend analysis, the consistent lack of rivers featured in the present was taken to signify poor water quality and quantity.

With the exception of study site one, generally members drew more coherent stories. Attention to details such as creating riparian zones around rivers, sectioning off parts of the park where enrichment planting occurred and the clustering of technologies around individual households advocates that members made a greater effort in 'thinking through' the exercises (Bell and Morse, 2013). This was also mirrored in the clarity of the drawings, where more colour, shading and attention to ensuring realistic connectivity (e.g. paths) and scale were made.

When considering the most pro-active groups, such details become even more pronounced. The CBO in community three adopted the broadest range of conservation technologies (Table 15) that correlated with high levels of community cohesion and forming cross-scale links (Jeha et al. Chapter 3). A similar narrative has emerged from the mapping, seeing members sketch the greatest diversity of features and numerous conservation induced landscape changes. Likewise, household data from community one had the greatest level of non-member information sharing, exhibiting the highest overall conservation technology adoption. As the only study-

site where non-members depicted superior amount of livelihood activities to their members (particularly in the future), the PRA activities compliment the household findings.

Table 15. Descriptive summary of mapped features and technology adoption

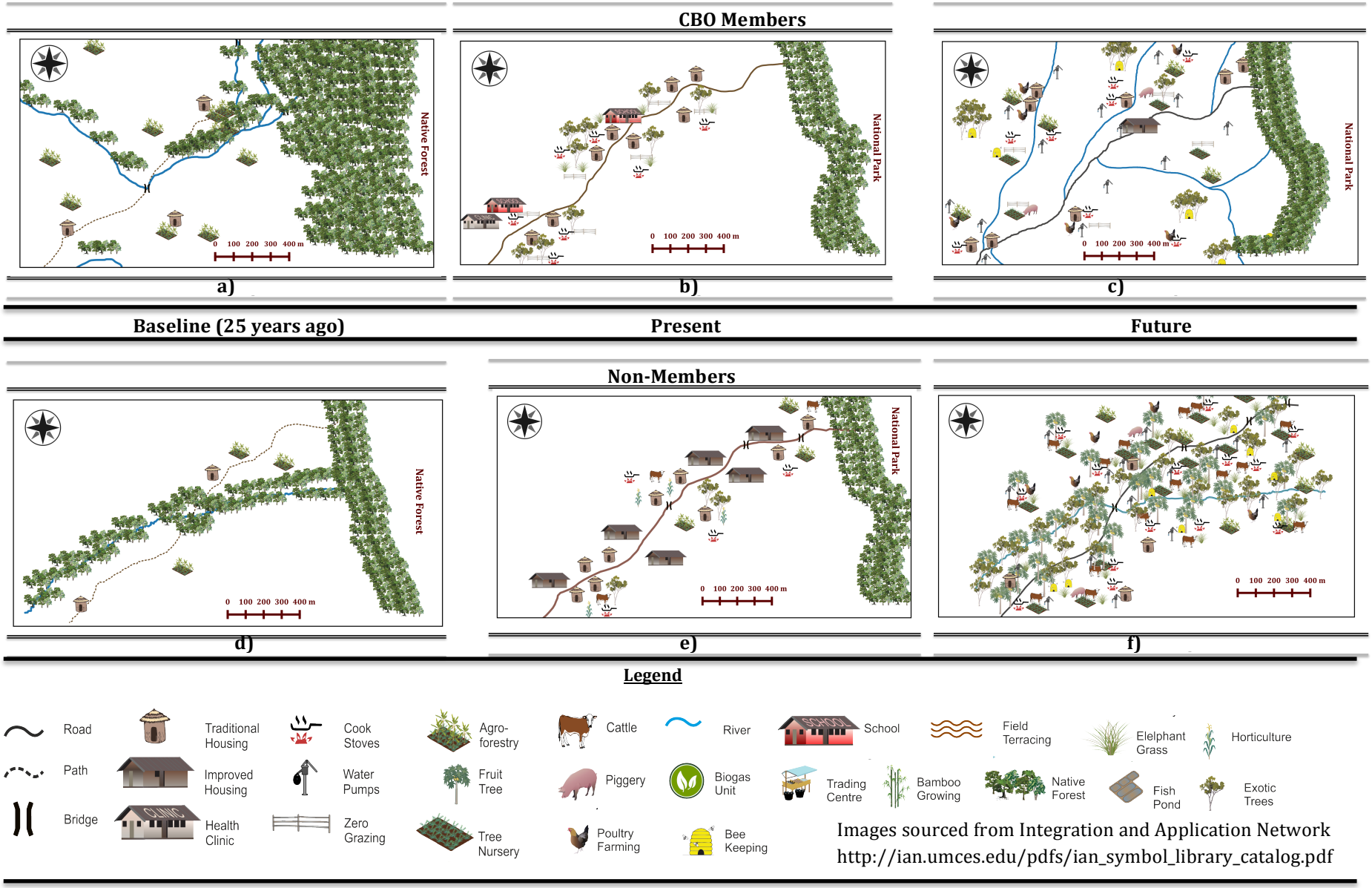
Study Site	Participatory Mapping		HH Interviews	
	Total Nº of Features Drawn	Diversity of Features Drawn	Average Proportion of Conservation Technologies adopted HH level	Nº. of conservation activities implemented at the CBO level
1	441	19	0.46	5
2	360	21	0.41	6
3	432	23	0.36	12
4	175	20	0.41	6

In keeping with the small network size and lack of information sharing amongst neighbours and with external bodies, the participatory mapping outputs in study-site four were basic, with the least amount intervention induced changes. Taking a closer look at study-site two, again triangulation between data sources can be made. The social network analysis (Jeha et al. Chapter three) revealed that information sharing and knowledge surrounding conservation agriculture was comparatively high to the uptake of technology for this case study. A development that can also be inferred from the diversity of activities despite their low frequency.

From past landscapes to the present, both members and non-members cited a drop in the number of cattle, semi-permanent houses and native trees and a general increases in exotic trees and permanent structures (Fig 21). Forest boundaries were almost always included in maps, except for study-site two where communities were based too far away to include them. On average non-members did not include as many features in their drawings (even for baseline maps), focusing on representing traditional farming methods and growth on infrastructure. On the other hand, members portrayed greater diversification in their livelihood activities, with the

incidence of green technologies such field terraces and zero-grazing mirroring household trends.

Figure 17. PGIS maps showing intervention induced livelihood changes and future aspirations in community one



Images sourced from Integration and Application Network
http://ian.umces.edu/pdfs/ian_symbol_library_catalog.pdf

Figure 18. PGIS maps showing intervention induced livelihood changes and future aspirations in community two

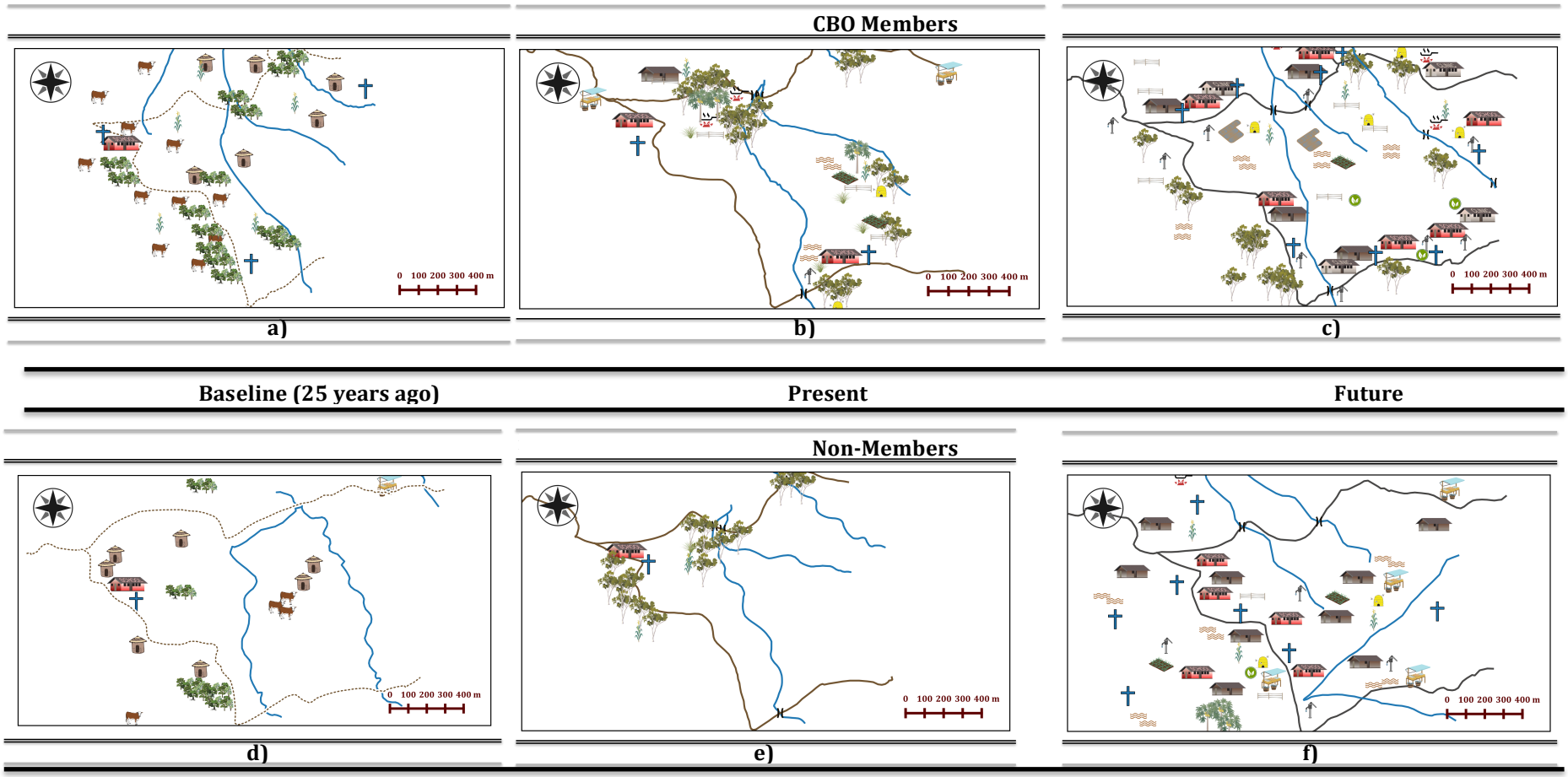
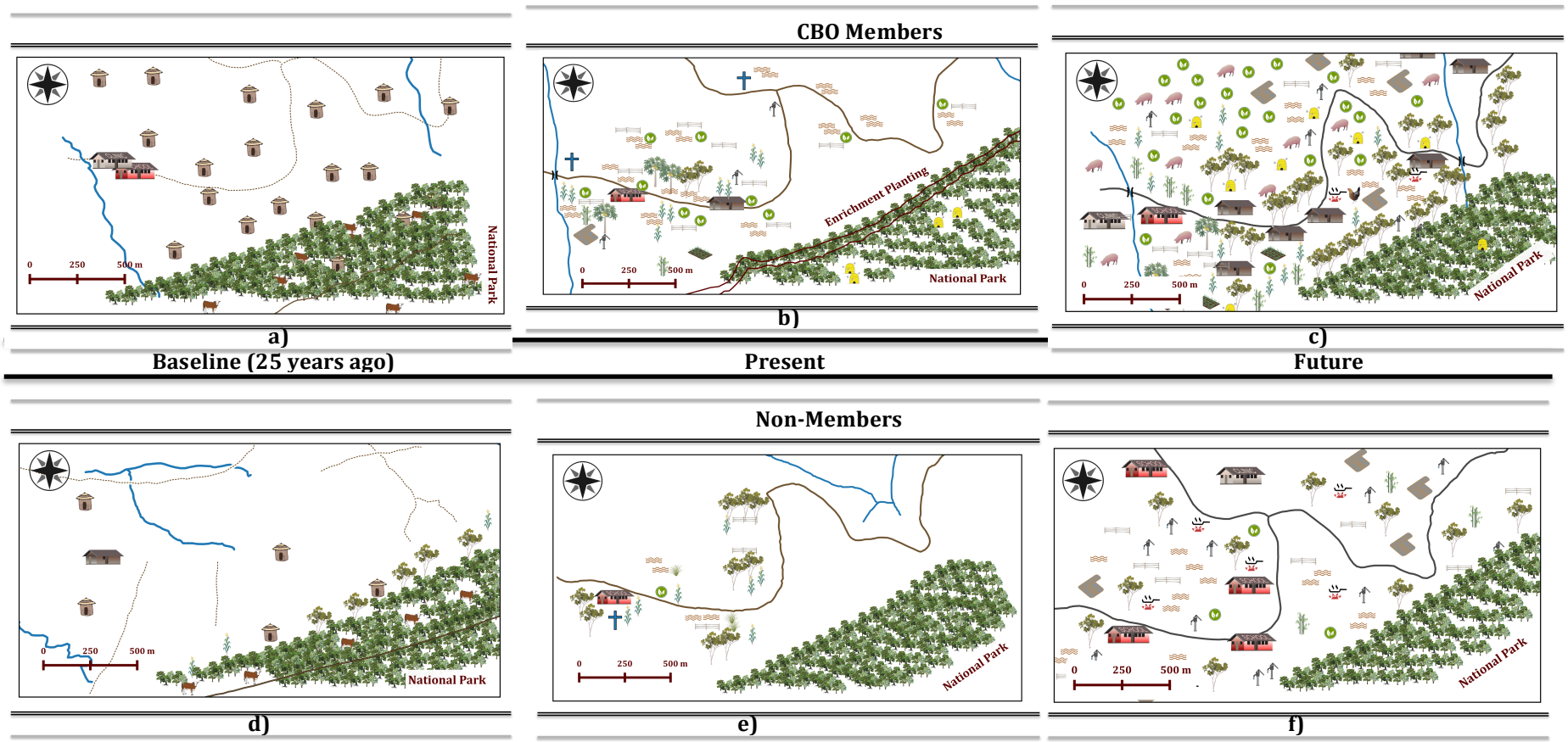


Figure 19. PGIS maps showing intervention induced livelihood changes and future aspirations in community three



Images sourced from Integration and Application Network
http://ian.umces.edu/pdfs/ian_symbol_library_catalog.pdf

Figure 20. PGIS maps showing intervention induced livelihood changes and future aspirations in community four

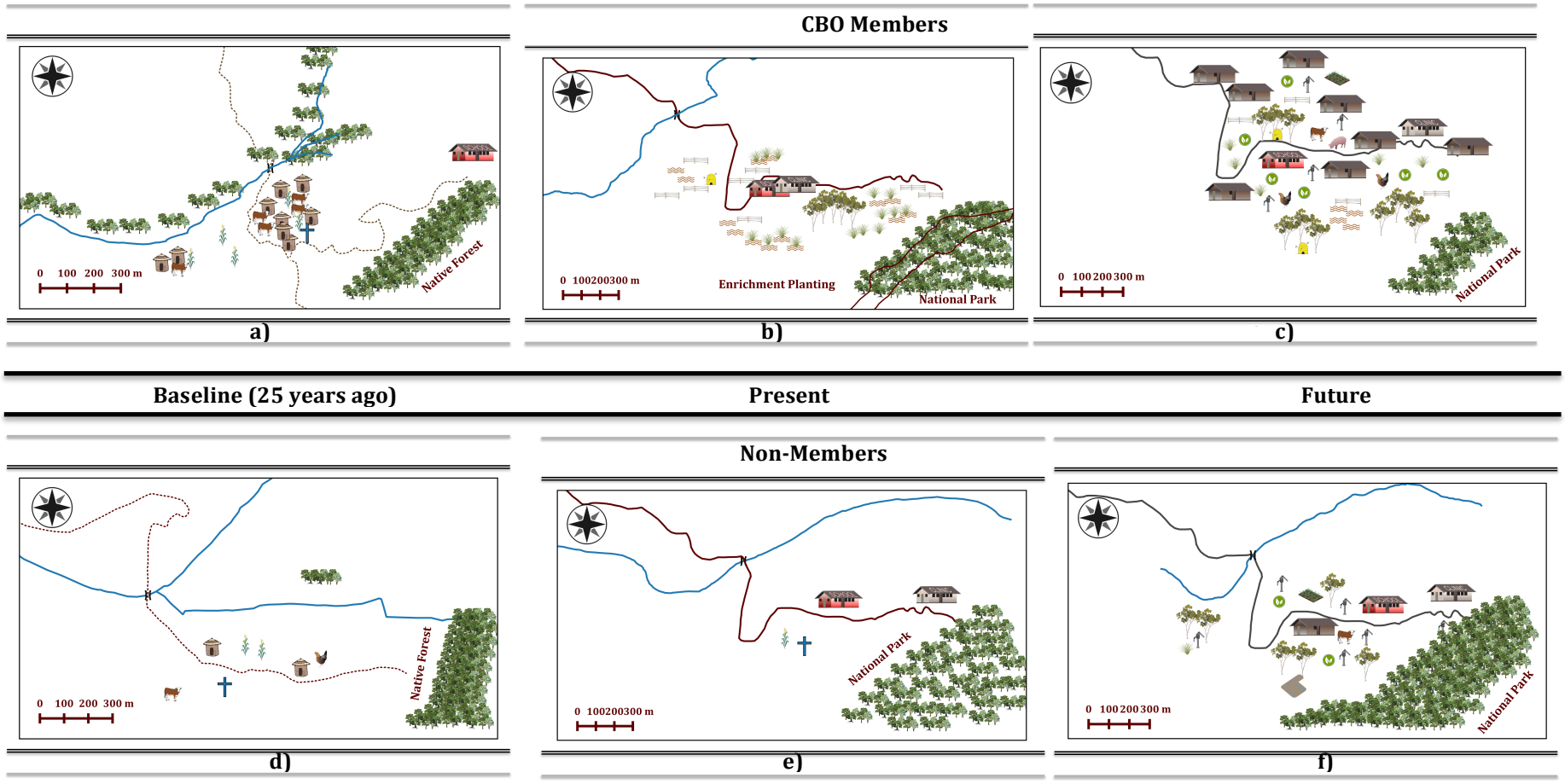
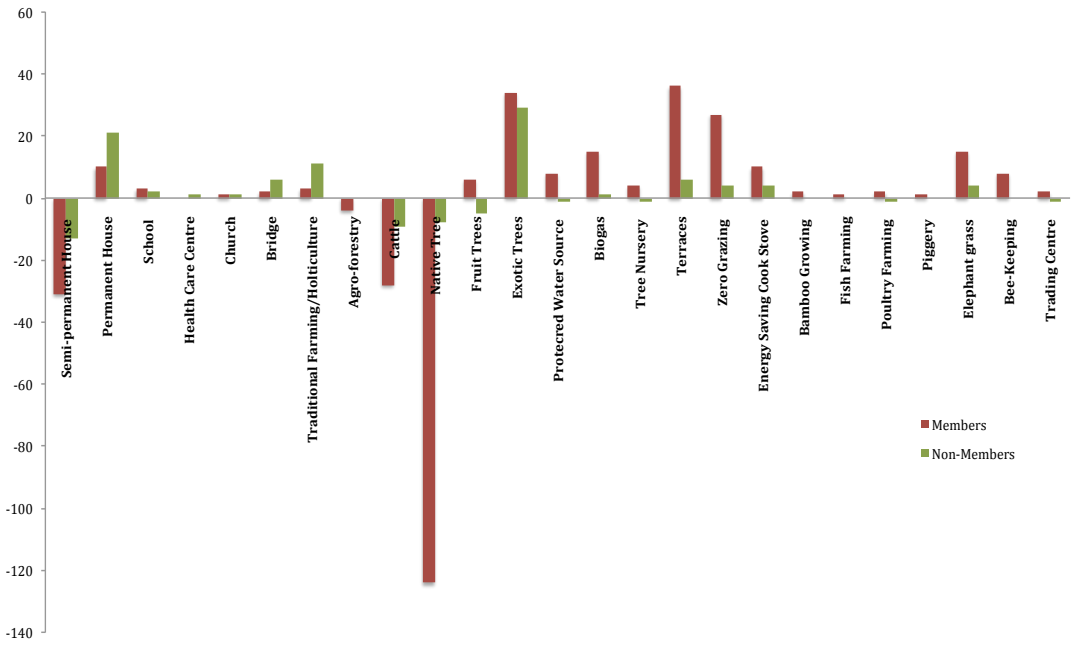


Figure 21. Combined changes across all four study sites in mapped features from the past to the present.



Regardless of quoting fewer livelihood-induced changes due to conservation interventions, together non-members and members converged in their aspirations for a greener future. Reinforced by ranking activities, protected water sources and further integration of field terraces supported goals of wanting to achieve better soil and water quality. Most communities continued to value the protection of the National Park, often delineating the same boundaries as the present and accepting that landholdings were likely to decrease into the future (refer to trend analysis results in Appendix II, Tables 1-8). Whilst native trees did not feature in future landscapes, aspirations for exotic and fruit trees increased. With these strong desires to improve natural assets, communities also sought to develop built infrastructure, drawing tarmac roads and more permanent houses, schools, churches and better health facilities. As smallholder farmers, agriculture remained important with the representation of agro-forestry and horticulture techniques increasing in the future, more so for non-members, reflecting further aspirations to engage with the market economy.

Calculations of livelihood benefits from the PGIS activities are summarised according to membership and time in figures 22 and 23. Benefits cited during the household

interviews verify those computed from the point data, both confirming that members are enjoying significantly more intervention induced livelihood benefits (two sample t-test, $p < 0.05$), with double the proportion of non-members (60% of respondents) having quoted no observed changes at present.

Across different communities, in line with their aims and objectives, interventions had the biggest impact on house income, energy security, animal production and the conservation of natural assets. Nevertheless, apart from study-site three, overall members depicted that their habitats continued to be degraded, drawing fewer trees, shifts in park boundaries and ranking a decrease in soil and water quality (Fig 22). For participating households, the introduction of alternative activities has, therefore, provided additional financial and physical benefits, however, this has not materialised into overall habitat conservation. For example, despite the construction of some permanent houses (made from bricks) this has not substituted the broader housing benefits farmers would be enjoying in a landscape richer in trees. Consequently, without as much access to construction materials on their farms, there is an increased likelihood they are accessing these materials from within the National Park, which could be detrimental to conservation goals depending on how they are extracted.

