Smallholder farmers in Africa, who have long relied on rain-fed agriculture, are currently experiencing adverse impacts of climate change which is posing serious challenges to their ability to sustain their livelihoods (Morton 2007). This is the case for many other areas around the world, especially among indigenous or rural communities who rely directly on natural resources. Little is understood about the day-to-day impacts felt in many of these communities, impacts that vary considerably, based on location. Little still, is understood about the strategies that individuals or communities are adopting in order to cope and adapt, strategies that can be expected to vary based on the social and cultural context of specific communities (Crate & Nuttall 2009). Discourses around climate change have been dominated mainly by scientists and policy makers who, in their considerations, pay more attention to the biophysical aspects of climate variability. Consequently, strategies to address climate change are centered on
mitigation of greenhouse gas emissions, a major concern in the industrialized world (Orlove et al. 2010, Berkes 2007). However it is projected that greenhouse gases already present in the atmosphere, will result in increasing climate variability and extreme events such as droughts and rising temperatures among others. Communities in the non-industrialized world have contributed the least to greenhouse gases, yet they are disproportionately vulnerable to the adverse impacts of climate change (Kangalawe 2011). Given the broad scale of climate change, the resulting impacts affect many aspects of peoples' livelihoods. Hence there is a need for more place-based studies that highlight the human dimensions of climate change. Considering human dimensions provides to a better understanding of the links between perceptions of climate change, local knowledge and responses to climate change. This approach is adopted in this research study, which focuses on smallholder farmers in Rusinga Island located in Kenya's Lake Victoria basin. The main aim is to understand how they perceive climate change and in turn the strategies they are employing as they confront uncertain climatic conditions. The study is centered on the individual practices of local farmers as well as communal action aimed at enhancing their resilience to climate change. The approach is integrative seeking to understand the coping and adaptation strategies favored by farmers within the specific sociocultural context in Rusinga Island.
Local Perceptions of Climate Change, Coping and Adaptation Strategies among Smallholder Farmers in the Lake Basin Region of Kenya

by

Robert Asinjo

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Major Professor, representing Applied Anthropology

Director of the School of Language, Culture, and Society

Dean of the Graduate School

I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

Robert Asinjo, Author
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LOCAL PERCEPTIONS OF CLIMATE CHANGE,
COPING AND ADAPTATION STRATEGIES
AMONG SMALLHOLDER FARMERS IN THE LAKE BASIN REGION OF
KENYA.
CHAPTER 1 - INTRODUCTION

Confronting the impacts of climate change is arguably one of the biggest challenges rural farming communities in Africa currently face, and likely to face long into the future. Many of these communities depend heavily on rain-fed agriculture for sustenance, in terms of both food and income. Yet little is understood about how communities that rely on subsistence farming perceive climate change impacts and the strategies they are adopting in an effort to confront the associated challenges. The challenges posed by climate change are unfolding concurrently with community-based intervention initiatives aimed at alleviating poverty in many rural communities.

This study presents a case study of farmers in one such community, Rusinga Island, located in the Lake Victoria Basin of Kenya. The study seeks to answer the following questions;

1. How do farmer's perceptions of climate change influence their farming practices?
2. What resources do farmers deem important in confronting the impacts of climate change?
3. How are farmers employing communal action to confront the impacts of climate change?

The general approach of the study is integrative and seeks to understand the links between farming practices, local livelihoods, and strategies aimed at understanding and confronting climate change impacts. Rather than looking at current
practices as discrete outcomes, the focus is on understanding these phenomena as an ongoing process, within a specific social and cultural context.