One of the major differences in benefits quoted at the household level was in education where interviewees inferred that conservation capital was being used to send individuals to better schools further afield and hence this benefit not being captured through the mapping exercises (Fig 24). With the reality that non-members displayed quite different relationships with their landscapes, referencing fewer features (particularly native trees) and uses of their environment at the baseline level, this analysis infers that they are experiencing greater benefits from their environment today than they did 25 years ago. To a certain extent, this suggests that conservation perceptions/ acknowledgements of their benefits are reaching the broader community.

Figure 22. The collective livelihood changes by CBO members. Values were calculated by allocating the relevant benefits associated with each of the point features drawn during participatory GIS workshops (**refer to Table. 13**).

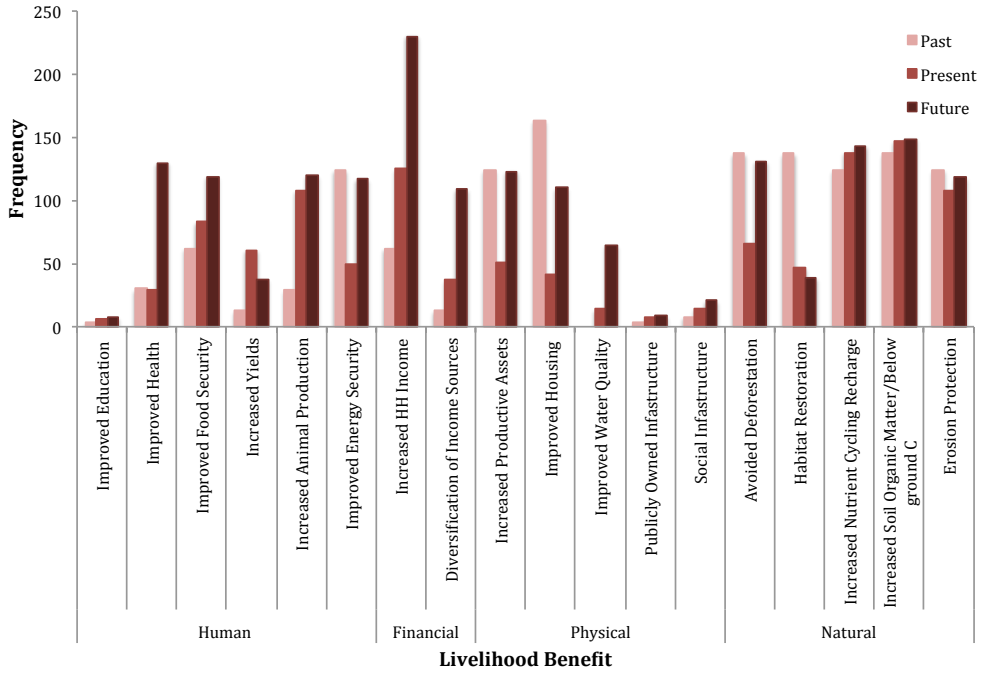


Figure 23. The collective livelihood changes by non-members. Values were calculated by allocating the relevant benefits associated with each of the point features drawn during participatory GIS workshops (**refer to Table. 13**)

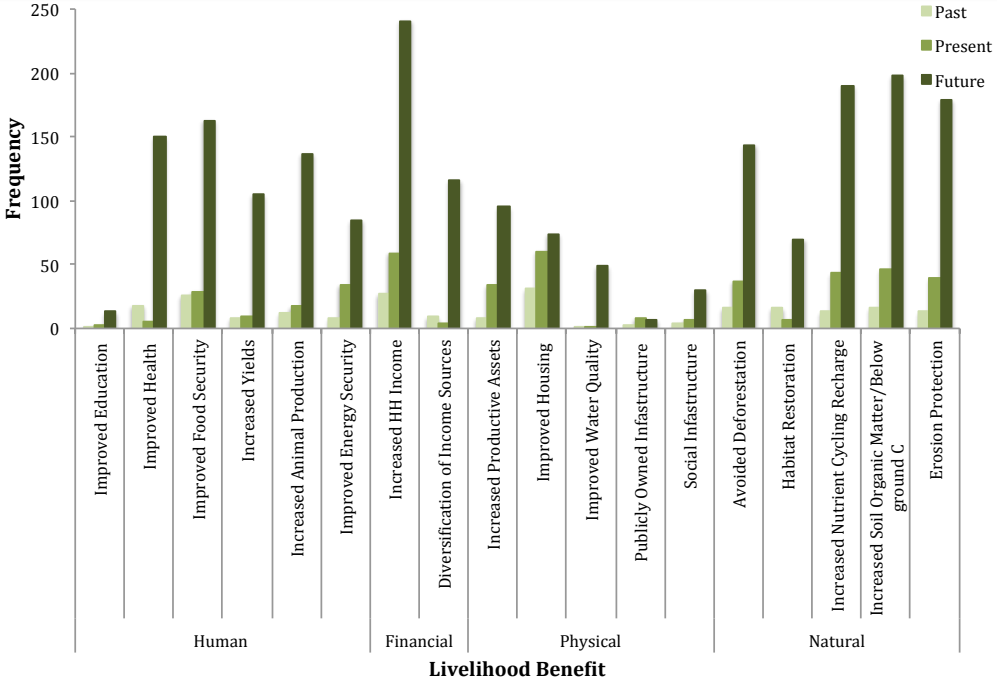
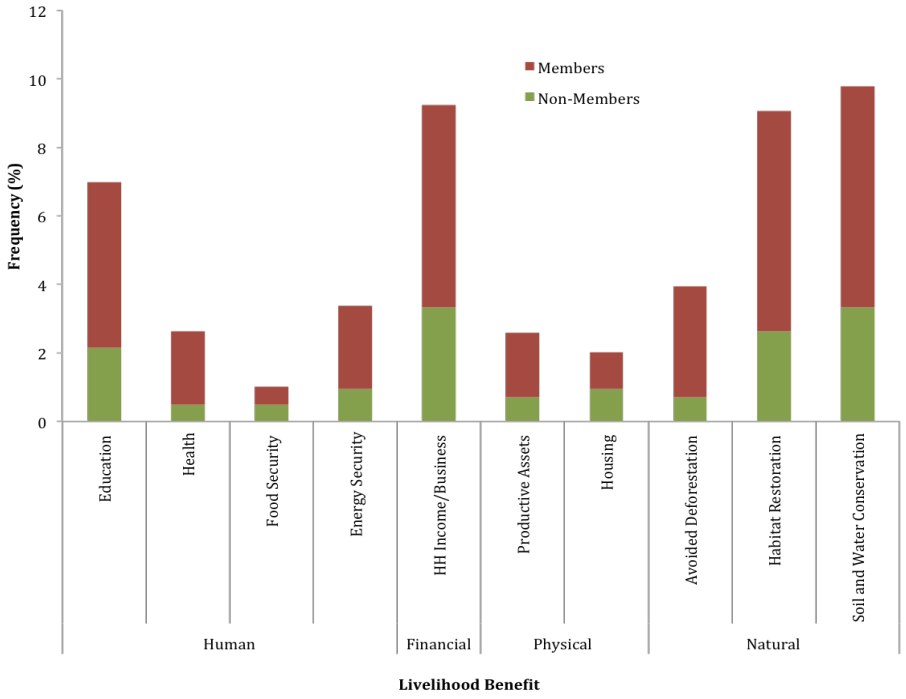


Figure 24. Livelihood benefits quoted during household interviews.



Discussion

Similar to the self assessments guided by Sainsbury et al (2015), the findings from this analysis have revealed how communities, and the people within them, have varied environment perceptions and experiences of project outcomes. Factors the discussion will now put into context and contrast with similar case studies. It will then go on to review methodological adaptations and the scope of using further participatory methods in meeting sustainable landscape approaches.

Understanding Livelihood Choices

Reflected in this study through the variety of mapped practises, the body of sustainable livelihood work produced in the 1990's shows that the rural poor are likely to engage in a broad range of livelihood activities (Carney, 1998). With one of the best poverty reduction performances seen since 1992, diversification away from subsistence agriculture has lead to significant increases in household income within Uganda (World Bank 2012). Often used as a risk mitigation strategy, scholars such as Brown (2003) have advocated that alternatives introduced through conservation

interventions are seen in the same capacity. An evaluation of the Amani butterfly project in the Eastern Arc Mountains, Tanzania found that regardless of its financial success (annual earnings increasing each year), without being a primary source of income, butterfly farming did not stop participants from engaging in other detrimental practises (Morgan-Brown et al., 2010). Similarly, the increase in mapped alternatives did not prevent members from depicting the degradation of their habitat over time. Mirroring the national trends in Uganda, it would therefore seem that alternative sources of income are being reinvested as farm capital, improving household income rather than substituting it (Bank World, 2012).

Amongst a mix of factors that drive land-use practises, confirming such a relationship is difficult. In a landscape that is experiencing rapid population growth which Sassen et al (2013) has correlated to forest cover decline across Mt. Elgon, the widespread uptake of sustainable alternatives may not be strong enough to support this pressure (Garnett, Sayer and Toit, 2007). A trend that was also noticed in the Danajon Bank of central Philippines where fisherman numbers increased despite declining stocks and the introduction of alternative seaweed farming (Hill, Rowcliffe, Koldewey and Milner-Gulland, 2012).

Consideration of external drivers is also important in this context. In Indonesia Linkie et al (2008) found no difference in forest cover between areas in which intervention functioned because the projects failed to target growing logging pressures. In Mt. Elgon, easy access to Kenyan markets and the continued weighting placed on horticulture and exotic trees validates the significance of markets in motivating livelihood strategies, particularly when temporal dynamics come into play. Whilst coffee prices are no longer associated with encroachment of the National Park (Sassen et al., 2013), income from horticulture techniques manifest quicker than those of increased productivity and carbon sequestration associated with agricultural conservation making it a safer farming choice from an incomes standpoint (Lescuyer, 2013; Salvini et al., 2016). Living in relative poverty, farmers are more likely to invest in health, education and housing than unknown alternatives (Garnett, Sayer and Toit, 2007). Furthermore, 'islandised' protected areas have been linked to feelings of insecurity which have triggered pre-emptive farming (Baird, Leslie and McCabe, 2009). In fear of losing land, households living in close proximity to the Tarangire

National Park in Tanzania, encroached on valuable habitat corridors (Sainsbury et al., 2015). Since a link between participating in environmental projects (Jeha et al. Chapter 5) and behavioural change has been proven by other authors (Blomley et al., 2008), improved environmental awareness may be key in changing attitudes (Morgan-Brown et al., 2010; Salafsky et al., 2001; Sommerville et al., 2010), particularly for non-members who have access to fewer benefits.

Paradoxically, regardless of these differing experiences, communities are unified in their aspirations for ambitious and greener futures. Akin to the Pygmie tribes in the Sangha Tri-National landscape (Boedhihartono et al., 2015), there was a strong desire to retain forest diversity and improve 'modern' infrastructure (concrete roads, solid buildings, sources of power etc). Often a measure of development success, it is not uncommon for communities to aspire to these built assets (Garnett, Sayer and Toit, 2007), nevertheless investment in them can act as a double edge sword. Their improvement can enhance communication pathways, access to alternative markets and mobilise citizens that would considerably improve sustainability practises. Equally they can create logging routes, encourage urban migration and open the doors to the carbon rich lifestyles typical of the west (Cinner, 2005). The establishment of the 'Posada Amazonas' eco-lodge on the buffer zone of Peru's Buhaja-Sonene National Park increased employment, reducing farming and hunting activities yet enabled greater production as individuals invested in chainsaws, motorboats and other equipment (Stronza, 2007).

Taking a closer look at choices, like the 'ranked outcomes' method used to evaluate technologies used near the Uzungwa Scap proposed Nature Reserve in Tanzania (Sainsbury et al., 2015), communities favoured tree-planting activities. In this study, water-demanding, fast-growing, exotic tree species that lack conservation value were prioritised above all others (Huettner, 2012). Emphasising the importance of co-benefits, conversely it shows little desirability to join carbon sequestration projects like Trees for Global Benefit that focus on planting native trees. According to local information, under the rapidly growing population, land is becoming increasing fragmented leaving only richer farmers the ability to join such tree-planting schemes. As the members of society most known to consume (Scott, 1994) and encroach (Sassen et al., 2013) on forests within the Mt. Elgon National Park, pragmatically,

targeting the rich may lead to the most ecologically gains. Nevertheless, the cumulative impact of poorer households on habitat degradation, (known to be between 94-80% of the population (Appendix I, Table A.1)), may be higher at the landscape level. In the future, development agencies need to consider the asset profiles of their users to deduce where efficiency gains can be made, then differentiate strategies according to the households capabilities be it land, knowledge, gender, willingness or access (Wright et al. 2015). Thereafter, more spatially explicit planning can be used to negotiate the specific location of activities (Opdam et al., 2016), which can expand to include elements such habitat corridors, planting along farm boundaries and field terraces in erosion prone areas.

Better knowledge of the socio-economic, environmental and risk trade-offs, as seen in role playing games associated with Participatory Land-Use Planning in Lao (Bourgoin and Castella, 2011), would help farmers reach these more informed decisions. The scope to develop and incorporate more versatile land-use practises into service markets remains a key part of this sustainable landscape discourse and could provide key financial incentives (Salvini et al., 2016). One such example could be the potential to gain carbon credits from bamboo. Across Mt. Elgon bamboo has great cultural (ceremonial purposes), social (vegetable) and economic (furniture) significance. Farmers travel big distances, taking substantial risks to retrieve it from the upper regions of the Park (Ditiro, Vedeld and Gombya-Ssembajjwe, 2008). Difficult to grow at lower elevations, with some careful planning, community three has demonstrated its feasibility. Other than its potential to provide domestic and commercial uses, its vigorous growth rate, high biomass accumulation and effective fixation of CO_2 make it a sound option for carbon trading (Nath, Lal and Das, 2015).

Methodological Considerations on Framed Observations

When environmental agencies target CBO members, it gives them the opportunity to partake in more training, workshops and face-to-face interactions (Opdam et al., 2016) which improves their agrarian knowledge, sensitises them to environmental problems and fosters greater group pride (Sommerville et al., 2010). Attention to detail and portrayal of alternative livelihood strategies could reflect their improved understanding/support of conservation-related activities i.e. improvements in local

attitudes. Given the hostile relationship between park authorities and communities, this is an essential first step in motivating the behavioural changes that will advance the conservation agenda. If nothing else, as Blomley et al. (2010) highlighted with his evaluation of ICDP's in Uganda's Bwindi Impenetrable National Park, it will ease antagonistic pressures. One cannot, however, omit the bias of members depicting what they feel researchers would like to see as oppose to portraying their genuine sentiments. With regards to technology adoption, without direct measurements, general observations of farms during household interviews would suggest lower frequencies then quoted (Personal observation, 2013-2014). The most obvious being terraces. In comparison to Southwestern Uganda, there was little visible evidence of their implementation on the broader landscape level.

Another issue to consider is the bias created by the facilitator's guidance, translations and the personalities of attendees who may vary in their confidence, creativity and participation. Equally, using recall techniques is known to be prone to inaccuracies (Papworth, Rist, Coad and Milner-Gulland, 2009). With few academic and practitioner partnerships, accessing official data to triangulate these community perceptions was challenging. Collaborations, like the monitoring of the Tri-National de la Sangha landscape across Congo, Cameroon and Central African Republic by several independent NGO's (de Lange, Woodhouse and Milner-Gulland, 2015) would be constructive across Mt. Elgon.

In other ways, the study design fails to accurately quantify key assets, especially changes in forest quality and use from within the National Park (in both target and untargeted area). Building from Scott (1994), future work should look towards quantifying household use of forests, adding the aspect of how resource-use has changed over time. In the same way as Wagner and Gobster (2007) socio perspectives could then be integrated with quantitative changes, selecting indicators that can give more concrete evidence on the health of eco-system services and how these are being impacted.

Another is its inability to capture the underpinning social, cultural and political assets that drive resource-use, adoption outcomes and future aspirations. Drawing from the broader literature and visual observations, communities that had updated

resource agreements, in this case community three in the north, tended to have better forest recovery (Nakakaawa et al., 2015; Sassen et al., 2013). In other cases, concern over implementing agencies motivations persisted where language such as 'cheating' and 'stealing' were used during the PRA workshops. Likewise, in some of the mapping exercises there was a long deliberation as to where the park boundaries should be drawn. In one case, an elders interpretation was overridden by younger member who argued that the researcher should be under the impression that communities had more land. Unresolved until today, continuous contests over ownership continue to hamper conservation efforts.

Often forgotten in project design, participation and the distribution of benefits also act as significant factors in determining efficiency. In the most centralised network where non-members aspired to greener futures (Jeha et al. Chapter 3), an attendee highlighted that, ***" Leaders do not have enough facilitation and sometimes are not capable of supporting farmers the way they need to be. Empowerment, accountability and transparency are big issues that need to be overcome."*** In community three, where the CBO has no local council leaders in positions of power (Jeha et al., Chapter 5), it was stated that, ***"benefits are causing jealousy in the community, especially politicians who want to oversee or take some of the them."*** Like a comparative analysis of 136 (Brooks, 2016), the success in some study sites illustrates that economic and ecology win-wins are feasible outcomes of conservation interventions, however, typically come at the expense of social ones (Jeha et al., Chapter 5). Be it moral (poverty alleviation), legal (through the social safeguards written in international policy) or for pragmatic reasons (willingness), current designs need to pay greater attention to issues of equity (Corbera, Brown and Adger, 2007; McDermott, Mahanty and Schreckenberg, 2013; Pascual et al., 2010) and utilise the appetite for collective action and improved environmental management. To avoid being rejected, implementing agencies also need to give farmers the freedom of choice to select the activities they desire the most (Abunge, Coulthard and Daw, 2013).

Conclusion

In the vacuum of published evaluations, this study has successfully demonstrated some of the multi-faceted impacts of conservation interventions on cultural landscapes. It has given primacy to those most affected (Woodhouse et al., 2015), allowing them to map the processes, define the indicators and observe the changes occurring in their lifetime (Gillson, 2015).

Using a setting that has seen and continues to host a plethora of development agencies, its strength lies in its focus upon mapping the cumulative outcomes rather than disentangling sometime indistinguishable project impacts. With the emphasis of creating value to the landscapes outside the park, it has paid greater attention to measuring on-farm changes, sufficiently demonstrating that despite improvements to household income, by and large policy interventions have failed halt habitat degradation in an area facing rapidly growing population pressure. Without quantifying forest use, few conclusions on whether livelihood diversification is reducing pressure on the National Park or sufficiently substituting the benefits provided can be drawn. Nonetheless, having pieced together external information and coupled this with drawn features, such as park boundaries and attention to details such as enrichment planting, correlations between positive environmental attitudes and conservation can be inferred.

Typically differentiated according to gender, separating groups according to CBO membership has provided valuable insights as to who has access and control of benefits in this setup. As proactive members of their society, from an implementers perspective, working through these groups ensures some level of efficiency, however, more emphasis to target different people may be a crucial factor in up-scaling activities. Including these different perspectives in the sustainability discourse is a vital first step. With the aspirations of a green future, further use of spatially explicit land-use planning can provide an open environment to negotiate trade-offs, whilst clarifying the rights and responsibilities of each citizen which is still needed in the Mt. Elgon context (Sayer et al., 2013). Above all, it can be used as a tool that promotes the continual learning and the adaptive co-management relationships required for sound environmental management.

Chapter Five

Equity in Access: Using Network Analysis to examine the role of Social Capital in the Participation of the Mt. Elgon Regional Ecosystem Conservation Programme

Equity in Access: Using Network Analysis to examine the role of Social Capital in the Participation of the Mt. Elgon Regional Ecosystem Conservation Programme

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Abstract

As incentive-based conservation programmes become common, and in some circles seen as a way to harmonise development and conservation agendas, the 'eligibility, ability and willingness' of stakeholders to actively engage in these interventions is a crucial feature of their success. In practice, contextual realities, predetermined policy conditions and social structures all affect broader community participation.

Using network theory, the Mount Elgon Regional Ecosystem Conservation Programme (MERECP) is used as a case study to examine how different socio-political dynamics affect the implementation and use of conservation funding under devolved ownership. By mapping four community-based networks (including the position and well-being of their actors, their social ties and the overall structure of these networks), the study investigates how the capability of heterogeneous smallholders influences their access to MERECP credit.

The analysis reveals that in all cases richer landowners occupied core network positions and in turn possessed a higher likelihood of receiving cash. In the most centralised network (where a few dominant individuals took control) such equity gains were further hampered. Conversely, in the Community-Based Organisation network devoid of actors from political positions with the greatest access to external support created the highest level of MERECP information exchanges, quoted the most beneficiaries and adopted the most diverse number of conservation technologies. These findings signify that more successful forms of decentralisation emerge when communities have built a high level of trust both amongst one another and with supporting organisations. Subsequently, this research argues that 'co-management' is central to participation at the grass-roots level as communities still require external

guidance to: a) build positive conservation attitudes; b) install a level of downward accountability; c) transfer technical knowledge; and d) act as a safety net of information sharing when internal members fail to do so.

Introduction

At the heart of modern day conservation strategies is the 'subsidiary principle' in which decentralised forest management is being promoted through increased citizenship and community participation (Fontana and Grugel, 2016; McDougall and Banjade, 2015). Stemming from the 1992 Rio Convention Biological Diversity, the international policy-making arena has prioritised such devolution through eco-system based approaches (Second Malawi Principle)[2]. The main argument being that (if) engaged adequately, local people foster the knowledge systems and collective action (Putnam, 1993, 2000) required to reduce stress and even halt unsustainable resource extraction (Ostrom, 1990). From a legal perspective this shift is endorsed through transparency, legitimacy and accountability (Dong and Olsen, 2015; Parker, Thapa and Jacob, 2015), yet pragmatically is founded on ascertaining more equitable outcomes for the marginalised communities that typically characterise these areas (Oyono 2004; Plummer Armitage 2007; Ribot 2002).

In reality, contextual realities and predetermined policy conditions all shape the participation levels required in making meaningful ecological gains (Macfarquhar and Goodman, 2015). Local people are not homogenous entities (Agrawal and Gibson, 1999; Namara, 2015; Ribot, 2002). They differ in their histories, social structures and belief systems that not only affect their ability to actively partake in conservation-related activities but their desire to do so (Kolinjivadi, Gamboa, Adamowski and Kosoy, 2015; Robinson and Berkes, 2011). Whilst it is almost impossible to design a one-size-fits all policy intervention, it would be misguided to believe that devolved ownership automatically equates to greater results for conservation and equality. Decentralised governance systems are susceptible to the same power asymmetries as their higher order counterparts where those who are in a better position to articulate

[2] Malawi Principle 2: Management should be decentralized to the lowest appropriate level (1998) Fourth Meeting of Conferences of Parties.

themselves wield the most influence and in turn derive the most benefits (Anderson, Mehta, Epelu and Cohen, 2015; Chomba, Nathan, Minang and Sinclair, 2015). A factor amplified when policy designs are complex, target specific institutions (both formal and informal) and contain rigid eligibility requirements (Kosoy, Corbera and Brown, 2008; Nakakaawa et al., 2015).

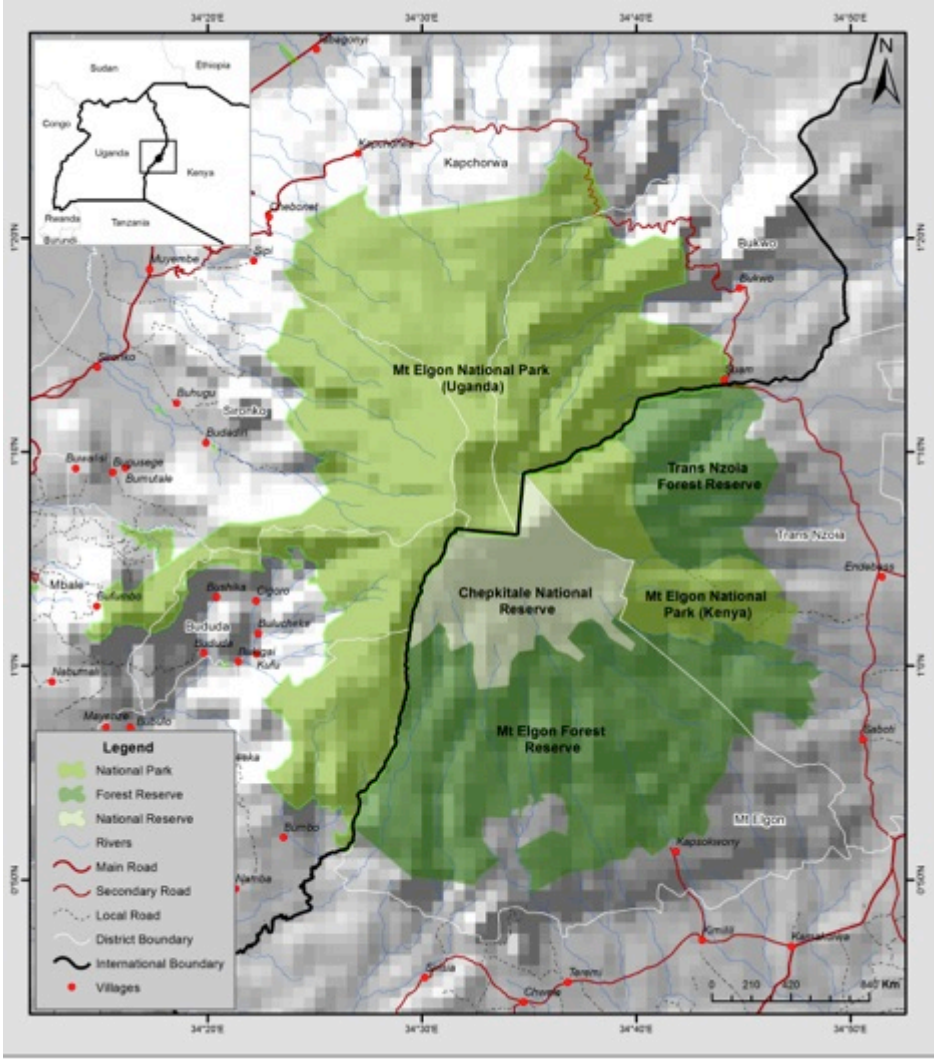
With the scale, complexity and dynamic nature of communities, collating and understanding these socio-political features can be difficult. Nevertheless, systematic reviews of existing interventions can help identify efficiency and equity trade-offs whilst avoiding common pitfalls (Angelsen, 2008). Considering the growing popularity of incentive-based conservation schemes, including the development of Reduced Emissions from Deforestation and Degradation Programme (REDD+), this chapter evaluates the adaptive capacity of Community-Based Organisations (CBOs) in executing the Mt. Elgon Regional Conservation Programme (MERECP) revenue-sharing scheme. Applying social network theory, information networks (and the characteristics of their components) are reconstructed at the local level. This uncovers who holds the most power under decentralisation and which network structures result in greater dispersal of knowledge and overall participation levels. The chapter begins with a short description of the MERECP case study, followed with the rational of using Social Network Analysis (SNA) as an analytical tool. The discussion then presents a critical evaluation of how MERECP network properties influence resource governance, before placing these findings into the broader Mt. Elgon context.

Mount Elgon: A Ugandan Perspective

Bisecting the Uganda/Kenya border is the extinct Miocene volcano home to the Mt. Elgon Protected Area (PA). Rich in closed canopy tropical hardwood, bamboo and heath moorlands high in endemic flora; this forest eco-system hosts some seventy six threatened species of global conservation value (Nakakaawa et al., 2015). Protected under different jurisdictions (Fig 25), in Uganda, a single 1120 km^2 National Park (NP) is administered by the Uganda Wildlife Authority (UWA) (Sassen et al., 2013).

Below these demarcated boundaries smallholder farmers have converted the landscape into intensively managed crop production sites intertwined with animal

Figure 25. Map of Mt. Elgon, Uganda and Kenya. For anonymity, exact location of selected study sites is not revealed.



Adapted using data on Mt. Elgon boundaries and forests from Sassen et al (2013). Protected Area Boundaries sourced from UN EP-WCMC

rearing and *Eucalyptus* woodlots (Hitimana, Kiyiapi and Njunge, 2004; LVBC, 2012). The abundant rains, fertile soils and access to the parks environmental income and services have made this one of most populous (1.6 million people) and rapidly growing regions (3.4% per year) in east Africa (Nakakaawa et al., 2015).

Inhabiting the Ugandan side are two distinct ethnic tribes: the nilo-cushitic Sebei and the Bagisu of Bantu decent. Once in direct conflict over land, the occupying Sebei

maintained their territories in the north of the mountain whilst the Bagisu retreated to the south (Pétursson, Vedeld and Sassen, 2013). Historically, the Sebei and Bagisu practised very different livelihood strategies. The forest dwelling Sebei were nomadic pastoralist, supplementing their diet with herd and forage from within the forest (Himmelfarb, 2005); whereas the Bagisu cleared land for agriculture. Despite their differences, both tribes have longstanding cultural (burial and circumcision sites) and use (wood, medicine and food) values associated with the park (Nakakaawa et al., 2015). They have both faced harsh evictions creating resentment towards park authorities and negative conservation attitudes (Oonyu, 2009). Most notable is the case of the Sebei, who were displaced from the elevated heath moorlands to the peripheries of the protected area in 1983 (Himmelfarb, 2005; Sassen et al., 2013). This denied access, especially to the grazing of their livestock, soon made these hunter-gatherers alter their livelihood practices towards the intensive cultivation of maize, potatoes, beans, coffee and bananas.

Inside a landscape with soil properties and topography that are naturally prone to landslides, escalating human pressure and conflict on Mt. Elgon is causing severe soil degradation, habitat loss, water pollution and homelessness (Claessens et al., 2007). In a bid to reconcile such hostile relationships and build sustainable livelihood strategies, over the past twenty years conservation initiatives and resources agreements have been put into place (Oonyu, 2009). Aided by international funding, their main agenda has been to reduce deforestation and promote habitat restoration through the development of on-farm diversification. The techniques introduced include: soil erosion measures, agroforestry, tree crops, zero grazing and the introduction of mix-breed cattle and energy saving cook stoves (Muhweezi, Sikoyo and Chemonges, 2007).

MERECP

Jointly funded by the governments of Norway and Sweden, MERECP is one of the latest International Conservation and Development Projects (ICDP) to be launched across Mt. Elgon. Initiated in 2006 by the International Union for the Conservation of Nature East African Community, with the support of the Lake Victoria Basin Commission (LVBC), the programme was re-designed in 2008. Unlike its

predecessors, MERECP developed a novel trans-boundary ICDP founded between the countries of Uganda and Kenya (Mwayafu, Kimbowa and Graham, 2012). Placing a greater emphasis on the role of decentralised governance, MERECP focused on bridging and strengthening the capacity of different institutional bodies from both countries. Thereafter funds were channelled towards National Governments, Protected Area Management Institutions (PAMI), Focal Point Ministries (FPM) and local communities to help support this procedure (Hoefsloot, Kahata and Nsita, 2011). With the principal objective of incentivising environmental stewardship, the programme primarily linked livelihood improvement and adaptation through the implementation of different participatory benefit-sharing models (Larsen, Kamugasha and Karani, 2008).

The Community Revolving Fund (CRF)

Having been used in other rural development settings around the world, one of the benefit-sharing schemes introduced by MERECP was a Cash Revolving Fund (CRF). Based around the concept of micro-finance, the purpose of CRF was to offer households at the periphery of the National Park (NP) the economic freedom to invest in sustainable Income Generating Activities (IGA). It is hoped that the scheme will secure greater longevity in payment dispersal as (unlike most incentive-based payments); participants of the CRF scheme were expected to repay loans with a small interest component. This feature makes it a 'revolving' rather than a sinking fund (Mwayafu, Kimbowa and Graham, 2012).

Partaking in technical micro-credit training and accepting a start-up fund of 10,000 USD, twenty Community-Based Organisations (CBO's) established their own criteria for lending along with unique terms and conditions for repayment. Built on existing constitutions, ownership and control of these funds was completely devolved to the grass-roots level and based on a 'learn-by-doing' management approach. It is important to note that selected CBO's were already in existence before external sponsorship was offered. Capitalising on pre-existing conservation networks, communities were purposely selected on their good reputations via consultations with extension staff and community informants. District governments were subsidised to monitor and evaluate these interventions which means an element of

'adaptive co-management' was envisaged in MERECP's design; in particular, their role in providing technical knowledge and managerial support. Despite some aspects of devolved ownership, this overall approach remains top down as centralised decisions determined which communities the project engaged with, the manner in which this was done and the benefit-sharing model introduced (Chow, 2015) .

Devolution Successes: The role of Social Capital, Common Knowledge and Collective Action

Governance, "the structures and processes by which people in societies make decisions and share power (Folke et al. 2005)," is central to the CRF decentralisation process. In turn, the capability of community members to actively engage in governance, is heavily dependent on localised social capital such as the willingness of stakeholders to participate (Knight, Cowling, Difford and Campbell, 2010). Defined as 'the norms and networks facilitating collective action for mutual benefit' (Woolcock, 1998); social capital is inclusive of relations of trust, reciprocity and exchanges, common rules and connectedness (García-Amado et al., 2012). In this context, collective action is 'the action taken by a group (either directly or on its behalf through an organisation) in pursuit of members perceived shared interests (Marshall, 1988). Common knowledge, the 'set of understandings embedded in a given social structure which enables putting resources to a particular use (García-Amado et al., 2012)', is what specifically transforms social capital into collection action (Ishihara and Pascual, 2009). Appreciating and optimising the interplay among social capital, common knowledge and collective action is therefore critical when assessing co-management relationships between agencies promoting conservation and the individual action taken by farmers (Pretty and Smith, 2004).

Network Analysis as a Proxy of Participation

When the twenty CBO's came together and agreed to implement a CRF, they engaged in co-ordination, trade-off sharing, information building and exchange of common knowledge (Bodin and Crona, 2009). Empirically mapping the actors (nodes) and relationships (ties) established during this process (a technique known as Social Network Analysis (SNA)) who and what types of knowledge are driving participation on the ground will be investigated (Stein, Ernstson and Barron, 2011). In the

conservation context, interventions may be unsuccessful if the readiness and ability of stakeholders to work together is low. Given that Mt. Elgon's socio-ecological system has suffered conflict, poor management and still has unresolved boundary disputes, rural farmers may be unwilling to co-ordinate actions due to the lack of trust. Nonetheless, mapping social networks to understand participation can lead to a more strategic implementation (Ajani and Tijani, 2009). For example working with members of the community that have acquired trust and respect amongst their peers (Corbera and Schroeder, 2011).

Social networks can also be used to indicate whether stakeholders are clear and agree on the purpose, goals and impacts of the CRF, i.e. is the programme being implemented in a transparent manner? Early narratives from existing interventions reveal that acceptability and what communities deem fair, is not just based on their direct involvement in a project, or the material assets they stand to obtain, but being able to voice their personal opinions and question the decision-making process (Macfarquhar and Goodman, 2015; Oonyu, 2009). Especially, as Robinson and Berkes (2011) highlight, when people have the freedom to deliberate, i.e. "confer, ponder, exchange views, consider evidence, reflect on matters of mutual interest, negotiate and attempt to persuade each other'' (National Research Council, 1996).

Structural aspects of social networks, such as their level of cohesion, can either impede or promote such activities (Isaac and Dawoe, 2011; Stein, Ernstson and Barron, 2011). Particularly whether those who hold power allow project training and education to penetrate to the grassroots level. Examining information flows can uncover whether people are aware of impacts of Climate Change (CC), deforestation and degradation on their ecosystems and consequently the purpose of MERECP's intervention. Do they appreciate the technical terms and conditions set for accessing and repaying loans or more importantly that the money is not simply a hand out. With the accounts of poor downward accountability in Uganda, elite capture, nepotism, corruption and politicisation are realistic risks for the project (Cooper & Wheeler 2015). Such poor implementation not only limits access to such pertinent information but also erodes trust, making communities less likely to adapt to change in the future (Cooper and Wheeler, 2015; Macfarquhar and Goodman, 2015).

MERECP's approach of targeting CBO's is certainly a cost-effective and operational way of fostering the collective action required to implement the CRF as these groups have already established the agency and level of mutual understanding needed for effective information exchanges (Prell, Reed, Racin and Hubacek, 2010). Such groups, however, assemble amidst a heterogenic population through their shared interests and similarities, be it wealth, education, language capabilities, ethnicity etc. (Grannovetter, 1973; Newman and Dale, 2007). Whilst, like-minded people are predicted to interact more, known as homophily in SNA, others are often ignored creating fragmented networks (Yuan and Gay, 2006). This may limit benefit-sharing and create further resentment in communities.

With these factors in mind, the following research will explore participation within the broader concept of social capital. It will focus on relationships of trust, communication and co-operation (Baynes et al., 2015).

Methods

Study Site Selection

Following several focus group discussions with participating MERECP CBO's, four study-sites, from four different districts in Mt. Elgon Uganda were sampled (Table 16). Working across Manafwa, Bududa, Sironko and Mable, CBO's were selected according to their willingness to participate in the research, ethnic diversity and the differences in CRF criteria and implementation. Membership, and the subsequent number of villages they came from, varied for each CBO, as did their access to roads and markets. In these circumstances, standardisation was difficult however, this variety will be used as a point to compare and contrast qualitative differences seen in participation levels (Berman, Quinn and Paavola, 2014; Crowe, 2007).

Table 16. Summary of CBO Activities.

CBO	Majority Ethnicity	Membership Composition and Fees	Loan Terms and Conditions	Group Activities
1	Bagishu	- 120 Members -Membership from three sub-counties -TACC funding received -Membership fee UGX 5000 -Registration fee UGX5000 -CRF UGX 20 million	-Repayment 4-12 months -Interest rate 3% -All loans have to authorised from the LC1 -Membership required to access loan -Guarantors that are existing members of CBO required to access loan	-Energy saving cook-stoves -Horticulture seedlings -Tree nursery -Zero-grazing -Trench digging -Napier grass Planting
2	Bagishu	- 83 Members -Membership UGX 20,000 -UGX 23 Million from WWF -UGX 3.7 Million from UWA -TACC funding received	-Interest Rate 2% -Loans up to UGX 400000 -Repayment after three months -Membership required to access loan	-Horticulture seedlings -Zero-grazing -Bee-keeping -Tree nursery (especially fruit) -Trench digging -Napier grass planting -Bee-hives
3	Sabiny	- 411 Members -Registration fees UGX 10,000 -Annual Subscription UGX 20,000 -8 sub-groups -Membership from one sub-county -UG X 15 Million Received from Deforestation Avoidance Fund -UGX 650 000 from HIEFER International	-Interest rate 10% -Repayment period depends on activity -Membership required to access loan -Loans range from UGX500,000- 1 million -Loans giving to sub-groups -Money invested in group activities	-Bamboo demonstration -Fish pond demonstration -Trench digging -Bio-gas -Woodlots -Dairy cows -Bee-hives -Tree nursery -Coffee pulping machine -Infrastructure -Napier grass planting -Zero-grazing
4	Bagishu	-36 Members -Membership UGX 5000 -Subscription UG 10000 -Membership from one village -CBO received no other funding -Group Savings	-Interest Rate 10% -Repayment after a year -Money invested in group activities	-Woodlots -Dairy Cows -Apiary -Coffee nursery -Trench Digging -Napier grass planting

Note: *In the absence of clear record keeping, and with conflicting data published online, information cited here is from focus group discussions with executive CBO members.*

Study Design

A single data collection period was conducted between September 2013 to March 2014. In each of the respective sites, this began with a ten to fifteen person focus group discussion introducing the community to the research team and objectives. Comprised of men and woman of different ages, socio-economic backgrounds and affiliated to different organisations, a wealth-ranking exercise based on community-specific criteria followed (Appendix 1.C Table 1). Here participants were asked to define four different wealth categories based on common (material and non-material) indicators (see Appendix 1, Table A.1 for full results). Starting with a randomly selected household from a list of CBO members, a total of one hundred and thirty two in-depth, semi-structured interviews at the house level and thirty-one at the expert were then conducted (see Appendix 1 for survey guidelines). With permission of the survey respondent, interviews were tape recorded, transcribed verbatim and thematically coded following a discourse analysis approach (Weiss et al., 2012).

Using one set of interviews, two separate network questions were asked. With some of the same actors listed in both, this chapter only focuses on MERECP networks. Following an egocentric design, i.e. one in which an ego and their alters are mapped as opposed to a complete network (Prell, 2012), a five actor free recall name generator technique was used in the household interviews to identify "From whom did you receive information about the MERECP intervention?" The farmers listed within the community became the further study participants, also referred to as snowball sampling (Prell, 2012). The fact that "A" mentioned "B" does not necessarily imply that "B' mentioned "A" therefore a directional, binary, actor-by-actor matrix is derived (García-Amado et al., 2012).

Without a natural frontier, a combination of relational and positional approach was taken in defining the network boundary. Executive members of the CBO and local leaders (culturally important) were purposively sampled (positional), however, the sampling in each study site finished when the same names were continuously repeated (relational). With the interest of appreciating participation of community members, information networks at higher management level were not tracked and

were simply crossed-checked as a form of triangulation. The ties that respondents mention beyond the community (31 expert interviews) were simply used to cross-check information given by communities and used to explain contextual realities (García-Amado et al., 2012). Consequently the size of networks sampled varied between the different study sites and no statistical analyses between villages can be made, however, a qualitative comparative interpretation of what network structures result in better adoption of technologies will be (Berman, Quinn and Paavola, 2014; Crowe, 2007). In addition to sources of MERECP, participants were asked to identify which types of information they received from each actor (common knowledge), whether they participated in the CRF, their perceptions of the programme and what they believed future benefit-sharing schemes should look like. Combing indicators outlined during the well-being ranking (Appendix 1, Table A.1) and those identified in the national survey report (Ministry of Finance 2001), at the end of the interview each household was then placed into a corresponding wealth category.

It is important to highlight that as an outsider, obtaining accurate membership information, clarity on recipients of loans and proof of repayments was problematic- a procedure made worse by the lack of trust, conflicting narratives and being unable to differentiate the effects of the CRF with other similar interventions. Bearing these issues in mind, these results will report participation cited during interviews regardless of their inconsistencies with other data sources. Here, participation is taken as either having had or being offered a CRF loan from MERECP cash inputs (distributional outcomes). Despite some descriptions that clearly resembled those of other conservation programmes (WWF/IUCN/TACC), access to MERECP information and membership statistics are used as an indication of the underlying procedural processes. Keeping a fieldwork diary during the research period, which was spent living near study sites and observing current interventions, the discussion will then be used as an arena to explore the context of these findings, piecing together different narratives.

Network Analysis

Descriptive statistics and structural characteristics of knowledge networks were analysed using the UCINET Programme (Borgatti, Everett and Freeman, 2002). All

visualisations were created using NetDraw (Borgatti, 2002) where a multidimensional algorithm was used to lay out actors based on their similarity in geodesic distances (shortest path lengths) to other actors (Weiss et al., 2012). The size of the nodes signals an actor's eigenvector centrality (see below for more information), the symbol the type of actor they were (based on the highest governance level they belonged to) and the thickness of ties the relative degree of information exchange. Respondents who failed to list actors and were not mentioned by any other (i.e. had no ties) were represented in network visualisations however, had to removed from some statistical analyses for them to be valid. Features of the network were measured at two scales: the entire network and at the individual level.