**SIGNIFICANCE**

All around the world, small-scale farming remains the norm with 70% of the world's population earning a living from agriculture. It is estimated that 50% of rural residents worldwide, are smallholder farmers. In Africa it is even higher at 73% of rural residents (Morton 2007). Smallholders are generally considered as households that farm small plots of less than 3–4 hectares, for subsistence as well as cash incomes (Morton 2007, Netting 1993). Smallholders in the global south make up a large subset of communities that are considered to be the most vulnerable to climate change (Kangalawe 2011, Crate & Nuttall 2009, Downing 1997). To date however discourse on climate change has largely been dominated by climate scientists in the industrialized world and often emphasizes biophysical aspects. Consequently perhaps calls for responses have stressed the need for mitigating greenhouse gas emissions a major issue of concern in industrialized or fast industrializing countries. Alternately many of the most vulnerable communities have contributed the least to greenhouse gas emissions that are considered one of the main anthropogenic factors driving global climate change (Crate & Nuttall 2009). Yet it has been observed that smallholders, who rely closely on their surrounding environment are already confronting varied impacts of climate change, that include changing rain patterns, droughts, and the depletion of natural water sources among others. Many studies project more of adverse impacts and greater uncertainty long into the future (Kangalawe 2011, Downing 1997).
Climate change impacts can be expected to vary depending on the location, while responses can be expected to vary based on the social and cultural environments of a given community. This foregrounds the importance of considering human dimensions that take into account the varied ways in which people perceive, understand and respond to adverse climate change impacts (Crate 2011, Roncoli et al. 2009). There are already numerous calls for intervention initiatives, and given the broad scale of climate change and its span across multiple localities, initiatives that bring together actors from different communities are likely to become more common in the future. For instance the UN Millennium Development goals lists the need for community-based sustainable development initiatives as one of its top priorities, together with the incorporation of sustainability principles into government policies. In response large multinational institutions such as the World Bank are currently directing funds to many such initiatives. There is already a presence of initiatives in many communities of the global south, with the aim of poverty alleviation or preserving natural resources (Mansuri & Rao 2004, Kottak 1999). It has been widely observed that interventions are inherently political in nature and despite professed intentions, have the potential to undermine local or culturally preferred practices, in favor of what is often referred to as outsider or expert knowledge. This approach has the potential to further undermine the ability of a community to cope with the impacts of climate change (Fisher 1997). In this respect it is very important to understand the varied dimensions of how people perceive, understand and respond to impacts of climate change.
This thesis follows a manuscript format, and includes two manuscripts that address different aspects of the research findings. The thesis contains six chapters starting with this introduction. The second chapter provides a brief overview of the theoretical frameworks that influenced the study. Chapter three discusses the research context, describing the actual research site, as well as the process by which myself as the researcher, approached, entered and commenced my research in Rusinga Island.

Chapter 4 contains the first manuscript which addresses the first research question. It details local perceptions of climate change impacts and their effects on land-use, crop selection and food provisioning. This is followed by the second manuscript, Chapter 5 which details collective action in Rusinga Island that is once again aimed at addressing climate change impacts. The second manuscript addresses the second and third research question, discussing resources considered important in addition to communal efforts that are seen as enhancing the ability to confront climate change. Detailed discussions of the relevant theoretical background are included in both manuscripts. Each manuscript also includes sections describing the relevant methods, analysis, findings, as well as a concluding discussion. The final chapter includes overall concluding points, the limitations of this study and recommendations for further research.
CHAPTER 2 – THEORETICAL FRAMEWORK

RESILIENCE AND VULNERABILITY

The overarching framework employed in this study is drawn from the concepts of resilience and vulnerability. This approach allows an understanding of shifts in farming practices and collective action among farmers in Rusinga Island, as coping and adaptation strategies to the challenges presented by climate change. Within this framework, the term socioecological system has been used to encapsulate the ways in which humans interact with their environment to sustain their livelihoods (Crane 2010, Adger, 2006, Kottak 1999). Vulnerability refers to the extent to which a socioecological system is exposed to events or phenomena that constitute a shock, disturbance or challenge in some form. On the other hand resilience refers to the ability of a socioecological system to absorb these challenges without, being radically altered. Both resilience and vulnerability include three interacting factors. One is the actual disturbances, often termed stressors and can include climatic phenomenon such as drought, floods, or non-climatic factors such as food insecurity. A second factor is the impacts of the stressor, while the third is the response of the socioecological system. The responses can either be coping responses, which are short-term measures either during the disturbance or in the immediate aftermath, while adaptive responses are proactive and often long-term measures that involve changing the context in which coping takes place. Adaptive responses are essentially efforts to enhance the resilience of a socioecological system (Berkes 2007, Adger 2006, Erikson 2005).
LIVELIHOODS FRAMEWORK

The Livelihoods framework emerged as one way to understand how disparate communities go about maintaining and enhancing their well-being while confronting various stressors associated with changing socioeconomic, ecological and even cultural circumstances (Scoones 2009, Eriksen et al. 2005, Ellis 2000). It is an approach that conceptualizes and categorizes activities that constitute an individual's or a household's livelihood and well-being.