Network Cohesion and Composition: Characterising the Whole Network

To measure the overall structural cohesion found in a network, an indication of the level of common knowledge, trust, reciprocity found in a network (Bodin and Crona, 2009), density and two centralisation statistics were used in this study (Stein, Ernstson and Barron, 2011). Calculated by quantifying the proportion of all existing ties to the number of all possible ties, density shows whether all members in the network are receiving or providing information (Weiss et al., 2012). 1 indicates that all actors are connected and 0 that the whole network is disconnected (Prell, Hubacek and Reed, 2009; Vignola, Mcdaniels, Scholz and Rica, 2013). In accompaniment to network density, centralisation statistics were used to depict the degree to which overall networks are organised around focal actors. In a highly centralised network, only one or two powerful actors exist. In a decentralised network there are a higher number of relational ties among different actors in the network. The degree statistic applied here quantifies to what extent ties are connected to a vocal actor in an ideal 'star' configuration (100 % centralisation) (Hanneman and Riddle, 2005; Weiss et al., 2012). To track the directional flow of information, especially whether those who are receiving information were also giving information, the data are not symmetrised (which is sometimes necessary to run certain statistics). This gives an outdegree value (% of outward going ties) and indegree (% of inward going ties) (Barnes-Mauthe et al., 2013).

Actors not only shape a network by the number of ties they maintain but their strategic placement within that network. In some cases networks break into smaller groups where a few key actors bridge them into a single system (referred to as cliques in SNA). Such actors might be CBO members or district officials that transfer information from the MERECP administration to the community. At the macro-level, the percentage of all geodesic paths that link one group to another through a single actor is quantified using the metric betweenness centrality (Hanneman and Riddle, 2005). A high betweenness centrality represents a clumpy network consisting of structural holes with bridging characteristics (Prell, 2012). In this scenario, the network is not very resilient, depending on a few prominent actors to bridge information (Prell et al., 2010).

Understanding Power: Homophily and Actor Centrality

After grasping the overall level of cohesion within the four networks, the role of individuals in shaping them was then investigated using eigenvector and betweeness centrality. The SNA theory assumes that the number and type of relational ties you maintain is an indication of the power you occupy. This is based on the notion that actors that interact more often, or with the right type of actors, are more likely to receive valuable information, wield influence and mobilise resources (Bodin and Crona, 2009; Weiss et al., 2012). The most intuitive measure of this is the number of ties an individual actor holds (degree), however, the type of ties you hold are equally as important. For example, an actor may have a few ties, but these ties are established with actors who are well connected to others, i.e. at the core of the network (Barnes-Mauthe et al., 2015). Known as eigenvector (Bonacich, 1972), in this analysis it is assumed that higher scoring actors hold greater influence within their network (Prell, 2012). Subsequently the specific individuals who are bridging different groups, including cross-scale links, were calculated. At the micro-level this is the extent to which an actor falls on the shortest geodesic path length between two others who are not directly connected (Freeman, 1979).

Finally, to test the theory that individuals are more likely to interact with others similar to themselves (McPherson, Smith-Lovin and Cook, 2001), an ANOVA density model of variable homophily is used to assess whether CBO membership affected

participation levels. Building on the density statistic this model tests the probability that within-group ties (bonding) density differ from between-group tie (bridging) density (Berman, Quinn and Paavola, 2014; Hanneman and Riddle, 2005).

Combining this theory with the objective of exploring participation levels, the aforementioned SNA statistics were used to test the following hypotheses: -

H_1: CBO's whose associational networks are densely connected, decentralised (i.e. few dominant actors) and comprised of supporting extension officers acquire higher levels of community participation.

H_2: The local elite (i.e. actors from higher socio-economic and political status) hold the most discretionary power in disseminating MERECP information, possessing the highest-ranking eigenvector centrality measures and in turn participation levels.

H3: Communities that exhibit lower levels of socio-economic and membership homophily (i.e. within group sharing) acquire higher participation levels.

Results

Network Cohesion and Composition

Within all four sites, MERECP information sharing networks comprised of different actor types, relational ties and levels of participation (Table 17). Network 1 had the largest number of respondents and most diverse actor typology, yet lower levels of respondents accessing information and loans. Network 2 and 3 included a similar number of actors, yet had marked differences in their composition. A quarter more of the respondents in network 3 had established information sharing ties in comparison to network 2. The availability of a board and diverse set of network connections enabled nearly all of the actors to access some degree of MERECP knowledge (94%). This was followed with higher participation levels and a greater likelihood of receiving a loan (32%), especially as CBO member (80%).

Table 17. Summary of network participation levels

Network	Nº of Respondents	Respondents who were CBO Members (%)	Respondents Participating (%)	Respondents Accessing Information (%)	CBO Members Participating (%)
1	47	53	26	64	48
2	35	51	26	69	50
3	34	29	32	94	80
4	16	56	38	63	67

Note: *CBO participation levels are calculated according to the number of CBO members interviewed, not quoted in focus group discussion*

Network 4 was substantially smaller than all the other networks with respondents only coming from one village. With fewer people to share with, and a greater chance of interviewing a participant, the percentage of loan-takers was the highest. Nevertheless, access to MERECP information was the lowest, unexpectedly so, given the likelihood that more actors will connect to a higher proportion of others in a smaller network.

Considering the size and structure of the four sampled networks were very different, all possessed relatively low density and centralisation measures (Table 18). This was due to the study design where snowball sampling was used to identify an ego-network and alters were not asked if the relationship was reciprocated (lower out-degree). Comparatively, network 1 was the most centralised, possessing the highest in-degree (information moving through fewer actors), yet exhibited features of low network cohesion. More than a quarter of the network received no information surrounding MERECP (26.2%), with a tendency to form groups (higher betweenness centrality). In contrast, network 3 was the most cohesive obtaining the highest number of relational ties with lower betwenness centrality figures to network 2 of equal size. Nevertheless, network 2 still displayed relatively high levels of structural unity achieving the second highest level of knowledge dissemination.

Table 18. Summary of cohesion measures at the whole network scale

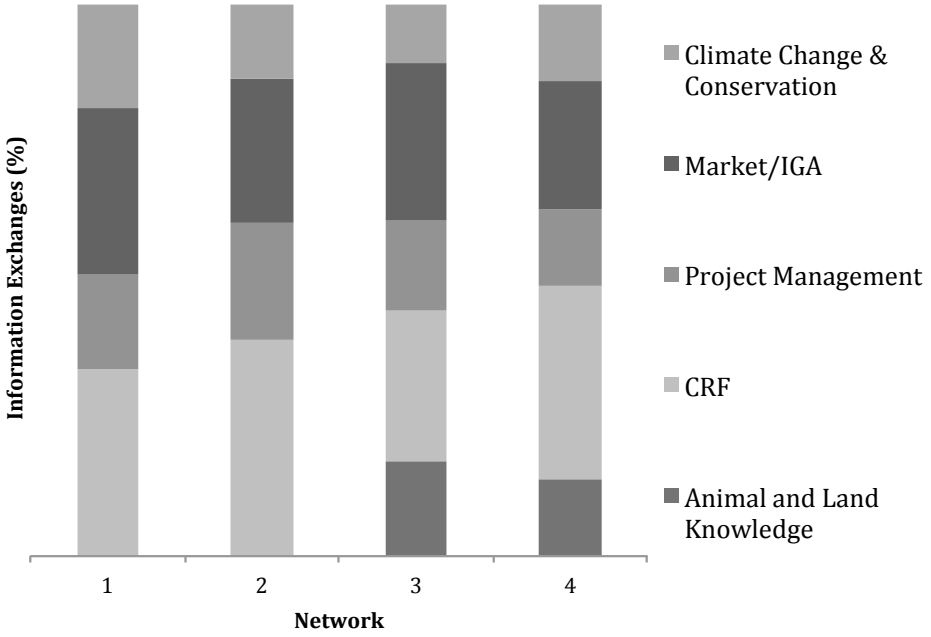
	1 (n=61)	2 (n = 54)	3 (n=54)	4 (n=24)
Number of ties	87	83	95	32
Density (d)	0.02	0.03	0.03	0.06
In-degree (%)	33.17	29.7	29.7	30.25
Out-degree (%)	6.10	7.00	6.2	16.64
WholeNetwork Betweenness (%)	3.35	2.91	1.76	6.61
Isolated Actors	16	10	2	6

Note: *Statistics run on data with isolated nodes.*

Of the ties established, nearly a quarter (if not more) were based on the general terms and conditions of the CRF (Fig. 26). Across all four networks there was a good understanding of the purpose of the loan, or references to other on-farm diversification efforts, as numerous information exchanges were built upon knowledge surrounding market access, technology choice and other income generating activities. For communities that invested in mix-breed cattle and biogas, the reference to animal and land management knowledge was more substantial (Network 3 & 4). Overall, the percentage of information shared surrounding MERECP's overarching aims and objectives, those of conservation and climate change, were low.

Grouped according to management level, Table 19 provides a detailed list of the actors involved in MERECP information networks. With no formal association with the programme, extension officers belonging to the National Agricultural Advisory Services (NAADs) were common knowledge mediators throughout all networks. Similar government or private led agricultural and development programmes played a particularly dominant role in network 3, whereas actors in political positions were mainly void. Brought in to help implement and monitor the programme, district staff and the Uganda Wildlife Authority assisted MERECP information flows throughout all of the networks.

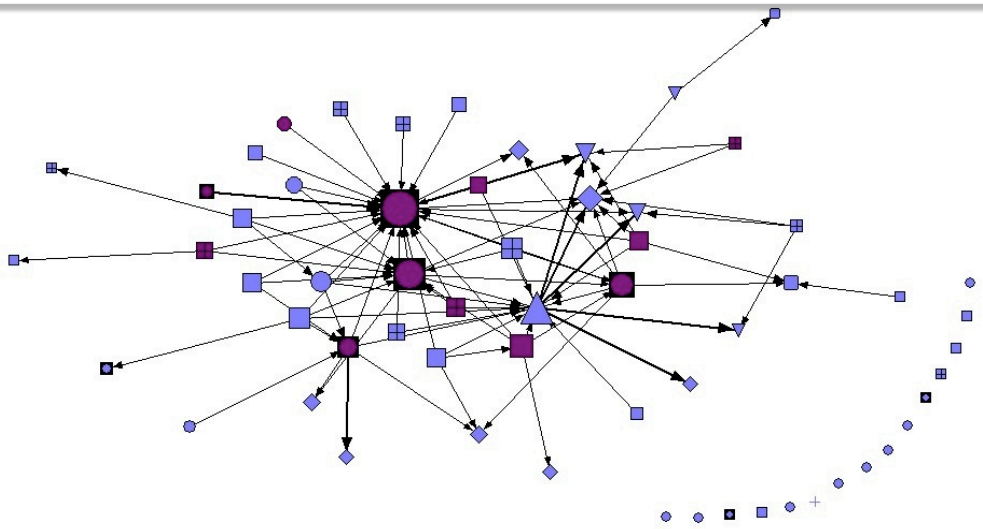
Figure 26. Composition of knowledge exchanged in MERECP information ties



Actor Centrality

Amongst the different actors, trained CBO members remained the most prominent brokers in disseminating MERECP knowledge. Establishing more relational ties with supporting organisations, they sat in close proximity to these actors within network configurations (Fig. 27, 28, 29 and 30) and obtained higher betweeness centrality values (Table 20). Consequently, with greater access to vital knowledge these members exercised the greatest control, occupying core positions and acquiring higher eigenvector centrality values (as indicated by larger node size). Confirmed in each of the networks using a two-sampled t-test, actors with a high eigenvector centrality were also significantly more likely to obtain a loan ($p > 0.01$; participants shown in dark purple in sociograms).

Figure 27. Network one MERECP-information sociogram. The size of each node correlates with Eigenvector centrality for each actor (larger nodes reflecting higher centrality). Arrows indicate directional relation with thickness representing the relative degree of information exchange. Nodes in dark purple are loan-takers. The shape of the node indicates the type of actor (refer to **Table 19** for more information about actor type).



Actor Key

Small-holder Farmer		Local Council (village)		Private Developer			
CBO Member		Sub-County Council/Government		Religious Affiliation		NGO	
Executive CBO		District Government		National Government			

Figure 28. Network two MERECP-information sociogram. The size of each node correlates with Eigenvector centrality for each actor (larger nodes reflecting higher centrality). Arrows indicate directional relation with thickness representing the relative degree of information exchange. Nodes in dark purple are loan-takers. The shape of the node indicates the type of actor (refer to **Table 19** for more information about actor type)

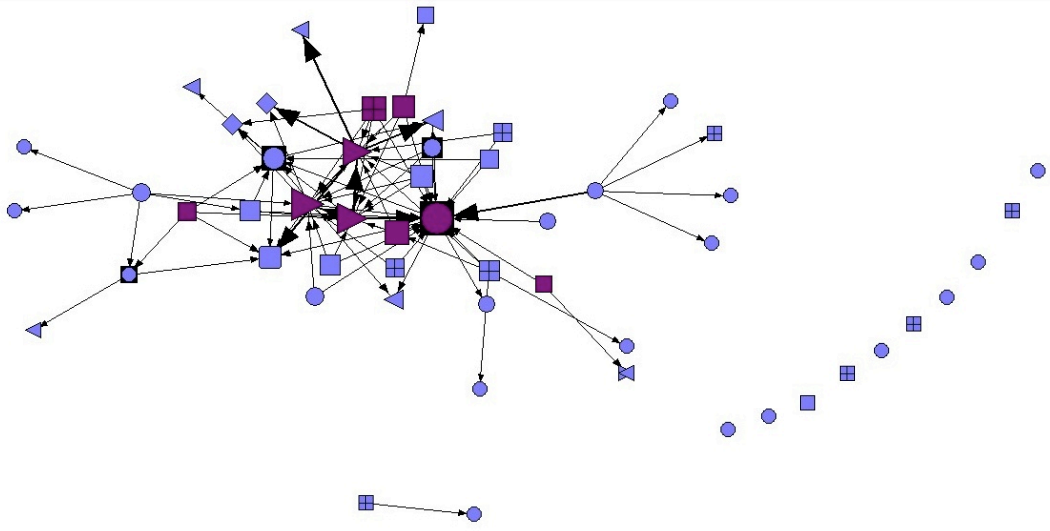
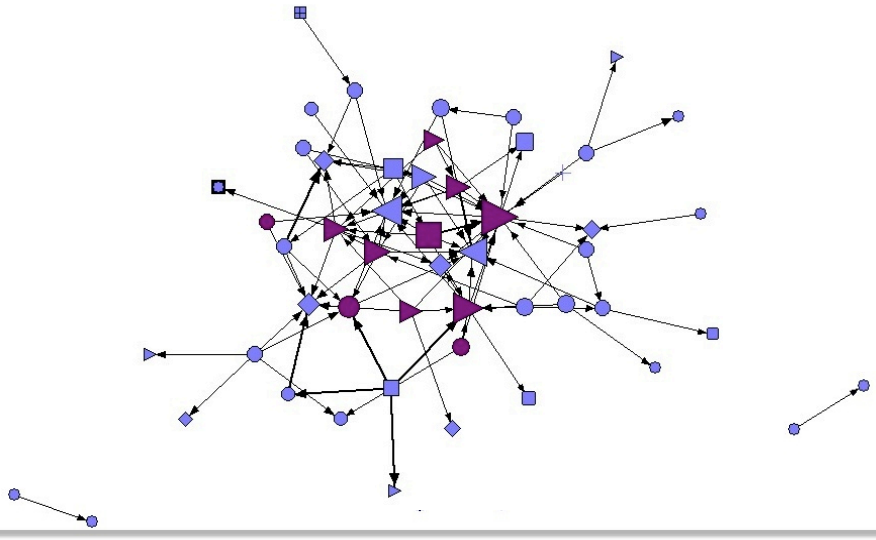


Table 19. Type of actors/organisations linked to MERECP information networks, grouped by management level

Actor Typology	Network 1 (16)	2 (13)	3 (15)	4 (12)
Village	Small-Scale Farmer Ordinary CBO Member Executive CBO Member	Small-Scale Farmer Ordinary CBO Member Executive CBO Member	Small-Scale Farmer Ordinary CBO Member Executive CBO Member	Small-Scale Farmer Ordinary CBO Member Executive CBO Member
Local Council (Village and Parish)	LC1 LC2	LC1 LC2	LC1	LC1
Sub-County Council	LC3 Sub-County Chief	LC3 Sub-County Chief	Agricultural Extension Officer	LC3 NAADs
District Government	Community Development Officer District Natural Resource Officer Environment Officer Forest Officer NAADs	NAADs Environment Officer	Agricultural Extension Officer District Natural Resource Officer Veterinary Officer KADLACC KACODA NAADs Forest Officer	Natural District Resource Officer Agricultural Officer District Internal Security Officer Community Development Officer
Private Developer/Business		Bagishu Co-operative Union	KAWACOM	
Faith-Based Organisation	Reverend		Reverend	
NGO	Mount Elgon Regional Eco-system Conservation Porgramme (MERECP)	Mt. Elgon Conservation and Development Project (MECDP) Mount Elgon Regional Eco-system Conservation Programme (MERECP)	Mount Elgon Regional Eco-system Conservation Programme (MERECP)	Mount Elgon Regional Eco-system Conservation Programme (MERECP)
National Government	Member of Parliament (LC5) Uganda Wildlife Authority (UWA)	Uganda Wildlife Authority (UWA)	Uganda Wildlife Authority (UWA)	Uganda Wildlife Authority (UWA)

Note: *There may be more than one actor listed under the same title, some of which work at different governance levels*

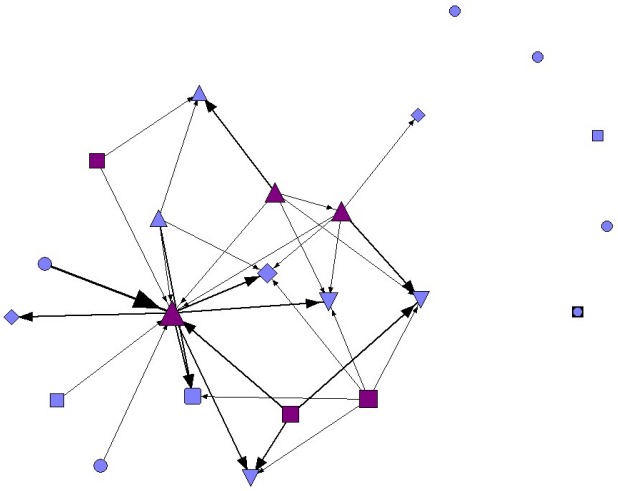
Figure 29. Network three MERECP-information sociogram. The size of each node correlates with Eigenvector centrality for each actor (larger nodes reflecting higher centrality). Arrows indicate directional relation with thickness representing the relative degree of information exchange. Nodes in dark purple are loan-takers. The shape of the node indicates the type of actor (refer to **Table 19** for more information about actor type)



Actor Key

Small-holder Farmer	○	Local Council (village)	⊞	Private Developer	⧖		
CBO Member	□	Sub-County Council/Government	◘	Religious Affiliation	┼	NGO	▽
Executive CBO	▷	District Government	◇	National Government	▢		

Figure 30. Network four MERECP-information sociogram. The size of each node correlates with Eigenvector centrality for each actor (larger nodes reflecting higher centrality). Arrows indicate directional relation with thickness representing the relative degree of information exchange. Nodes in dark purple are loan-takers. The shape of the node indicates the type of actor (refer to **Table 19** for more information about actor type)



Local politicians also featured in all of the networks, especially network one, where they took on executive positions. Managing to uphold their pre-existing roles of authority, these politicians created one of the most centralised networks, where the majority of MERECP information was channelled through them.

Table 20. The top three betweenness and eigenvector centrality actors and their relative wealth ranking in each perspective network.

Rank	Type of Actor	Relative Wealth	Betweenness Centrality	Type of Actor	Relative Wealth	Eigenvector
			Network 1			
1	Sub-County Chief/ Executive Member	Very Rich	3.44	Sub-County Chief/ Executive Member	Very Rich	65.29
2	Executive Member	Rich	1.99	Executive Member	Rich	51.32
3	LC3/Executive Member	Rich	1.74	LC3/Executive Member	Very Rich	49.84
			Network 2			
1	Sub-County Council/ Executive Member	Rich	3.00	Sub-County Council/ Executive Member	Rich	62.68
2	Extension/ Farmer	Very Rich	1.29	Executive Member	Poor	53.41
3	Executive Member	Poor	1.14	Executive member	Poor	49.96
			Network 3			
1	Executive Member	Rich	1.82	Executive Member	Rich	60.31
2	Executive Member	Very Rich	0.77	MERECP Personal	N/A	44.67
3	Executive Member	Rich	0.74	Executive Member	Rich	43.33
			Network 4			
1	Executive Member	Rich	6.62	Executive Member	Rich	74.21
2	Executive Member	Poor	0.30	Executive Member	Poor	48.18
3	-	-	-	Executive Member	Rich	43.31

Note: *Normalised betweenness and eigenvector centrality values reported. Sample Size too small to run statistical test on wealth and centrality*

Broken down according to membership, the ANOVA model of homophily further reveals that within network 1 there were no relational ties established amongst non-members and comparatively lower amount between members (Table 21). In comparison, network 3 had the highest proportion of non-member information

acquisition, in what was overall a fairly dense network and one exclusively governed by smallholder farmers. Most notable were the relationships between community members and umbrella organisations/extension officers. It was the only network in which a MERECP representative was directly ranked amongst the top three most influential actors and one in which external personal founded strong relational ties both with members and non-members. This network confirms hypothesis 1 and 3 that infers that dense networks, with between groups sharing resulting in more participation.

Table 21. Differences in group tie density according to non-members, members and external organisations

Network		Non-Members	Members	External Organisations	Adj R-Square	P-Value
1	**Non-members**	0	6.8	3.8	0.34	<0.02
	Members	0.9	8.2	9.4		
2	**Non-Members**	2.9	2.6	1.3	0.060	<0.00
	Members	1.3	14.1	11.7		
3	**Non-Members**	2.1	5.4	5.9	0.052	<0.00
	Members	0.30	9.0	17.3		
4	**Non-Members**	0	11.1	0	0.141	<0.00
	Members	0	13.9	31.7		

Note :*Organisation–Organisation relational ties were not identified in the network design used in this study.*

Following a snowball sampling design, relatively few actors belonging to the 'very poor' wealth catogery featured in MERECP information networks. Exposing either their low densities within communities or their lack of access to the programme, not a single beneficery came from this wealth class (Fig 31 & 32). In absolute terms, of the interviewed respondents roughly 42% of participants came from 'poor' households and 45% from 'rich.' However, as a proportion of the total number of respondents sampled in each perspective wealth class, richer actors were more likely to have gained acces to a loan than the poor (Fig 31). None of the sampled population in network four belonged to the very rich category, hence not accessing any loans. Of the members interviewed in network 3, the 'very rich' and 'rich' also showed a high

likelihood of recieivng a loan. A similar pattern emerged in network 1, with more favouritism towards richer farmers. Lastly, when comparing the percentage of participants coming from each wealth ranking to the corresponding number of households belonging to that wealth catogery, it becomes even more evident that the 'rich' and 'very rich' are in a much better position to acces a loan than the poor (Fig 32). Supporting hypothesis two, the elite are dominating CRF. Nevertheless, since the majority of households are considered 'poor,' relatively speaking, this wealth class have gained from the MERECP programme.

Figure 31. The percentage of respondents that received MERECP CRF loans as a proportion of the total number of respondents interviewed within their relative wealth class in each of the networks.

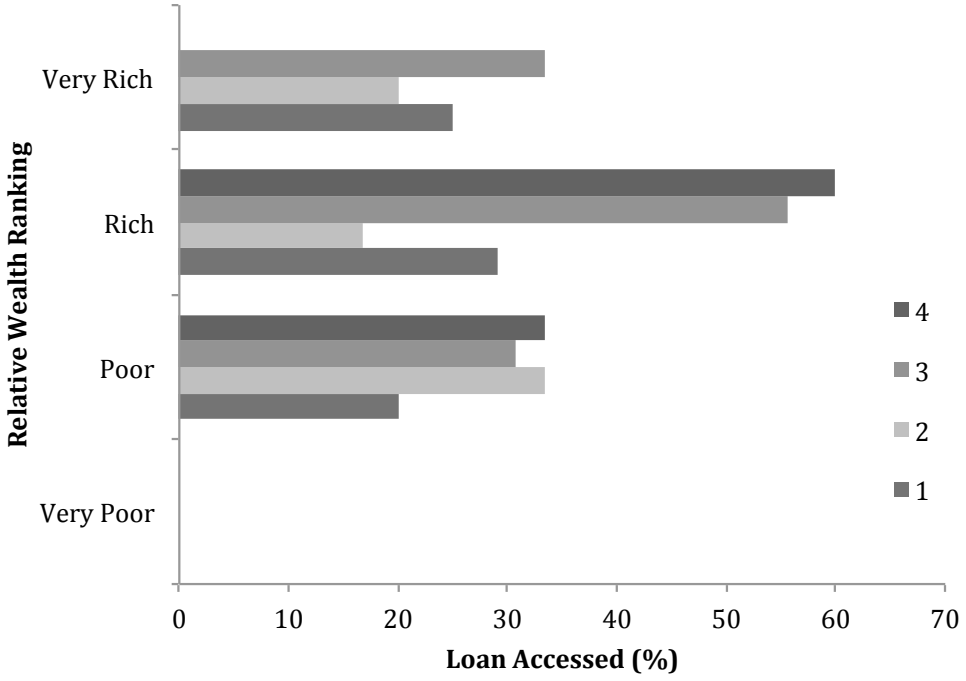
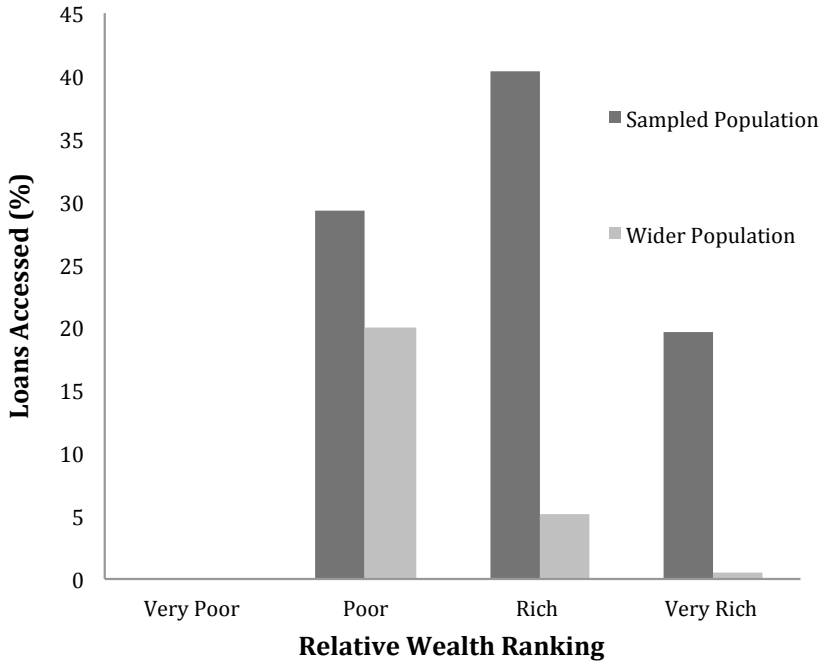


Figure 32. Mean percentage of sampled respondents that received MERECP CRF loans in comparison with mean respondent that received loans in the wider population according to relative wealth ranking



At the end of each interview respondents were asked for their opinions about benefit-sharing mechanisms (Fig 33) and for management recommendations that would help their implementation and use (Fig 34). A majority agreed that distributing finances to the community level was the best (59. 8%) and cash payments were prefered (65.5 %). It was acknowledge that the terms and conditions of the CRF were complex and would benefit from recieivng technical training and increased minitoring and evaluation (Fig 34). Left freely to respond to the questions, community members, however, did not vocalise dissatisifaction about goverance and participation dynamics.

Figure 33. Household perceptions on future benefit-sharing mechanisms

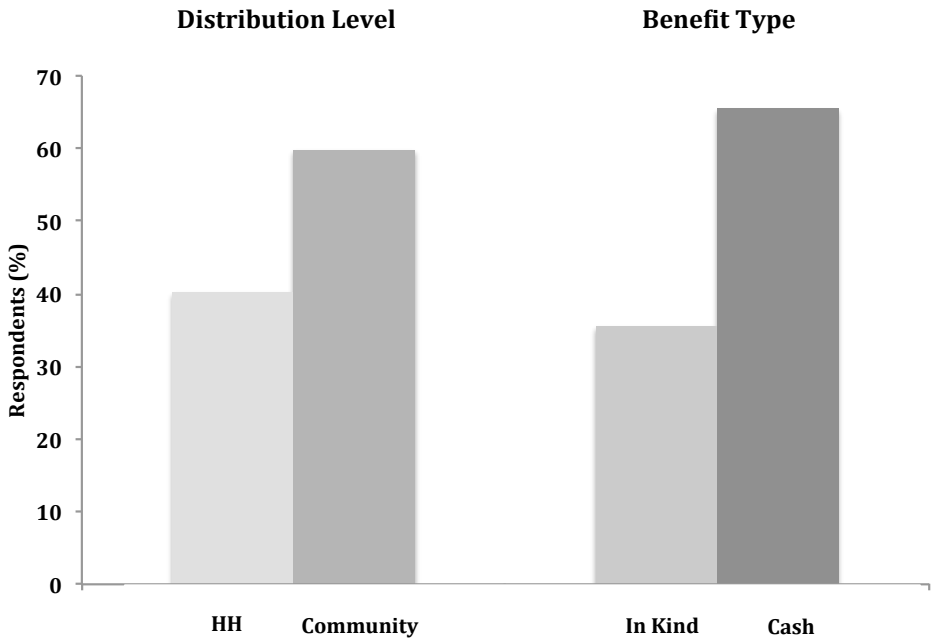
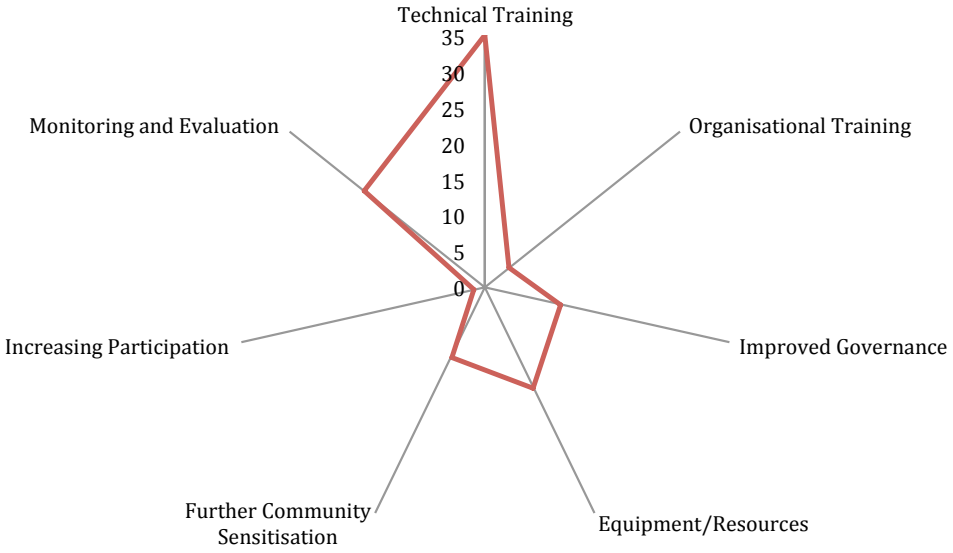


Figure 34. Collated MERECP CRF management recommendations as a percentage from household interviews



Discussion

Like the findings of this study, the literature is full of diverse accounts of how social networks influence development outcomes. Apart from confirming how variable socio-ecological systems can be at the fine-scale, the outcomes uncovered here reiterate that there are no idealised network structures that result in 'good governance' (Alexander, Armitage and Charles, 2015; Crowe, 2007) but perhaps consistent features within the Sub-Saharan context can yield more desirable effects.

The first aspect of which is that knowledge dissemination is central in achieving more successful forms of decentralisation (Khatun et al., 2015) and in keeping with earlier research (including the tested hypotheses) that a combination of bonding, bridging (between group) and cross-scale links facilitate fluent information flows (Cooper & Wheeler 2015; Crowe 2007; Baynes et al. 2015; Jeha et al. Chapter 3; Pretty et al 2011). Under this structure, intra-community ties (particularly amongst non-members) represent strong social relationships as network 2 and 3 show, can transcribe into the broader acquisition of knowledge. Cross-scale ties then have the ability to strengthen these interactions (Baynes et al., 2015; Olsson and Folke, 2001), providing a safety net of information sharing when CBO members fail to do so.

Empowerment? Or Another Token of Participation?

Following years of contradictory management regimes, some promoting encroachment of the park whilst others used coercive means to prevent it, the sentiments from Mt. Elgon re-emphasise that communicating a clear and convincing conservation storyline is fundamental in bringing about change (Folke, Hahn, Olsson and Norberg, 2005). In the face of distrust towards the Ugandan government, who by and large are still seen as corrupt, violent and trying to steal land, reconciliation with local communities remains sensitive and one that should be treated with care. Indeed, one of the marked differences between network 3, and those with much poorer levels of knowledge dissemination, was the relationships established between external organisations and smallholder farmers. Not only were these assembled at all levels of network, signifying a strong level of community outreach, there were numerous different agri-ecological and government personnel relaying coherent messages of conservation. Bearing testament to over twenty years of continuous sensitisation, in

some cases with the same people, positive co-management regimes have started to emerge. Indicated by the high quality of forest cover bordering this networks villages, negotiated compromises from these longstanding partnerships has seen community 3 (and their neighbours) sign and adhere to the most resource agreements with UWA (Nakakaawa et al., 2015).

Coupled with a stronger MERECP presence (as reflected through their high centrality ranking), akin to the communities that were better facilitated by the project staff in the Socio-Bosque Program, Ecuador (Krause, Collen and Nicholas, 2013), directly sourcing information from an NGO lead to more transparent, better quality information exchanges that enhanced the innovation and adaptability of the group. Confirming hypothesis 1 and 3, this point is illustrated in network 3 through a) a better understanding and consequent use of the CRF and b) the adoption of a broader range of conservation technologies. In this instance, useful MERECP collaborations included repeated field-visits, a biogas demonstration and executive members participating in a higher number of meetings and trainings.

Exhibited through the high number of within and between group ties, the foundation of this collective action was the strong level of inter-community co-operation. Community 3 showed a greater ability to work across different sects in what appears to be a more inclusive and deliberative approach in implementing their CRF. In two-way progression, the long-term partnerships with external organisations provided the environment for these elements of community cohesion to develop, yet simultaneously acted as an arena to rebuild levels of trust with higher order management. Together these dimensions have improved the willingness to engage and initiative taken by farmers, one of the most central factors in driving participation (Méndez-López et al., 2014). An example that typifies the groups self-motivation is when the CBO members, using CRF cash and a forest avoidance reward, actively approached HIEFER International to support further bio-gas installations.

For most of the other communities studied, conflicting messages from uncooperative politicians, on-going disputes over park boundaries and the failure of the district government in providing adequate support has halted this level of progress. With the opportunity to sit in on a workshop held by a different NGO, the reality of the

tokenistic participation came to light. A communication barrier during the session meant that community voices were lost and limited to a one-way flow of information. When the community were asked who would volunteer to plant trees no one accepted. Instead they stressed that they were limited by land, even requiring more from the park to survive. Having been promised incentives throughout, in addition to the small allowances given to attend meetings, a member then immediately inquired about compensation. The LC3 and environment officer who were facilitating the translations then refused to relay the communities concerns back to the NGO, proceeding with participatory mapping exercises that failed to engage the majority of attendees. Whilst aiming for a more consultative process, the whole interaction remained instrumental with communities being told to develop action plans and implement eco-agri technologies with no real desire to do so.

With this experience, the fact that community 1 had the second biggest network (both in terms of number of ties and actors), yet the most centralised network, suggests that the extensive MERECP knowledge dissemination is a product of these big group style meetings as oppose to proactive group proceedings. In the absence of true willingness or a course of action where citizen control can take place-which requires a growing level of inclusion, consciousness, solidarity and good leadership - authentic participation is unlikely to follow. As network 3 case study proves, the motivations of stakeholders are not only founded on the just distribution of benefits but a feeling of empowerment over the decisions that affect their lives. Void of this level of participation, financial gains start to crowd out intrinsic motivations (Atela, Quinn, Minang and Duguma, 2015). Undeniably, compensating poorer communities for their time and effort is crucial in giving them the flexibility to adapt (Baynes et al., 2015) however, the lack of information exchanges centred on the principles of climate change and conservation reminds us these core values are being lost.

Having invited district staff to several regional meetings, requested their input on the selection of CBOs, then provided them with the financial support to carry out detailed monitoring and evaluation tasks, MERECP did invest in building inclusive relationships at this level. The problem is whether they did so in the most effective capacity. The aforementioned findings have already validated the need to include government institutions in the operations of NGOs, not least because they need to

recognise and support the programmes agenda (Atela et al., 2015), reinforce external accountability (Agrawal and Goyal, 2001; Labonne and Chase, 2009) and add legitimacy to the process (Mbeche and Dorward, 2014). The fact is that districts are underfunded by central government. Staff still require vehicles to reach remote villages, better equipment to document their work and more human resources to meet their objectives (Namara, 2015).

"As an office we are having a problem of not being able to move, so we are not really capable of doing the routine monitoring that we are supposed to do." Environment Officer, Network 2, November 2013.

More often than not, instead of investing in these aspects of development, NGO's host expensive workshops where personnel are presented with responsibilities and left little decision-making power. Much like the grassroots level, district level management need to be won over by the intentions of the project, building longstanding partnerships with NGO's they are working for.

Piecing Together Participation Dynamics

So far constructing MERECP information networks has given us some useful insights into governance structures, however, by no means provided us with concrete evidence in understanding participation dynamics. In practise, the management of finance remains a sensitive topic in Uganda and one that is hindering the development of micro-credit programmes throughout the country (FAO, 2005). The account from Mt. Elgon appears no different. Contrary to the information supplied by executive members, in every community, at least one interviewee claimed that loans were no longer being offered or in fact were never made available. Instead it was implied that these funds were shared amongst group members or hijacked by local politicians.

"I understand that they go on writing names close to 500, yet in reality there are below 11 in the group and they keep showing that these are the people we are with. It is not good." Household interviewee twenty-four, network 3, October 2013.

"They were 17 members, combined with the ladies this totalled to 22, of these only 10 people benefited from the 19.6 millions." Household interviewee sixteen, network 3, October 2013.

Being documented with the case of NAADs in Kigando (Berman et al 2014), after years of civil unrest in Uganda, it is not uncommon to see such mistrust amongst anyone beyond close family connections (Auren and Krassowska, 2004). Although relational ties were not mapped between participants (a future improvement), evidence of such nepotism did surface during the snowball sampling. The most prominent form of which was the sharing of loans with the wives of dominant male members.

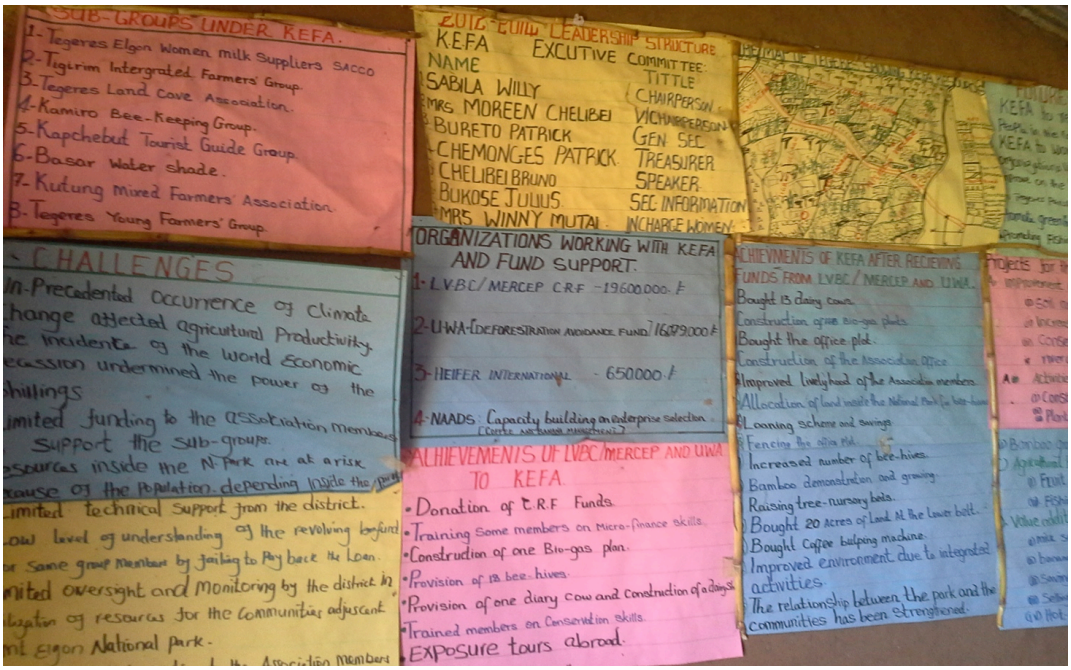
In conjunction with these observations, in network 3, household figures point towards high participation in what is a closed group. So as MERECP information spread extensively, access to credit did not, advocating more of core-periphery structure in the management of finances where richer landowners dominate. Certainly the bonding ties, consensus and collective action displayed in this network are more characteristic of centralised networks (García-Amado et al., 2012). As too are the levels of exclusion (Ernstson, Sörlin and Elmqvist, 2008) and rivalries that erupted. Interviews revealed that after two members failed to reinvest, the remaining associates dismissed them from the group and the remainder are now seeking legal assistance to retrieve their assets. Typically, in groups that possess such a strong social identity, i.e. one in which everyone shares a minimum set of common values and trustworthiness (van Staveren and Knorringa, 2007), a level of favouritism can a) lead to certain members enjoying more benefits at the expense of the community and b) when broken can result in this type of disagreement. Under these circumstances the improvement in well-being of a few individuals has had harmful effect on social cohesion. Often forgotten in the scope of policy designs, detrimental impacts from interventions can occur and as an evaluation of 136 projects found, social and economic win-wins are not common in community-based conservation (Brooks, 2016). Nevertheless, akin to the conclusions in the Sierra Morena case study in Mexico, the inequalities and disputes witnessed amongst this group have not hampered positive natural resource-management (García-Amado et al., 2012).

In addition to the bias in the distribution of funds, executive members were not shy in revealing that loan defaulters were limiting the access of funds. In the absence of downward accountability, weak prosecution bodies and loan-takers being close ties, handling repayments was named as one of the most challenging aspects of dealing the CRF, especially when communities are accustomed to hand-outs and those with authority are giving conflicting messages.

"They told us to use court of law and police when they saw a list of defaulters that had signed agreements but we feel some shame to use police to attack our members." Interview twenty two, Network 1, November 2013.

Fundamentally, the experience of financial decentralisation is novel to most grassroots organisations (Dewan, Buisson and Mukherji, 2014). In projects haste to distribute funds, mainly to avoid past experiences of misappropriation, neither executives nor district personnel were adequately prepared for their upkeep. Understandably, asking government officials to resolve internal disputes when they do not hold power or trust in this situation would be difficult and explains their reluctance to do so. Of the studied groups, the only executive to take firm action against defaulters was in networks 3, who as mentioned above, are trying to take loan defaulters to court. Having the confidence to carry out such actions is a form of empowerment necessary (Mbeche and Dorward, 2014), but not seen by any of the other groups. In this situation, developing the legal status and rights in the constitutions under which executives function may increase their effectiveness in managing and controlling funds (Armitage, 2005). Like in Nepal, (Gentle, Acharya and Dahal, 2007) accompanying this with public hearings, audit sessions and the public display of information may increase the transparency of the groups, making the recovery of lost money easier (Chinangwa, Sinclair, Pullin and Hockley, 2015). Regardless of their choices, network 3 were the most open group, making the biggest effort to provide and share knowledge (Fig 35) that has translated into expansive information flows and tighter control of finances. Finally, insisting on a unified bookkeeping methodology, and providing CBO's with the training manuals, resource books and other materials to do so, may have led to a more standardised administration system.