Ellis (2000) defines livelihoods as:

comprising the assets (natural, physical, human, financial and social capital), the activities, and access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household.

Essentially the livelihood framework identifies assets, or resources that a given individual or household depends on, the factors that facilitate or constrain access to those resources, as well as activities undertaken in the course of maintaining a livelihood. In many communities in the non-industrialized world, it is common for individuals or households to alternate between multiple occupations such as farming, wage employment, and even a small-scale income generating enterprises (Nyasimi et al. 2007, Eriksen et al. 2005, Bebbington 1999). Varied resources, activities and resulting outcomes are conceptualized and categorized into what Ellis (2000) terms as assets or capital. While emphasis is usually placed on the extent to which one has access to resources or assets, many have related these concepts to resilience and vulnerability. Access to an adequate mix of assets facilitates resilience (Ellis 2000, Chambers & Conway 1992). The resulting diversification of activities is also understood as an
effective risk mitigation strategy (Nyasimi et al. 2007).

While diversification across multiple occupations is a dimension more prevalently discussed in livelihood literature, there is also recognition of diversification specifically with respect to farming practice, exemplified by cultivation of a wide selection of multiple crops and mixed use of varied plots with different ecological characteristics. Hillsides, river beds or plots with different soil profiles all provide different micro-ecological niches that can be exploited in ways that are beneficial. Smallholder farmers exploit such varied topographies in ways that are acknowledged to engender agrobiodiversity (Connelly & Chaiken 2000, Netting 1993).

Overall a livelihoods framework provides a conceptual framework for considering livelihood activities of smallholder farming communities and the ways in which climate change impacts either their access to, or ability to exploit resources they depend on to maintain well-being.

LOCAL AND INDIGENOUS KNOWLEDGE

The importance of knowledge systems as a fundamental basis from which individuals or whole communities regard the world around them is now recognized in numerous approaches to understanding human–environment interactions (Moran 2008, Kottak 1999, Berkes 1999). This is a stance that has emerged from research in indigenous knowledge systems (IKS) otherwise referred to as traditional ecological knowledge (TEK). Recent research on indigenous knowledge systems, reflects a shift away from homogenous and self-exclusive conceptions of knowledge, towards the recognition that all knowledge systems are dynamic, situated in practice and specific
cultural contexts (Lauer & Aswani, 2009, Antweiler 2004). As recent scholars have pointed out, in the initial interpretations of TEK, the terms "traditional" and "ecological" were often taken to imply knowledge that was old, static, culturally and spatially bound, essentially a closed system (Brook & McLachlan 2008, Berkes 1999). Since then the terms such as indigenous knowledge system (IKS), local ecological knowledge (LEK) or simply local knowledge, have gained widespread use, in order to emphasize knowledge that is dynamic and adaptive and embedded in practice (Antweiler 2004). This is perhaps a truer reflection of indigenous knowledge and practice, as adapting to changing ecological circumstances has more been the norm for many indigenous communities (Berkes 1999).