Figure 35. An example of a more transparent CBO, who openly displays their aims, objectives, finances and future goals in a public area.



Understanding the Small Print: How do the Terms and Conditions Affect Participation

In hindsight, the concept of using micro-finance as a benefit-sharing scheme is not necessarily a poor one. Communities require cash flows to give them the opportunity to invest in income generating activities and diversify their livelihood strategies accordingly – effects that have been more accurately documented in the International Crane Foundation Trickle Up Programme in the Caohai Nature Reserve China (Herrold-Menzies, 2006). Some of its limitations, however, are in its design that fails to account for local realities. In Uganda strong hierarchical governance structures typically impede full and effective participation. Regardless of their involvement, in their fear of losing power and patronage benefits (Dutterer and Margerum, 2015; Mbeche and Dorward, 2014; Pasiecznik, Herman, Campbell and MacQueen, 2015; Van Dam, 2011), the political elite believe they should be compensated by external interventions often leaving smallholder farmers with insignificant funds/inputs to make meaningful changes. To avoid this common monopolisation, MERECP

intentionally channelled funds directly to CBOs. Nonetheless, amongst their efforts to resist institutional change, the political elite either dominated their group or created conflict. In one of the case studies examined the executive members were forced to give a large sum of their CRF to their LC3 and in another the Community Development Officer refused to continue working in the area. With the ability to override community preferences, similar to the community-driven development projects in Indonesia (Fritzen, 2007), in network 1, the governance by political leaders lead the most inequitable distribution of both knowledge and credit despite having the ability to attract the most funding from environmental NGO's. Considering these insights, the findings presented here mirror those found in Mbarara, Uganda where wrangles over power is wearing down issues of trust, exacerbating community divisions and discouraging participation (Cooper and Wheeler, 2015).

In many ways, by using executive CBO members to introduce and manage the project's intentions, MERECP also limited participation towards the end of the project (Atela et al., 2015; Mekuria, 2015). Comparable with many other smallholder farmer groups across the globe, executives typically comprised better-off members of society who owned more land, had a higher level of education and in some cases were involved in other leadership positions (Dewan, Buisson and Mukherji, 2014). Taking into consideration skill-sets required in running a CRF, there is no doubt that these members are more capable of implementing the scheme. Just keeping up with project training that was conducted in English using elaborate language such as 'accountability' and 'interest-rate,' would be problematic for most illiterate farmers. Under this type of application, it is inevitable that power asymmetries will be amplified rather than evened out.

Realistically, no network can be free from dominant leaders, yet in the absence of prior stakeholder consultations, as promoted through the 'Free, Prior and Informed Consent (FPIC)'' principle in international agreements and safeguards (Mahanty and McDermott, 2013), there was no guarantee that the CBO's selected by MERECP and local governments were a) the ones desired by the community as a whole or b) those who would promote participation (Krause, Collen and Nicholas, 2013). Just comparing and contrasting the findings from four of the studied CBO's shows that working with leaders who are willing to share rather than obstruct resource and

decision-making arenas is the key to breaking equity barriers (Namara, 2015). Communities did not rank participation or governance as a major hindrance to project development but they did recognise the need to monitor and evaluate their actions. The attitude observed from some marginalised farmers is that leaders should be key participants, holding disproportionate power in planning, rule formulating and decision-making. Observed in other Sub-Sarahan contexts (Chinangwa et al., 2015), hierarchical structures are therefore grounded and valued by communities.

Parallel to other PES schemes across the globe, the inability of smallholder farmers to understand the terms and conditions or meet their eligibility requirements has to a certain extent limited the success of the CRF (Fisher, 2011; Kosoy, Corbera and Brown, 2008). As advised during the MERECP training, most CBO's incorporated asset backing as a prerequisite to accessing a loan. Theoretically speaking, smallholders would, therefore, need to provide evidence of their ownership of assets equal to the sum of their desired loan thereby making it almost impossible for landless and poor to contract. The results from this study verify these restrictions but from an efficiency standpoint (when willing), the farmers participating from the 'rich' and 'very rich' wealth category made the most ecological gains. Since the amalgamation of Poverty and Environment Network (PEN) data also show that poorer households are not the main drivers of deforestation, targeting the poor could boil down to ethics rather than the goal of reducing carbon losses.

On occasions some participants vocalised the difficulty in repaying loans came from poor investments, the most cited problem being the failure of crops due to unexpected weather events such as drought or heavy rainfall. Under the short repayment timeframes (often set between three to twelve months), selecting an appropriate enterprise can be tricky. Some returns can take many years, for example tree planting exercises. These longer term gains involve risk farmers cannot afford both in terms repayment or the opportunity costs involved in doing so (Fisher, 2012). When non-participants were asked what limited their participation, the fear of taking out a loan was often cited. In a landscape where poorer households are directly dependant on natural resources, as shown in the previous chapters, large insecurities lie in changing livelihood strategies making them less reluctant to participate (Lapeyre, Hartanto and Pirard, 2015). Ultimately, even with the flexibility and

financial resources to choose the most fitting technologies, the majority of farmers are obviously lacking the confidence, agricultural innovation and market linkages required in creating income generating enterprises (Lamb et al., 2015).

Conclusion

In conclusion, this chapter has reviewed both the individualistic and community interactions that have moulded CRF participation across Mt. Elgon, Uganda. Through information networks, this analysis has identified that power symmetries are restricting resource flows, as are capabilities of smallholders in accessing them. Importantly, the narratives uncovered here highlight that an improvement to one of these dimensions does not necessarily lend itself to the other. In the absence of prior stakeholder consultation, bypassing hierarchal governance structures and financially empowering a few individuals has created conflict and further animosity towards conservation interventions. Aiming to work with democratically elected leaders, who have intrinsic supportive values, abilities to share power and a vision to propel their fellow members is central to dispersal of knowledge, decision-making and access credit (Krause, Collen and Nicholas, 2013).

Following hostile involvements with the government, some of which are ongoing, establishing trust is at the epicentre of motivating participation (Pasiecznik et al., 2015). There are no shortcuts in rebuilding meaningful relationships or in fact the capacity of smallholder farmers in adapting to decentralised control and alternative livelihoods. It requires resources and time that if used appropriately NGO budgets could finance. The findings are, therefore, in line with the global analysis of 160 terrestrial and marine Protected Areas, in that the best outcomes for both conservation and equity are founded upon productive co-management regimes (Oldekop, Holmes, Harris and Evans, 2015). Achieving a fine balance of autonomy, yet transferring the appropriate legal and correct technical knowledge (Dolisca et al., 2006) is what is required to achieve these results. In hindsight, a CRF is not necessarily a poor benefit-sharing scheme. Development practitioners just need to devote more effort into ensuring that sufficient and the effective facilitation is given so these schemes can become self-governing.

Concluding Discussion

Are Community Revolving Funds a Sustainable and Equitable Method of Slicing Conservation Capital?

Are Community Revolving Funds a Sustainable and Equitable Method of Slicing Conservation Capital? Insights from Mt. Elgon Uganda.

Major Findings

Communities neighbouring the single protected area of Mt. Elgon are heterogeneous (Lamb et al., 2015). They differ in their socio-economic conditions, governance structures, livelihood strategies, levels of community cohesion and experiences of conservation interventions. All of which have affected the capabilities and desires of local actors in participating and adapting to the alternative livelihood strategies introduced through Integrated Conservation and Development Projects.

From an environmental viewpoint, the self-reported evaluation conducted here indicates that, despite twenty-five years of intervention, on-farm habitat degradation surrounding the national park has persisted. Exploration of social networks reveals that similar to the Sloping Land Conservation Program in China (He and Sikor, 2015), the lack of knowledge surrounding sustainable agricultural production systems is limiting their development, as too are the unsuitability of introduced technologies that fail to have regard to the cultural, socio-economic and gender variations amongst target populations (Lamb et al., 2015). In the context of extreme poverty, it is not uncommon for communities to prioritise the development of non-cash needs, i.e health, education and housing The diversity of mapped livelihood activities today (particularly napier grass and zero-grazing) represents the fruitful changes intervention projects have created. In communities where positive environmental outcomes arose (both on-farm and for the protection of the N.P.), trustworthiness amongst neighbours and partnerships with supporting personnel were distinguishing features.

In reality, past experiences of colonial rule (Soini, 2007) and coercive conservation tactics (Norgrove and Hulme, 2006) continue to supress the appetite to engage with such programmes. This is reinforced by the continual use of top down approaches, persistent political interference and the lack of tangible benefits materialising. Overall, the introduction of incentive-based initiatives has not legitimised

decentralisation over the parks natural resources nor has it worked towards settling on-going boundary disputes (Petursson and Vedeld, 2017). Comparable to the scenario in the Bukit-Bulit Raya National Park in Melawi District West Kalimantan, Indonesia (Myers, Ravikumar and Larson, 2015), livelihood incentives alone have failed to win over community consent over the park's existence, where some residents are still fighting for their claims to land. A review of the International Forestry Resources and Institutional datasets by Pelletier, Gélinas & Skutsch (2016) found rulemaking autonomy, local enforcement rules, well-defined property rights and the design of effective institutional arrangements were fundamental characteristics for sound community-based natural resource management. In the present study, like the REDD+ process in Peru, pouring resources into creating these enabling conditions may be a necessary precondition despite their high transaction costs (Dunlop and Corbera, 2016).

Tracking the MERECP cash-revolving fund as an example, the analysis in chapter five highlights how different dimensions of elite capture are further restricting resource sharing and hindering the elements of procedural equity that give rural farmers the confidence to diversify their livelihoods accordingly. For the most part, implementation of Vietnam's payment for Forest Environmental Services program (PFES) (Wong et al., 2016) and Zambia's Administrative Management Design for Game Management Areas (Gibson and Marks, 1995) followed the same pattern, where village heads who were given a large responsibility in running the scheme made most of decisions on how to use and distribute revenues, favouring family members. Mainly documented through unequal forest access (Agarwal, 2001; Thoms, 2008), widening disparities between the rich and the poor due to the devolution of power has been documented in other forms of decentralised management (Luintel, 2016). With regards to the forest funds in Nepal, like this study, the 'very poor' were excluded both from decision-making process and from accessing credit (Pokharel, 2008).

In the Mt. Elgon context, this unequal sharing of money has gone as far as creating disputes, further tarnishing conservation values rather than improving them. Typically amongst leaders and local governors who were not compensated (a form of resisting redistribution of power), without stressing the need for improved

participation in the programme, communities still favoured the distribution method employed under the CRF (i.e one that targets CBO's and provides cash inputs). Whilst some cases of resentment were reported, for the most part it would seem that local conceptions of fairness that show respect for hierarchical governance systems (referred to a 'Kiganda') are mismatched with external ones (Martin et al., 2014). Known as achievement/status/power economic fairness principle (Le et al., 2016), benefit-sharing mechanisms here need to overcome misappropriation of resources by sufficiently compensating the dominant elite so that they will continue to transfer resources to the most marginalised, albeit in a smaller capacity. Acknowledging these local informal structures will help design an operational based system (Moeliono, Pham, Le and Brockhaus, 2016), particularly one that prioritises trustworthy leaders (Diedrich et al., 2016). For instance, in Ghana, of the 55% of rent paid by mining companies, 20% goes to local communities, 20% to traditional authorities and 10% in administrative fees (Ministry of Finance and Economic Planning, 2010).

Not forgetting that wealthier individuals dominated MERECP information flows, the snowball sampling methodology employed in this study is biased towards their views. Whilst this reflects the reality of how benefit-sharing is unfolding in practice, if greater equality is the aim, further research into how the poor perceive notions of fairness is required. From their sites in Guinea-Bissau, Mali and Senegal, a review of the Kyoto Think Global, Act Local carbon project found that offering smallholders as little as 10% of their financial returns would motivate participation (Skutsch and Ba, 2010), because it is the perception that they have received a just reward that influences their behavior (Bennett, 2016; Sikor and Hoàng, 2016). Studies from Rwanada (Martin et al., 2014) and Vietnam (Le et al., 2016) have highlighted that at this horizontal level, egalitarian options were viewed as most the legitimate. Again, drawing from the PFES scheme, a combination of different payment distribution models can be introduced to fulfill these societal differences of fairness (Yang et al., 2015). To ensure that marginalised people are represented in the policy goal, distribution models under the REDD+ pilot scheme in Nepal may be applicable. Here, pre-financing the poor to ensure that they are in the same position as the rich to participate (rights-based approach) then providing further incentives that rewards

this participation (merit-based), can be included (Nawir, Paudel, Wong and Luttrell, 2015).

Given the paucity of documented evidence of agreements found, it was very difficult to gauge exactly who had benefited from the CRF inputs, by how much, and what investments were made. With a fair number of residents unwilling to be interviewed and those reluctantly agreeing feeling awkward or requiring lots of probing to answer questions, verifying transactions was difficult. Coupled with inconsistencies in facts and lack of monitoring, there was no guarantee that what was cited during field visits has materialised in real life. For example, during a focus group discussion CBO members specified that they received 35.6 million Ugandan shillings, 19.6 from the CRF and an additional 16 million as forest avoidance fund. With respect to loans, They stated that these had been used in the construction of an office, a coffee pulping machine, beehives and other livelihood activities. This included the installation of 48 biogas units costing 2.2 million shillings each, some of which HIEFER International co-funded to the tune of 0.8 million of the cost. If all of the 48 units had been subsidised, a deficit of 67.2 million would still remain (equivalent to more than 30,000 US dollars at the time). Whilst one member mentioned he had financed the additional costs himself, contributing 1.1 million (approximately what farmers make in a whole year), of the sampled households in the area only 8 (23 %) actually quoted having biogas units. In this more confidential environment, some interviewees even claimed that a large sum of money went missing and only a small proportion was used as loans.

Comparable to Le et al.'s (2016) assessment, the number of unrelated actors and descriptions of similar interventions mentioned during discussions reveals that a majority of smallholders were unable to differentiate MERECP from other programmes. As numerous environmental organisations target the same CBO's, certain individuals are receiving constant consultation and training. Not only is this creating fatigue (witnessed by the difficulty in mobilising participants for this research), attendance is becoming increasingly motivated by compensation or the incentives on offer. Reimbursing time that could have been used to produce income is essential, particularly for poorer households where the opportunity costs of participating are higher (Adhikari, Kingi and Ganesh, 2014), however over time

groups are becoming over-reliant on development agencies, mobilising with the pure objective of receiving inputs, a phenomenon also documented in the Philippines by Peras et al. (2016). On reflection, one does need to question what type of interactions are occurring that has lead to such disengagement with the true purpose of interventions. It is still the case that devolving financial ownership and control to grassroots level is ideal, because it gives rural farmers the flexibility to invest in the strategies that are most suited to their needs, but to take full ownership does requires a strong level of technical, organisational and managerial skills that smallholder farmers seem to lack, hence their failure to comply with the term and conditions.

Transferring these resources efficiently under complex project designs is essential and as case-studies in Indonesia (Myers, Ravikumar and Larson, 2015), Vietnam (Wong et al. In Prep) and with the CBO's that had strong external ties highlight, local level governance institutions play a crucial role in horizontal success (Schreckenberg and Luttrell, 2009). This is not just in terms of supporting local communities but also in colouring their perceptions of equity, motivating behaviour change, creating local goals and installing a level of downward accountability (Fujisaki, Hyakumura, Scheyvens and Cadman, 2016; Loft, Gebara and Wong, 2016; Luintel, 2016). Yet the weak capacities of local districts (inadequate transportation, personal etc.) limited their ability to provide this support to very scattered groups, particularly in the much needed monitoring and evaluation. In some respects the fact that MERECP did not channel CRF funds through these intermediaries (though some small funds were separately allocated), left them demotivated. Often underpaid, district officials also need financial motivation so that the need to focus on other money-making activities, especially those that are detrimental to conservation objectives, is reduced. Akin to a merit-based system at the horizontal sharing level, rewarding districts that meet specific targets (adequate planning, x number of field visits, written reports) may motivate further involvement. Within this perspective, it should also be acknowledged that local institutions are not a single entity but a network of different agencies with varied objectives and areas of expertise (Fujisaki et al., 2016). Learning from the Kecamatan Development Project in Indonesia (Hite, 2015) and pilot REDD+ schemes in Vietnam and Indonesia (Dunlop and Corbera, 2016), including subnational capacity building, strengthening of social capital and giving adequate

operational support to as many of these organisations would help them provide sound community support. More co-operation between these organisations would also avoid targeting the same CBO's, leading to clearer measurement of their impact across a wider number of individuals. To speed up this process, trustworthy private contractors could be brought in to develop these relationships.

Who should be targeted?

The observations made on Mt. Elgon highlight that it is not necessarily the benefits communities receive that motivates their behaviour but their inclusion in the process that is fairing well for conservation. Perceptions of justice are, therefore, not universal and vary depending on the eye of the beholder (Corbera, 2015). Given the billions of dollars that are required in rebalancing habitat degradation to build effective and equitably managed Protected Areas, crucial decisions on where finances should be channelled need to be made. Below, the thesis concludes with a discussion of the general trade-offs that may be involved in different incentive mechanisms to the CRF.

For projects that are based on actual provision, i.e the number of trees planted absorbs x metric tonnes of carbon which is sold at x value, tend to be the most straightforward benefit-sharing mechanisms to implement as they mimic existing market structures. With this design, wealthier landowners who have the space, productive land and capabilities to engage in tree-planting activities are more likely to participate (Kosoy, Corbera and Brown, 2008; Mahanty, Suich and Tacconi, 2013). As the recent amalgamation of Poverty and Environment Network (PEN) data suggests, poorer, isolated households are not responsible for the highest deforestation rates (Foss, 2014), therefore, targeting richer landowners would undoubtedly meet additional criteria. This approach, however, could not claim to be 'pro-poor', nor a fair one to those who have historically engaged in conservation efforts (Gebara, 2013). Schreckenberg & Luttrell (2009) argue that the key to providing rural people with a stream of sustainable and equitability benefits is to adopt poverty reduction as a stated objective.

Not forgetting social safeguards presented in policies such as REDD+, (criterion 12), which calls for 'equitable, non-discriminatory, and transparent benefit-sharing and

distribution among relevant stakeholders with special attention to the most vulnerable and marginalised groups,' an 'individual needs' principle that favours disadvantaged groups may be a more rational approach (McDermott, Mahanty and Schreckenberg, 2013). Theorists such as John Rawls and Karl Marx justify such distribution by arguing that societies are not created equal and that consequently benefits should be channelled to disadvantaged groups (McDermott, Mahanty and Schreckenberg, 2013). Differentiating distribution methods according to socio-economic status and gender may yield the most effective results. This could be in the form of capacity building or finding suitable incentives to meet specific livelihood strategies. At least the initial findings from REDD+ pilot schemes in Nepal and Indonesia verify these assumptions, demonstrating that right-based approaches generate more tangible and intangible benefits than performance- or input-based alone (Wong et al., 2016).

For the case of protected areas, like the MERECP cash-revolving fund, stakeholders that incur the largest costs may be compensated. As seen in this study, given the number of households that typically occur in these areas, finding sufficient funds and alternative livelihood activities to compensate each community is extremely challenging and expensive (Pinto and McDermott, 2013). If small revenue streams were divided equally, the high transaction costs and ineffectiveness of small amounts of compensation are unlikely to motivate environmental stewardship (Wong et al. In Prep). In terms of short-term efficiency it may be practical to target those who have a history of high deforestation rates, although in the long run it could be counter-productive. Introducing monetary incentives does not necessarily strengthen social and ethical motives to conserve and can even go as far as eroding forest services into a single exchange value of receiving carbon credits, a phenomenon Kosoy and Corbera (2010) refer to as 'commodity fetishism.'

Conclusion

Adding to the small but growing body of literature, this much-needed (Corbera, 2015) practice-ordinated research has provided detailed insights into how three dimensions of equity -contextual, procedural and distributional - affect local participation and subsequently the outcomes of ICDP's projects across Mt. Elgon.

With the unified policy aim of diversifying livelihood strategies away from the protected park, it explored how differing operational conditions and design principles can shape the capabilities and willingness of rural farmers in developing sustainable alternatives.

The story presented here reminds us that conservation is political. Political in that people's livelihoods are involved, money is at stake and that stakeholder perceptions of legitimacy and fairness come into play (Calvet-Mir et al., 2015). In hindsight, it seems almost impossible to design a benefit-sharing scheme that does not create some clear winners and losers (Sommerville et al., 2010). The decision practitioners opt for is clearly a political one based on what specific goals that project is seeking to achieve, i.e to a) maximise equity, b) improve equity or c) do no harm (McDermott, Mahanty and Schreckenberg, 2013). Despite being costly and time consuming, on-going stakeholder consultation where participants have the freedom of choice on how they manage their land is a key aspect of achieving justifiable, fair and equitable benefit sharing mechanisms.

Appendix I: Guidelines For Household Interviews

A) Selecting Research Assistants and Enumerators

Both the SNA and participatory mapping exercises required enumerators to have some level of expertise, especially as they need to actively engage with participants, asking and/or probing responses given the context. Equally the research would not be possible without assistants fluent in the locally specific languages found across Mt. Elgon. For this reason, I sought a research assistant that had completed a degree (particularly in social sciences) but was also from the Mt. Elgon region. In particular I looked for the following skills:-

-Eagar to work
-Trustworthy
-Shows good communication skills
-Someone who can commit to the whole fieldwork time frame.

Coupled with extensive training before and during data collection; I was able to obtain a balance between an affordable, culturally sensitive and capable research assistant (although this did not go without its fair share of problems). To help with my selection and to determine payment method (salary and bonus) Rhoda Nyaribi (Mbale District Environment Officer) and Richard Gafabusa (Mbale office IUCN) helped arrange the interviews and provided advice.

For the semi-structured interviews, the idea was to get the recoded interviews translated and transcribed by an external party. Not only does this give additional verification, it meant both my enumerators and I can concentrate on conducting the interviews, rather than taking exhaustive notes. Unfortunately finding people to transcribe the interviews was more challenging than I had initially anticipated. Numerous different people were involved (recruited from NGO's, the local university

and the church), the quality was poor and eventually due to time limitations a number of interviews had to be directly coded for the analysis.