The emerging perspectives on indigenous or local knowledge has provided new insights in the area of agricultural change, especially among smallholder farmers. In Africa narratives that inform agricultural research and policy, have tended to emphasize desertification, land and environmental degradation, often blamed on poor land management practices informed by the indigenous knowledge of farmers. The influence of other factors such as economic policies, increasing exposure to commercial markets are often relegated. This is a view not unique to Africa and is premised on the stance that farming practices based on indigenous knowledge systems are inferior to modern agricultural techniques. The dominant view is that agricultural practice should evolve along a trajectory from traditional to modern practices. This view has also been challenged by many studies that show evidence to the contrary (Amanor & Pabi 2007, Humphries 1993). Indigenous knowledge systems are an important asset for many smallholder communities and, a source of inspiration for innovative strategies which enable adaptation to challenging circumstances (Nyong et al. 2007).
It is now common place to find many communities navigating and reconciling diverse knowledge systems, a function of an increasingly interconnected world, confronting challenges such as climate change that transcend single localities. This poses major challenges given that local knowledge systems form the basis from which people regard the world around them (Berkes 1999). This is evident in the way indigenous and scientific knowledge systems have been positioned in categorical opposition. This need not be so. Through participatory and collaborative research studies, communities are gaining further insights into natural resource management strategies, in cases where local issues are prioritized, and different knowledge systems are all considered on equal footing (Lauer & Aswani, 2009, Archer et al. 2008). With the advent of climate change, the shift towards acknowledging the performative aspects of local or indigenous knowledge could not be more timely. It is of particular importance in bringing to the forefront emic perceptions of climate variability and the impacts on livelihoods. After all it is emic perspectives that tend to underpin the coping and adaptation strategies that are favored in any given community (Slegers 2008, Meinke et al. 2006, Roncoli et al. 2002).
Dinner had been served. There was a hot plate of *kuon* in Luo the local language, or *ugali* in Kiswahili. Ugali, made from maize flour is a very common staple all over Kenya and served with almost every meal. In the Lake Victoria basin, among the Luo *kuon* can be made of sorghum flour, or a mix of both sorghum and maize flour. Along with *kuon* was a dish of *sukuma wiki*, collard greens, another staple all over Kenya, and *omena*, a dish unique to *joNam*, people of the lake, as residents of Rusinga Island call themselves. Really all Luos, are considered *joNam*, but the people of Rusinga Island and those in the surrounding regions immediately adjacent to the Lake consider themselves truly *joNam*, exemplified by their day to day activities, fishing and farming, or farming and fishing depending on who you ask and then maybe some kind of employment.

Having Luo ancestry I was also considered a *jaNam*, except several degrees less given that I had grown up in the capital city, Nairobi. Nonetheless I was still a *jaNam*, and one who on this day sparked curiosity as a researcher who had returned from the United States. I had been so introduced by Oriek, a young man with whose family I would be staying with for the duration of my residence in Rusinga Island. At the moment we were sitting around a small dinner table at his uncle's house, about a five minute stroll away from his father's house, within a large homestead *mier*, that was shared between Oriek's father and two of his father's brothers. Oriek himself had a small hut, within his father’s section of the homestead. In between the houses and huts were plots of maize and sorghum with stalks all grown over 5 feet tall. So here I was, about to enjoy what was
probably going to be the first of two dinners that evening as I was sure, being the guest, I would be welcomed to eat again when we returned to visit with Oriek's father before he retired for the night. Meanwhile we enjoyed dinner and chatted with Orieks aunt, Min Oloo.

After the meal as we continued chatting with Min Oloo, we were joined by Wuon Oloo, Oriek's uncle. He had arrived back from a day long trip to Homa Bay the district headquarters on his motorbike. He and Oriek, exchanged greetings and chatted. After a few short minutes Oriek introduced me as the student researcher he had mentioned would be coming to do some research here in Rusinga Island. Wuon Oloo turned to me and asked, “in ng’a?” (Who are you?). By this point, having introduced myself a handful of times throughout the day, I was well practiced in the formal and full introduction that is expected if you are meeting someone for the first time. It requires your first and last name, and a short narration of where you are from, actually where your ancestry is from. Nairobi the capital city would not count except maybe to say that is where you currently live. Often more questions follow about your home area.