B) Meeting Government Officials and Community Based Organisations

Steps at the beginning of the fieldwork period were taken to officially introduce myself to all the relevant government officials, organisations and CBO's. Clear explanations of my research and its intentions were given. Emphasis was placed on the long-term benefits communities can gain by engaging in the research, especially with regards to improving the management of CRF's. This is of course in an unofficial capacity and I can only make recommendations for the future rather than directly affecting the programme myself. I clarified that my position was as a student researcher and I cannot assist with compensation for loss of access to natural resources within the forest, prosecute illegal activities or the failure to repay loans. This was reinforced with the promise of returning to any villages involved in data collection to discuss issues raised in the research and potential suggestions to improve forest management set-ups. Contact details were left for those who wanted further information.

Initial meetings in this capacity not only served as an introduction forum but to gain detailed information on the real-life implementation of CRF's. This helped develop my methods further as well as answer my research objectives. Questions that were brought up during such meetings:

- Main ethic/religious groups and the presence of ethnic/religion-based forms of segregation or conflict
- Current population level and trends (migration issues or increasing in mortality rates)
- Number and type of migrants (permanent, seasonal, men or woman)
- Poverty levels
- Main livelihood strategies in the community and dependence on programmes such as MERCEP
- Current tenure and decision-making power over different land use types

- Main changes in land use and the provision of CRF's
- Internal and external drivers of land-use change

This opportunity was also used to identify the four villages I chose to do my fieldwork in. Decisions were based on the willingness of communities to participate, how many members have been taking out loans, whether repayments have been made, the types of activities communities have been engaging in, the distance to the national park, whether people feel there really had been forest avoidance due to the project and logistics such as getting to and from the village.

C) Well-Being Ranking

Following Schreckenburg *et al* (2012), participatory well-being ranking activities were conducted in each of the four selected study sites during their village introduction. A focus group comprising of men and woman that live in different areas of the village and have different occupations were brought together in a spacious area. This included CBO members, participants and non-participants of the MERECP Programme. I introduced the overall research aims, highlighting that I am not interested in where households rank and that I have no intention/ability to change it. Following an introduction of the aims of the focus group consultation, the group were asked to discuss the meaning of 'well-being' and 'livelihood.' The dialogues were centred on material ranking of well-being i.e livestock and non-material ranking of well-being i.e education. Using drawings and symbols, the most commonly mentioned material and non-material indicators were listed on flipchart/board or on the ground. On the basis of the listed indictors, the participants were then be asked to define and name four well-being categories; focusing on the productive and income generating activities associated with each. Following this exercise participants were asked to have an in depth discussion about what they have just created, making any final adjustments if they wished to. With the results of the focus group, four well-being cards with the key indictors listed on them was created.

Categorising Households

With the initial intention of stratifying each household into wealth category, the diversity of attendants coming from several different villages made this challenging.

Instead, the most straightforward and robust indicators from the participatory wealth ranking activities (Table A.2), coupled with indicators from a large national household survey report (Ministry of Finance 2001), were incorporated into the SNA interviews. Based on the information given during the household interviews and following the descriptions during the focus group discussions (Table A.1), each household was ranked into a wealth category with study site having its own relative degree of wealth.

Table A. 2: Top eight indicators used to measure wealth.

Asset	Indicator
Human Capital	No. Of Children Education
Natural/ Agriculture Capital	No. Goats No. Cows No. Sheep No. Pigs Average Landholding (Acres)
Income	No. of kg sugar/month, No. of bars of soap/month

In addition, an on-site assessment of housing material helped categorise respondents.

Table A.1: Results of Participatory Well-being Exercises

CBO 1				
Indicators	**Very rich 1%**	**Rich 5%**	**(Active) Poor 75%**	**Very poor 19%**
Education	-Private -Degree and higher level -Boarding -Most go to school	-Private- no boarding, maybe within the sub county -Some diploma, some degree	- Government schools -Some are sponsored -Senior 4. Average level reached	-Government -Stop at primary level -Not all children attend school- cannot afford uniform
Health	-Private hospital -Can travel further -Access to good medicine- abroad	-Cheaper private hospitals closer to their homes -Afford treatment for small diseases.	-Health centres provided by the district -Most die of cough malaria etc.	-Health centres within the sub county -Use herbs from the forest -Cannot afford medicine.
Assets	-Car -Boda boda -Many wives -TV, mobile -Generator, solar	-Boda boda -Bicycles -Phone(mobile) -Radio	-Radio (small) -Phone -Mattress	-Mat -1 wife -Lots of children
Land	-5plots, 2acres+	-3plots, 1 ½ acres	-1-2plots, ¼ - ½ acres	-No land -Maybe small plots
House	-Permanent house, glass windows, doors- iron roof	-Semi-permanent, iron sheet, wooden doors	-Mud house, iron sheets	-Mud with banana thatched, no doors
Livestock	-Cows (6+) -Pigs (10+) -Goats (5+) -Sheep (2+)	-Cows (2) -Pigs (2) -Goats (1) -Poultry (20+	-Cow (1)	-Two hens
CBO 2				
Indicators	**Very rich 1%**	**Rich 10%**	**Not very poor 80%**	**Very poor 9%**
Crops	-Coffee, bananas, plantation, onions, agro forestry, tree diversity, beans, wood lots.	-Some beans, some matooke, some wood lots, (trees), maize and beans.	-Bananas, yams, cassava, beans.	-Beans, not much growth or land.

Land	-3-5 acres	-1.5- 2acres	-1.5- 1acre	-0.5 acre
Food security	-Rice, chicken, beef, bananas mature, chapatti (makes)	-Immature bananas sometimes eat meat.	-Yams, beans, pumpkins, greens, bananas.	-Chapatti (buy), greens, not much meat.
Education level	-Higher education, send children to schools like private schools	-Send children up to public secondary schools.	-Send children to public primary	-No education, works instead.
Housing	-Permanent and cemented houses, glass windows, bars and gate	-Iron, galvanized sheets for roof, semi-permanent houses.	-Mud, cow dung, different size than very poor, slightly bigger.	-Cow dung, thatch roof or banana fibres for roof, mud
Assets	-Constant supply of paraffin, beddings, radios, TVs	-1 bed, half bar of soap, ½ kilo salt.	-Make own beds from stakes and mattress, some soap.	-No bed, no soap, mats, buys soap for 200/=shs, borrows salt, steal items, no radio

CBO THREE

Indicators	Very rich 5%	Rich 15%	Poor 60%	Very poor 20%
Education	-Private school, is educated to university level	-Can afford university education	-Goes to free public schools -Typically ends at primary level	-Children do not attend school
Land	-Has up to 10 acres of land -Hires people to work on his land	-Owns 5-6 Acres of land	-Owns one acre of land -Casual worker for the rich	-0-1/4 acre of land Casual worker for the very rich
Health	-Government hospitals, he can buy medicine			
Livestock	-30 Cows, -10 goats -10 pigs	-6-7 heads of cattle -5 goats -4-5 pigs	-1 cow -2 goats -3 pigs	-None
Assets	-Buys up to 15 kgs of sugar per month -Uses 10 bars of soap per month -Owns a cars	-Can use a pressure lamp and solar energy for power -Can buy up to 10 kg of sugar per month -Owns a motorcycle	-Uses paraffin for light -Buys 3 kg of sugar per month -Buys 1 bar of soap -Bicycle	-Uses firewood to cook -Buys a piece of soap per month -Used ½ kilo of sugar per month

	-Uses electricity, solar and biogas			
House	-Permanent house	-Lives in semi-permanent house	-Lives in a mud hut with grass thatched house	-Mud hut with grass thatched house
Food	-Has a balanced diet, takes food everyday	-Has a balanced diet twice a week	-Mainly eats vegetables	-Eats food once a day

CBO FOUR

Indicators	**Very rich 5%**	**Rich 15%**	**Poor 60%**	**Very poor 20%**
Education	-Private and public s4	-Public schools senior 1-2	-Public schools, drop outs in - primary 5- senior 3	-No education
Land	-1-2acres	-1-2 acres	-Small plots like ¼	-No land
Health	-Government hospitals, he can buy medicine	-Government hospitals	-Government hospitals	-Government hospital
Livestock	-2 cows -2 goats	-1 cow -1 goat	-Chicken -1 goat	-No livestock
Assets	-Phone -Radio -Pulping machine	-Phone -Radio	-Two cell radio -Mattress	-Mat -Sauce pan
House	-Semi-permanent and iron -sheet	-Semi- permanent with iron sheet	-Banana fibre thatched house	-No house (room with another family)

D) Ethical Considerations

A number of ethical considerations were undertaken during the research period. Firstly, to address the risk of disclosure, all data was stored securely and anonymised in presentation. During interviews, special care was taken not to directly link or name specific individuals. This point was emphasised to both my participants and research assistants throughout data collection.

For seeking informed consent, a full explanation of the purpose of the research and what I will do with the information was given. At this point they had the option to opt out. Due to literacy and sensitivities over using signatures, verbal consent was sought.

A final consideration about rewarding respondents was taken. Due to the presence of poverty and the fact that people gave up valuable time to participate, after a discussion of gift possibilities with Michael Mbogga (Makerere University) and Rhoda Nyaribi (Mbale District Environment Officer) sugar, salt and soap was given to each household.

E) Consent Form

Before each household interview translated versions of the following consent form were given: -

What is the purpose of this research?

This research is designed to share and learn how conservation interventions have been impacting communities living across Mt. Elgon. Data collection is primarily focused on capturing social-economic and land-use changes occurring in your area.

I am not a funder, therefore, I have no ability to provide finances or change the way the project is run. I am however, hoping to collectively present your feedback to the relevant organisations.

This research is being undertaken by Lena Jeha and will be written up in a Doctoral dissertation and submitted within the Environment Department, University of York, U.K. I have research clearance from Uganda Commission for Science and Technology and Uganda

Wildlife Authority. The results will be fed back to these organisations and may be published in an academic publication (journal or book form).

The research is funded through a three plus one doctoral studentship of the UK Economics and Social Research Council (ESRC). You will have access to the final thesis (in .pdf format) when it is available. Please indicate if you would wish to be sent a copy by providing an e-mail address.

What is involved?

Your participation in this research will include an in-depth interview with the discussion focused on social relations, information exchange and decision-making. You will be asked to list the people you interact with on-farm practices.

You will have a choice regarding whether the interview will be recorded. Your participation in this research is entirely voluntary and you may decide to withdraw from the research process at any point before publication of the results. If you wish to do this, your interview transcript and recording (if applicable) will be destroyed.

Your responses will be treated in complete confidence and will be made anonymous in the final report (see below). Transcripts of your interview will be stored securely and will only be accessible to a small research team. You will also receive a transcription of your interview. I am an independent researcher, therefore, I will never divulge any personal information you give me with anyone else, especially UWA, MERCEP or local government.

Note on anonymity

Part of my research will ask you to list the names of those who have given you important information on farming practices. Consequently, these people will also

be asked to part take in the study. At that point your name will not be disclosed to the contacted participant. Furthermore, as they may refuse to participate, none of the names you give will be mentioned in any of the final publications. Instead categories such as an organizations name, executive CBO members, ordinary CBO members and non-participants will be given. Please consider this issue before giving me consent and ask me any questions you might have. Your participation is central to this research and I am very grateful for your assistance.

F) Semi-structured interview for household Interviews

Basic Household Questions
Sub County _____ Parish & Village _____ GPS Waypoint Number _____ Dictaphone Recording Number _____ **1.** Name of respondent (s) _____ **2.** Age of respondent (s) _____ **3.** Respondent head of household (Yes/No)? **4.** Are you involved in any community activities or in any leadership positions? **5.** Marital Status _____ **6.** Educational Background (Primary/Secondary/Tertiary and Literacy)_____ **7.** Number of Children and their highest level of education _____ **8.** Number of goats/pigs/cows/sheep_____ **9.** How many bars of soap do you buy each month? _____ **10.** How many kg of sugar do you buy each month? _____ **11.** Ethnicity _____ **12.** Approximately how much land do you own? **From the aforementioned information place a HH into a wealth category that is the most fitting to the characteristics listed during the study sites participatory well-being ranking.**
Questions on Structure of Famer Networks
13. What type of activities do you engage with on your farm? Horticulture Bee-keeping Tree planting- fruits, indigenous, exotic Cows-Dairy, Biogas Coffee

14. Can you list five people whom you seek advice for on-farm practices?
15. What type of information did you discuss?

Western Scientific
Indigenous Knowledge

16. How often do you engage with these people?
17. Did this knowledge alter your farm practises in any way?
18. Do any other NGO's work in the area that you have not mentioned?

Questions on MERECP Networks

19. Have you ever heard of the CRF MERECP programme? If no, go to question 34.
20. Can you list the name of five key people that gave you useful information surrounding MERECP CRF?

Farmers Association
MERECP
UWA
District Forest Officer
District Environmental Officer
Members from another CBO's, please list their name (s)
Members from within your village, please list their name (s)
Members from another village, please list their name(s)
Other, please specify

21. What type of information did they give you?

Micro-finance
Planting
Land-use planning
Conservation

Questions Surrounding MERECP CBO Management

22. Are you member of the MERECP CBO? (Yes/No) If ordinary member or non-member go to question 30.
23. What tasks/ work does your job in the CBO involve?

Facilitating meetings or getting people together
Finances
Voicing personal or community opinions
Communications e.g writing down minutes of meetings
Providing direction and leadership
Being accountable to stakeholders e.g sharing information with non-members, providing training etc
Dealing with compliance issues e.g repayment of loans

24. How and why did you decide to be an executive member of the CBO?
25. How long have you been in this position?
26. Have you learnt any new skills from taking on this role?
27. Where did you learn these skills?
28. What do you feel you would need to enhance you performance?

Questions on MERECP Loans and Benefits

29. Have you ever taken out a CRF loan from MERECP? (Yes/No). If no go to question 32.
30. Why did you take out the loan?
31. Are you able to repay your loan (Yes/No)?
32. If not, why not?
33. Would you consider taking out CRF loan (again if repaid)? (Explain CRF if they have not heard of MERECP).
34. What would you invest the money in and why?
35. Do you feel the introduction of MERECP CRF funding has:

a) Affected/altered you well-being in a negative or positive way. (Refer back to well-being cards to identify key areas to discuss i.e. income, food, jobs land etc.)
b) Changed the quality/availability of natural resources. If not, why not?
c) Are these changes solely attributed to the MERECP intervention or other factors too? Please explain.

36. Do you believe that CRF is an effective way of distributing finance for forest conservation? If not,
a) What do you feel is the best way to distribute the funds?
b) How can the programme engage better with poorer households?
c) What measures need to be put in place and challenges overcome to make the programme for efficient? Do you have any suggestions how these can be achieved?

Other topics that should be discussed if not brought up by participants:-

-Interest Rate

-Repayment time frame

-Accessibility to loan i.e. getting a guarantor – Is it is easy to find someone to lend you money in the village when you need it?

G) Semi-structured guidelines for management officials

Questions for Management Offical
1. Name of respondent (s) 2. Name of organisation 3. Role in organisation 4. Can you tell how you became involved with the MERECP programme? 5. Have you ever provided stakeholders involved with the MERECP programme advice on on-farm practises? 6. Which particular communities did you engage with? Can you list any one in particular? 7. If so what information did you give? 8. Have you ever engaged with stakeholders surrounding the MERECP Programme? 9. Which particular communities did you engage with? 10. In what capacity have you worked with them? 11. What specific information/training/capacity did you share with them? 12. How often have you interacted with these communities? 13. Do you feel like there is sufficient information/training for community members to implement the project effectively? 14. If not what improvements can be made? 15. Do you feel the programme is meeting the project objectives? How about the broader REDD+ ones?

Appendix II Guidelines to Participatory Rural Appraisal

A) Facilitators Guide

Introduction

This manual is designed to steer facilitators through the Participatory Rural Appraisal (PRA) process I aim to undertake in Mt. Elgon Uganda, 2014. It will outline the purpose of each exercise, the questions that will be presented to participants, the types of activities we would like the participants to perform and some general notes on how the facilitator should be running each exercise.

The overall objective of the PRA is to evaluate the long-term effectiveness of policy interventions, such as Forest Restoration efforts and Conservation and Development Initiatives, in altering land-use practices in favour of environmental sustainability (Dalle et al. 2006; Semwal et al. 2004).

Whilst an extensive review of forest loss and recovery over the past four decades has been assessed through remote sensing data (Sassen et al. 2013), this research is focused on capturing a more detailed understanding of the social processes that have driven land-use and consequently conservation outcomes in the area (Dalle et al. 2006).

The data-collection process will include six main steps:

Mobilising Participants

Participants will be recruited through existing connections with local council and executive members of the CBO within each field site. A maximum of 10 people from differing gender, social, economic and cultural groups will be included. Two groups separating participants and non-participants will be created for each study site. Special care will be taken to ensure there is a gender balance within the groups and that specific questions are aimed specifically at engaging them.

Project Description for Participants

"My name is Lena Jeha and I am from the University of York in England. My assistants and I would like you to work with us on some research looking at how conservation interventions over the past few years have been impacting the communities you live in.

We need you to help us understand **who** has been working in your area, **what** information or resources they have given you and **if or how** this has changed your livelihood. More specifically we want to understand whether these interventions have altered your resource use both on your farm and from the National Park, or whether other factors such as governance, markets or your values have driven these actions.

We also want to grasp how you feel about such interventions in your areas and what can be done to improve them.

Please try and be as open and truthful as possible. Without an accurate reflection of the success and challenges from the introduced interventions, the implementation of such projects cannot be improved. Bearing in mind I am an impartial, independent researcher, I have no ability to change the way these programs run or their funding. I can however, guarantee that no private/personal information will be disclosed. This process is about sharing information and learning from one another.

The activities are fun to undertake and not too time consuming. We will start with a group meeting – followed by some participatory mapping. Snacks and soda will be

supplied; however, no allowances will be given. Please feel free to ask as many questions as you would like throughout the activities. Equally you have the right to stop the discussion at any time without giving any reason. Is that okay?

The information you supply will be analysed by myself – and will collectively feedback to the relevant organisations either through a progress report or a published article. Again, no personal information will be disclosed; instead I will highlight key emerging themes identified by the participant. We will not share your personal details or personal views with anyone else during this process. Is this okay?

If you wish to take part in the activity please write your name and sign next to it.

If you agree, we would like to take some photos. We might use these in presentations or publications about this project. Is this okay? Do you have any further questions? Can we start the discussion now?

Principles and Guidelines

Taken from Schreckenburg et al (2012), the following key principles will underpin this PRA :-

Mutual Learning

During this PRA, an open methodology that encourages "natural conversation" between both my research team and the participants will be introduced. The emphasis will be placed on building rapport and a good relationship with the community by showing respect, answering questions, and generally showing interest and willingness to learn from residents (who are the local knowledge experts). In addition, PRA exercises are expected to generate a space for debate and reflection about residents' understanding of local problems, reasoning behind actions, as well as expectations. Rather than a one-way flow of information, this PRA aims to generate a collective learning process in which outsiders and insiders learn together through those exchanges.

Passing the Stick

It is paramount that my PRA team let residents take the initiative. Although this manual presents the set of topics and questions that will be discussed, the

instructions provided will not be taken as a clearly structured framework to be imposed. Instead, facilitators will guide the key topics of interest for the research, allowing participants to freely contribute to the agenda of discussion, introducing any additional pieces of information that they consider relevant. Similarly, visual group exercises (i.e., drawings and diagrams) will be oriented by the PRA team but done by participants. The symbols, selection or ranking criteria as well as the key topics to be analysed will be defined and represented by residents in their own terms.

Participation

PRA exercises will be conducted in a manner that all participants—irrespective of their age, sex, education, or cultural background—can take part. Although some exercises demand a specific profile of participants (e.g., women only groups), my facilitators will be sensitive to any social, cultural, or economic differences within those groups. Participants of different socioeconomic and cultural backgrounds will be given equal opportunity to contribute in terms of information and opinion. All efforts will be made to avoid any potential bias in detriment of vulnerable groups such as women, the elderly, very poor neighbours or ethnic/religious minorities, amongst others. Likewise, diagrams and tables will be designed in a manner that all participants will be able to contribute. Symbols and other visual aids should be used so as to allow illiterate people to participate (if they are present).

Collecting Useful Secondary Data

Given the group dynamic, I will use this opportunity to ask whether any additional information about the study site exists. I am particularly interested in accessing documents that are not available online. The types of data that will be useful for my study include: -

- Maps
- Climatic Information
- Forest Inventories
- Reports
- Dissertations
- Census information-derived at sub-county level
- Journal/Newspaper reports
- Community Documentation

Introduction and Background

Task 1: To identify the socio-economic characteristics of the study site

Introduction to task: We are interested in finding out some background information about the area you live in. In particular we would like to know:

- Age/History of policy interventions in this area (participants come from more than one village).
- The distance to the nearest road
- Whether most people have access to formal credit
- Population stats at the Parish level- information derived from sub-county office.

Facilitators Notes

All the information discussed during this exercise will be transcribed onto a flip chart.

One facilitator will be taking notes throughout the discussion in separate notebook. They will be paying attention to details and recording any information missed out by the facilitator running the task (most likely me).

I have already captured some of this basic information during the focus group discussions and well-being ranking exercises so this discussion should be kept brief. Participants might get carried away with village history.

Materials: Snacks (Chapatti, samosas etc.) drinks (soda/water), flipchart, camera, colour pens, note-book.

Allow 10 minutes for this exercise

Task 2: To identify local resource-use in the study-site

Purpose: To determine how participants are using land and why they are making these choices.

Introduction to task: We would like to know more about how and why you use land in your area. We are interested in knowing

- What day-to-day livelihood activities do you engage with on your land e.g. home garden, food crops, fallow land, cash crop plantation, taboo or sacred patches of forest, wetlands, diverse types of farmland, etc?
- Can you think and agree on a symbol that represent these activities e.g cow for Zero-grazing, bee for apiary etc
- What type of harvest outputs do you get from your farms? How much do you typically sell? How much for?
- What type of trees have you planted in your gardens? When do you harvest them? Is it enough to meet your needs?
- Do you use the NP? How?
- What type of benefits do you receive from these activities?
- Are there any other drivers of deforestation in the area?