After introducing myself Wuon Oloo shook my hand and welcomed me warmly, and smiling. This left me feeling comfortable about my Luo which at first had been rusty, but was now improving day by day to a point where I could keep up with the Luo spoken in the rural area. Wuon Oloo invited us to sit back down after which he slowly began to introduce himself and as the head of the household, his family. He announced *Wan to ilwongowa ni Jolwedo* (Us we are called JoLwedo) he announced. “Amosou, ero kamano ahinya” (I greet you all thank you very much). I totally missed the joke. Everyone was smiling. Jolwedo. People who work with their hands. Hearing the prefix Jo- I was expecting a family name to follow but he used lwedo a reference for hands. He
later elaborated about how in Rusinga Island many of them were dependent on farming, fishing and odd jobs. Even among the few, such as local school teachers who had salaried jobs, most tended a farm, or went fishing, or both in order to support their families.

Oloo his adult son and Oriek's cousin, had by this point joined the conversation. His father turned to him asking him how fishing had gone the previous day. In Rusinga Island, young men are the ones who mainly go out onto the lake and fish, while women often stay on shore and process that catch. With farming it is predominantly the older generations and women who prefer to farm. The younger generation, are seen to shun a majority of farming work and opt instead for activities such as fishing, wage labor, motorbike taxi operators, or in general more direct ways to obtain a cash income. Nonetheless farming is still very important for any household. Early in the season young men in the household are often enlisted for plowing and other labor intensive activities such as constructing fences, but then tend to be absent from farming until the end of the season, when some return to help harvest mainly staple crops sorghum and maize. Apart from men who actively engage in farming, it is more likely women in any given household, who tend to other crops aside from maize and sorghum, such as vegetable for rest of the year.

Wuon Oloo, an active farmer pulled out two large and heavy green tomatoes from his coat pocket as he continued to chat with Oriek and his son. He had bought them earlier that day in Homa bay after he heard that they had been cultivated in a green house, quite rare in this part of Kenya. He was hoping to get the seeds from those tomatoes and grow them for sale. He figured they could fetch about Kshs10 each compared to 2 or 3 for commonly available tomatoes. All the tomatoes I had seen so far
were generally about the size of roma tomatoes, but these were about twice as big. After showing us the tomatoes he turned his attention back to me and advised me to get used to life here especially the food like eating maize for breakfast and drinking porridge made from sorghum or maize flour.

It took me about two weeks to really begin orienting myself to the rhythms of life in Rusinga Island. Through my initial observations with farmers and interactions with farmers, I became familiar with important key words that would prove indispensable in the process of understanding key activities and perceptions farmers expressed and in essence the idea of "being there" as an approach in and of itself (Roncoli et al. 2009). My initial days there provided ample context for how people in the community perceive their traditional lifeways and, farming practices alongside their desire to explore new crops as a way to supplement their cash income.

**FINDING THE COMMUNITY AND WORKING THROUGH INITIAL ASSUMPTIONS**

I arrived in Rusinga Island in late June 2012, close to harvest season. Perched on the back of an apiko, a motorcycle taxi, ferrying me into the island, I took in the fields of fully grown sorghum and maize stalks that lined the dusty road that runs around the island. The apiko driver, described that many in the Island were very hopeful for the harvest ahead. This year had been a "good" year, the rains had lasted longer, unlike the past three consecutive years. I had arranged my home-stay with Oriek's family through Badilisha a local community-based organization. Three months prior to the fieldwork, I came across Badilisha's website while researching community-based organizations focused on indigenous farming initiatives.
Badilisha Trust, in collaboration with a number of local farmers, is engaged in an effort to encourage sustainable farming practices in the community. Some of their efforts include preserving indigenous food plant species, and water catchment and preservation techniques. They are drawing on indigenous knowledge for instance digging irrigation channels that can direct rainfall and restore the local ecology. They are also drawing on external knowledge systems such as permaculture principles, to inform their efforts. I initially pegged Badilisha as a Non-Governmental Organization (NGO), and was intrigued at how the coordinators and affiliated farmers perceived and reconciled these different knowledge systems. It seemed a great example of a contemporary phenomenon given the far reaching trends of modernization, globalization and prevalence of intervention initiatives. I had not expected many NGOs, perhaps one or two, with Badilisha being one of them. However during my initial days in Rusinga Island I quickly came to realize that a number of other organizations and NGOs had been active in the community. I came to expect the likelihood that in the last few years it could be the case that a number of farmers could have collaborated or worked on projects with one or two other organizations, and furthermore each farmer having collaborated with an entirely different organization. Thus it would have proven even more of a challenge to disaggregate influences from various NGOs and associate them with farming practices, an endeavor I was not set up for. Nevertheless it remained apparent that farming in Rusinga Island is undergoing a lot of change, and climate was prominent on the minds of most community members.
RUSINGA ISLAND