Facilitators Notes

All the information discussed during this exercise will be transcribed onto a flip chart.

One facilitator will be taking notes throughout the discussion in separate notebook. They will be paying attention to details and recording any information missed out by the facilitator running the task (most likely me).

Materials: Snacks (Chapatti, samosas etc.) drinks (soda/water), flipchart, camera, colour pens, note-book.

Allow 30 minutes for this exercise

Task 3: To identify exactly which environmental organisations have been working in the area and what support they have given local communities-both via inputs, policy changes and training.

Purpose: To determine which environmental interventions have taken place and what methods have been used to do so (distribution of benefits). I have already captured some of this information during the focus group discussions and semi-structured interviews. The idea of this exercise is to set the context for the mapping exercise and capture any missing information.

Introduction to task: We would like to know what environmental organisations have been working in your area and what support they have been giving you. Can you tell us:

- Who the main organisations- both local and external- who have been helping you with natural resource management. Can you start with the first organisation you can think of then progress to the most recent so we create a timeline of interventions?
- How have they been working with you? Did you receive any training or inputs? Did they introduce any technologies such as elephant grass, biogas units, apiary/ contours/trenches etc. Again can we create a symbol for each technology/input. Did they help you design village plans or put any other management regimes in place like resource use agreements with UWA?

Facilitators Notes

During the first mapping exercise we will let participants come up with the symbols and corresponding colours. After that we will use the same symbols and colours unless they want to add additional ones. It is important that a legend for each of the map is created.

All the information discussed during this exercise will be transcribed onto a flip chart.

One facilitator will be taking notes throughout the discussion in separate notebook. They will be paying attention to details and recording any information missed out by the facilitator running the task (most likely me).

Allow 20 minutes for this exercise

Participatory Mapping

Task 4 To map the changes caused by conservation interventions across Mt. Elgon.

Purpose: To understand how conservation initiatives have impacted:

a) On-farm practises
b) Resource use of the NP

Introduction to task: We would now like you to map the specific changes you have made in your area from the knowledge or inputs given to you by the environmental organizations that have or are working in your area.

Facilitator Notes

Looking at inputs and changes caused by the intervention may result in a different symbols being used for the participatory mapping. During the first mapping exercise we will let participants come up with the symbols and corresponding colours. After that we will use the same symbols and colours unless they want to add additional ones. It is important that a legend for each of the map is created.

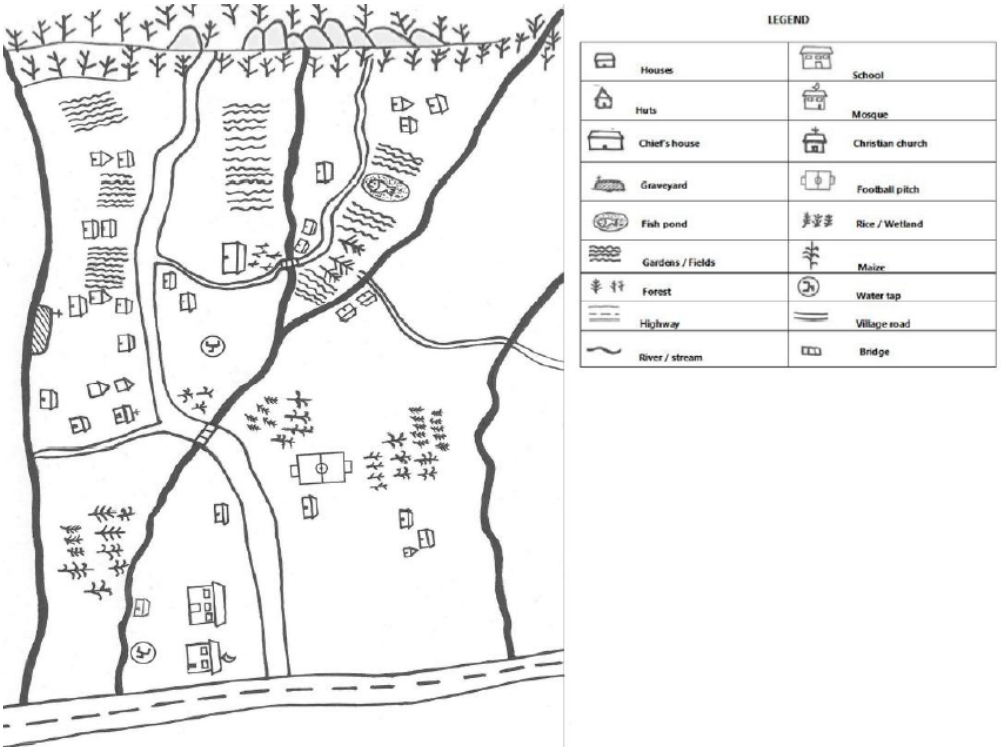
Again, one facilitator will be listening and noting down what participants are saying, while the other will be engaging with participants, helping them to draw, answering any questions and translating everything. Control points and orientation of the map will also need to take place during this exercise.

Note this exercise is not about general land-use change but about capturing the specific changes in inputs/land-use introduced by the project such as tree plantations, biogas units etc

Materials: Snacks (Chapatti, samosas etc.) drinks (soda/water), flipchart, camera, colour pens, note-book, base-maps and acetate.

Allow 30 Minutes for this exercise

Output



Task 6 To map future changes villagers would like to see in their local environment in ten years' time.

Purpose: To identify 'user inspired' and 'user-useful' management approaches for future conservation interventions.

Introduction to task: We are interested in understanding how and where you feel natural resource management can be improved in your area. Can you draw on the map what type of activities you would like to see in your village and where?

Facilitator Notes

At the end of the exercise participants will be reminded that we do not have the ability to implement such changes. Instead this process should be seen as an opportunity to reflect on the changes people could make to improve their landscape, acknowledging what exactly needs to be done to achieve it.

Again, during this exercise one facilitator will be listening and noting down what participants are saying. We will continue to ensure only one person is writing on the map at each point in time.

A picture of the final map will be taken at the end of the activity.

Materials: Snacks (Chapatti, samosas etc.) drinks (soda/water), flipchart, camera, colour pens, note-book, base-maps and acetate.

Allow 30 minutes for this exercise

Trend Analysis and Management Discussions

Task 7: To complete an analysis of perceived changes in benefits and dis-benefits.

Purpose: To quantify (socially) the changes policy interventions have had on natural resources and livelihood in the area.

Introduction to task: We would now like you to reflect on the mapping processes by looking how your changes in livelihood activities have affected or will affect natural resources and livelihood in your area. Let us begin by identifying what are the major aspects of your livelihood and natural resources that have changed e.g, crops, landholding, soil fertility, water availability, household income, walking distances and healthcare. We would now like to know:

a) What these were like 10 years ago
b) What they are like today
c) What you would like them to look like in ten years

Facilitator Notes

As the discussion takes place, a matrix will be drawn on the flipchart for participants to fill in. Similar to creating the symbols, we will let the first group determine the criteria then add additional ones if specified by other villages.

Facilitators will continue to take notes, help with translations and ensure everyone is engaging with the activity.

Materials: Snacks (Chapatti, samosas etc.) drinks (soda/water), flipchart, camera, colour pens and note-book.

Allow 45 minutes for this exercise

Output

	Landholdings	**Soil Fertility**	**Crops Cultivated**	**Forest Cover**
25 years ago				
Present				
Future				

Task 8 To identify the main governance issues surrounding resource-use

Purpose: To understand what governance structures are in place and how conservation interventions have impacted or been impacted by these dynamics on the ground.

Introduction to task: We would like to finish of this appraisal by understanding how natural resources are managed in your area. We would like to know:

- Have the conservation interventions in your area been effective?
- If so why? Were there some inputs/management techniques you liked or disliked?
- Do you understand why such programs have been introduced in your area? Do you believe they are good?
- How do you think such programs can be improved?

- Is everyone in the community is engaging with how conservation interventions are being run? How often do you meet as a group? Does everyone attend? If not why not? What can be done to improve this?
- Do you trust the partners you are working with-from local government to the NGO's running the program? How transparent are these organizations/committees?
- Is there any form of political interference with these projects? What about local elites? Do they influence how the organisations operate? If so how?
- What can be done to improve governance surrounding resource-use?

Facilitator Notes

Facilitators will continue to take notes, help with translations and ensure everyone is engaging with the activity.

Materials: Snacks (Chapatti, samosas etc.) drinks (soda/water), flipchart, camera, colour pens and note-book.

Allow 30 minutes for this exercise

Time Management and Housekeeping

Allowing a few minutes between each task, the total time required to complete all the exercises is approximately four hours. Considering the difficulties in engaging participants for long periods of time, each group will be asked to attend for half a day on two separate days. A timetable can be found in **Table A.**

Six maps should be created for each field-site, giving a total of 30 maps for the whole study (including trial).

Table A

Day One	Day Two	Day Three
Arriving to Field site, collecting secondary data and organising participants for the next day	**Members Group** **9.30**: Arrival time for members **10.00**: Introduction and consent **10.30**: Task One **10.50**: Task Two **11. 20**: **Break-Provide Soda and Chapatti** **11.45**: Task Three **12. 20**: Task Four **13.00**: End of first day /Break for facilitators **Non-Members Group** **13.30:** Arrival time for non-members **14.00:** Introduction and consent **14.30**: Task One **14.50:** Task Two **15.20**: **Break Provide Soda and Chapatti** **15.45:** Task Three **16. 20:** Task Four **17.00:** End of first day. Pack up and ensuring all data is organised.	**Members Group** **9.30**: Arrival time for members **10.00**: Recap of past activates **10.10**: Task Five **10: 45**: Task Six **11.15: Break- Provide Soda and Chapatti** **11.45**: Task Seven **12.30:** Task Eight **13.00:** End of PRA for members/Break for facilitators **13.30:** Arrival time for non-members **Non-Members Group** **14.00:** Recap of past activities **14.10:** Task Five **14. 45:** Task Six **15.15: Break-Provide Soda and Chapatti** **15.45:** Task Seven **16.30:** Task Eight **17.00:** End of PRA for non-members. Packing up and ensuring all data is organised.

B) Trend Analysis Results

Table 1. Trend Analysis Results for Members from Study Site One

	Landholdings	Crops	Soil Quality	Water Quality	HH Income	Level of Education	Communications	Health Services	Infastructure and Roads
25 Years Ago	2 acres	Matooke, Beans, Cassava, Coffee	+++++ Higher yields, better quality matooke. One large bunch would produce 12 clusters	+++++ All water was sourced from river Manafwa Good quality No cultivation near river	No money, completely subsistence	Few Children had education. Most likely reaching primary 7	Drums, different sounds had different messages	12 km to health centre in Bududa or Bukigai	Path, thatch huts
Present	¼ Acre	Cabbages, onions, ground nuts, improved bananas, sweet potatoes, potatoes, maize, garlic, coffee	++ 1 bunch of matooke yields 5-6 clusters	++ Protected water sources Springs wells	10 000 Ug Sh per day	Most children reach secondary level	Still some drumming, phones, radio, T.V, posters	Health centre in each sub-county, drug shops, ambulance-motorcycle	Murram road, semi-permanent houses with iron sheets, motorcycles, bicycles
20 Years from Now	Small > ¼ Acre	Onions, carrots, rice (uplands), cabbages, green peppers, vanilla, watermelon, wheat	++++++ 1 bunch yields 14 clusters	+++++ Every HH has a private water source like a tap	50 000 Ug Sh per day	Finish Secondary school and go to tertiary level	Computer (for educated) T.V's in each HH	Vehicle ambulance, Health centre in each parish, local hospital in each sub-county	Electricity, tarmac roads, permanent houses

Table 2. Trend Analysis Results for Non-Members from Study Site One

	Landholdings	Climate	Soil Quality	Water Quality	HH Income	Level of Education	Population	Health Services	Infastructure and Roads
25 Years Ago	2 acres	A lot of rain, seasons more predictable	+++++ Higher yields, quality matooke. One large bunch would produce 8-12 clusters	+++++ All water was sourced from river Manafwa Good quality	5 000 Ug Sh per day	Few Children had education. Most likely reaching primary 7	Sparely populated 3-4 people per HH	People rarely get sick, no health centre in sub-county	Foot paths that were muddy and busy
Present	¼ Acre	Drier seasons, less predictable, hotter	++ 1 bunch of matooke yields 5-8 clusters	++ Protected water sources Springs wells and they still use the river	10 000 Ug Sh per day	Most children reach secondary level, some attending university	6-12 people per HH	Few Health centres, more disease	Murram road,
20 Years from Now	Small > ¼ Acre	More predictable seasons	++++++ 1 bunch yields 8-12 clusters	+++++ Every HH has a private water source like a tap	50 000 Ug Sh per day	Finish Secondary school and go to tertiary level	3-4 per HH	More hospitals greater availability of drugs for different diseases . More health workers	Electricity, tarmac roads, phone boosters

Table 3. Trend Analysis Results for Members from Study Site Two

	Landholdings	Soil Quality	Water Quality	Family Size	Fuelwood	Healthcare	Infastructure
25 Years Ago	10 acres	Fertile, soft, 9-15 clusters of Matooke +++++	Clean and clear water. Water was collected from rivers and streams. +++++	5 people per HH.	Fuel wood was collected from within farm. They never went to into the forest.	Local medicine used People hardly got sick. The closest health centre was 4-5 hours away	Footpath Primary schools
Present	1/4 Acre	Soil quality is poor and requires fertilisers. Matooke has 6-8 small clusters++	There are wells protected water sources however they do not work all year round. ++	10-20 people per HH.	Buys firewood. They have a resource agreement with UWA and collect fuel wood on those days. They walk 5 miles to get firewood.	Motorcycle to health centre which is in the next sub-county 2 miles away. Drug shops available in the sub-county.	Phone reception Murram roads Schools
20 Years from Now	1/8th Acre to plots	9-5 Matooke clusters Good soil management ++++	Water all year, protected water sources, gravity water schemes. Cleaner water.	6 people per HH.	Biogas, energy saving stoves, More trees on forest, although there is not much space to do so.	Health centre being closer, more health workers and medicine	Better roads, more school and better quality. Electricity
Present	½ Acre	Not very fertile 5 small clusters +++	Very dirty with less of it. There are protected water sources but they are in poor shape. ++	12 people per HH	Today people go to the N.P. They walk 6 km	4 km away but the equipment is poor with little drugs. There are low number of health workers	impassable during the rain). No secondary schools. The schools they have low number of teachers.
20 Years from Now	1/5th Acre	More fertile Better Matooke 15-16 clusters +++++	Hope to get more protected water sources such as spring's boreholes, taps in each HH.	5-6 People per HH	With access to electricity, biogas and planting more trees they would not like to go in the N.P	Better and more medicine. More health workers with closer centres.	Electricity, tarmac road, permanent houses, charcoal stoves and secondary schools.

Table 4. Trend Analysis Results for Non-Members from Study Site Two

	Landholdings	Soil Quality	Water Quality	Family Size	Fuelwood	Healthcare	Infrastructure
25 Years Ago	4 acres	Very Fertile, 12 clusters of big Matooke +++++	Good, clean water they would drink. It was clear and there was plenty of water +++++	30. They had more than one wife. Polygamous	There were enough trees from within the farm. They were indigenous trees.	Little sickness local herbs	Footpaths. Schools and houses made of thatched grass
Present	½ Acre	Not very fertile 5 small clusters +++	Very dirty with less of it. There are protected water sources but they are in poor shape. ++	12 people per HH	Today people go to the N.P. They walk 6 km	There is a health centre 4 km away but the equipment is poor with little drugs. There are low number of health workers	Murram, roads (that are impassable during the rain). No secondary schools. The schools they have low number of teachers.
20 Years from Now	1/5th Acre	More fertile Better Matooke 15-16 clusters +++++	Hope to get more protected water sources such as spring's boreholes, taps in each HH.	5-6 People per HH	With access to electricity, biogas and planting more trees they would not like to go in the N.P	Better and more medicine. More health workers with closer centres.	Electricity, tarmac road, permanent houses, charcoal stoves and secondary schools.

Table 5. Trend Analysis Results for Members from Study Site Three

	Landholdings	Soil Quality	Water Quality	HH Income	Family Size	Fuelwood	Health Services	Infastructure and Roads
25 Years Ago	15 acres	Fertile, not much soil erosion, soil texture was soft. +++++ 11-12 clusters of banana	Water was clean, volume was constant and all water was collected from the river +++++	100,000 Ug Sh per year. Money had more value then. 100,000 could buy you five cows. Today you would require 1.5 million.	12 people per HH	Collecting fuel from within home. Indigenous trees only 5-10 meters away	1 health care centre in district. Found in Kapchorwa town 7 km away Access to medicine	Footpath
Present	4 Acre	Soil has become hard, with low fertility. 6-7 clusters produced from tree. +	Water is dirty (brown) and has reduced in volume. Water is now collected from streams, tap stands and protected springs	1.5 million Ug Sh	6 people per HH	7 km to collect fuel wood. Most collected from N.P	Better access to treatment within sub-county Health care centre within sub-county	Murram road, permanent houses, phone reception
20 Years from Now	1 Acre	Fertile soils that produce 15 clusters of Matooke +++++	Protected water source in each HH +++++	10 million Ug Sh	3 people per HH	Still collecting from N.P	Health care centre in every parish, better access to medicine	Electricity Tarmac road

Table 6. Trend Analysis Results for Non-Members from Study Site Three

	Landholdings	Soil Quality	Water Quality	Family Size	Fuelwood	Healthcare	Infrastructure
25 Years Ago	Population was small, houses were scattered. 5 Acres	Soil quality is poor. Matooke clusters small 5-6. They did not prune or in engage in any crop management activates ++	Good water quality, no cultivation near banks, collecting water from the rivers and streams	7 people per HH	Collecting Indigenous species from N.P They would walk 4 km	No health centres close by. Local herbs were used. They hardly got sick. People would carry sick friends 15 km to health centre.	Footpaths.
Present	1 Acres	Soil quality is improving.13 Matooke clusters ++++	Water contaminated, red in colour with waste in it. There are protected water sources which are contaminated +++	12 people per HH	Still collecting from N.P but now they walk 25 km	Health centre 1 km away. Good health care.	Murram roads, some primary and secondary schools.
20 Years from Now	¼ Acre > smaller plots	Good Quality Matooke 20 clusters +++++	Protected water sources, gravity flow schemes that start from within the N.P so water is clean. +++++	Four children per HH	Tree planting so trees collecting from forest. Switching to bio-gas and energy saving cook stoves	Closer services and more of them. Better medicine and more health workers.	Tarmac roads, milk cooler, electricity, permanent house

Table 7. Trend Analysis Results for Members from Study Site Four

	Landholdings	Fuel	Soil Quality	Water Quality	HH Income	Population	Health Services
25 Years Ago	1 acres	Walk short distances, about ½ km to fetch firewood	+++++ Higher yields, quality Matooke. One large bunch would produce 16 clusters	+++++ All water was sourced from river and well Good quality and quantity	10 000 Ug Sh per day. Coffee fetched a good price in the old days.	4-6 people per HH	Walk 4-5 km to the health centre. Medicine was available there.
Present	½ Acre	Today they walk more than 4 km to collect firewood from the NP and public lands	+++ 1 bunch of Matooke yields 8-10 clusters	+++ Protected water sources. Springs. Wells rarely using river	3 000 Ug Sh per day	8-10 people per HH	Health centre in village but not enough drugs because population is high
20 Years from Now	1/8 Acre	Biogas, more trees from chamba, charcoal	++++++ 1 bunch yields 16 clusters	+++++. Every HH has a private water source like a tap. More protected springs	10 000 Ug Sh per day	8 people per HH	More drugs available. More government assistance

Table 8. Trend Analysis Results for Non-Members from Study Site Four

	Landholdings	Fuel	Soil Quality	Water Quality	HH Income	Population	Health Services
25 Years Ago	1 acres	Walk short distances to the national park, about 1 km	+++++ Higher yields, quality Matooke. One large bunch would produce 12-14 clusters	+++++ All water was sourced from river Good quality	7 000 Ug Sh per day. Coffee fetched a good price in the old days.	4-6 people per HH	Walk 4-5 km to the health centre. Medicine was available there.
Present	¼ Acre	Today they walk more than 5 km to collect firewood from the NP	++ 1 bunch of Matooke yields 5-8 clusters	+++ Protected water sources Springs Wells Rivers have reduced in size	2 000 Ug Sh per day	9-12 people per HH	Health centre in village but not enough drugs
20 Years from Now	¼ Acre	They still want to use firewood, but on a lower scale. They want energy saving cook stoves and biogas.	++++++ 1 bunch yields 12-14 clusters	+++++ Every HH has a private water source like a tap	5 000 Ug Sh per day	4-6 people per HH	More drugs available.

Acronyms

ALP	Alternative Livelihood Project
CO_2	Carbon Dioxide
CRF	Cash Revolving Fund
CIFOR	Center for International Forest Research
CAPS	Conservation Agricultural Production Systems
CBD	Convention on Biological Diversity
HH	Household
IGA	Income Generating Activities
ICDP	Integrated Conservation and Development Project
IUCN	International Union for the Conservation of Nature
KADLACC	Kapchorwa District Landscape Chapter
LVBC	Lake Victoria Basin Commission
MECDP	Mt. Elgon Conservation and Development Project
MERECP	Mt. Elgon Regional Eco-System Conservation Project
NAADs	National Agricultural Advisory Services
NP	National Park
NGO	Non-Government Organisation
NUSAF	Northern Uganda Social Action Fund
PGIS	Participatory GIS
PRA	Participatory Rural Appraisal
PES	Payment for Ecosystem Services
PA	Protected Areas
REDD+	Reduced Emissions from Deforestation and Forest Degradation
SNA	Social Network Analysis
SPW	Student Partnerships Worldwide
SL	Sustainable Livelihood
TACC	Territorial Approach to Climate Change
UWA	Uganda Wildlife Authority
UNEP	United Nations Environment Programme
WWF	World Wildlife Fund

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