Rusinga Island is located on Lake Victoria Kenya, and is inhabited mainly by members of the Luo ethnic group. The island is connected to the mainland by the Mbita Causeway, completed in 1983 (Geheb & Binns 1997). Historical accounts date the settlement of the Luo in Kenya's Lake basin region starting around the late 1400s and early 1500s, and thus they have long established traditions associated with the region. They are believed to have migrated down from present day Sudan though Uganda finally settling around Lake Victoria (Kokwaro 1998). The wider Luo community is known for their rich knowledge of plants and long traditions of herbal plant uses. An extensive ethnobiological survey of Luo plant and animal uses, speculates that, traversal of diverse ecological zones during the Luo's southward migration necessitated the accumulation of plant knowledge required to stay healthy (Kokwaro 1998).

Starting in the early 1900s colonialism ushered in a cash economy that affected resource use and extraction patterns. As the fishing industry grew and attracted outside investors, it became the primary cash generating occupation for the local community. Introduction of fish species non-indigenous to Lake Victoria such as the Nile perch and tilapia in the 1960s was followed by steadily increasing yields that resulted in a fishing boom in the 1980s. As a result interest in farming declined. Over the last decades the lake's ecology has declined. Many blame overfishing. Secondly, the non-indigenous fish introduced to the lake are aggressive and predatory, and have adversely destabilized the lake ecosystem leading to mass extinctions of lake biota. This phenomenon presents a very serious environmental challenge for the region as a whole. Consequently the declining fish stocks and poor environmental condition of the lake has led to renewed
interest in farming (Geheb & Binns 1997).

In spite of the increased interest in farming, farmers have not returned to the traditional methods used in the past. Historical accounts have documented sophisticated terraced and erosion control systems that were used to farm on the hills of Rusinga Island. Furthermore large swaths of vegetative cover have been clear cut for fuel-wood production. What is notable is that in Mfangano, a neighboring Island, the traditional terraced farming still exists albeit not as prevalent in the past. One probable reason is the fact that Mfangano is less densely populated and only accessible by boat, making it more isolated and less subject to outside influences (Connelly 1994).
CHAPTER 4 - PERPETUAL COPING: SHIFTS IN FARMING PRACTICES AS A RESPONSE TO CLIMATE CHANGE IMPACTS IN LAKE VICTORIA BASIN OF KENYA

ABSTRACT

This study examines the impacts of climate change and associated shifts in farming practice among smallholder farmers in the Lake Victoria Basin of Kenya. Emphasis is placed on local perceptions of climate change impacts and the strategies they adopt in response. Perceptions of climate change are intimately tied to the sociocultural context which is in turn a crucial determinant of the strategies employed. An approach that examines links between resilience and a community's socio-ecological system is utilized. The study reveals the persistent nature of climate change, especially highlighting how options for adaptive strategies that can enhance long-term well-being are fast dwindling leaving many in the community in a mode of perpetually coping with an increasingly uncertain climatic conditions.

INTRODUCTION

Global climate change has emerged as a grave cause for concern with climatologists documenting and reporting on incidences of extreme weather conditions such as drought, increasingly variable rain patterns, rising global temperatures and melting
polar ice caps. There are calls worldwide for all manner of initiatives to reduce what are considered the anthropogenic causes of climate change or to explore ways to live with a new climate regime. Up until recently research studies on climate change have emphasized macro-level trends with one reason being that organizations studying climate largely operate at regional, national or international levels. Furthermore many studies are scientific, and draw distinctions between the biophysical and human environments (Orlove et al. 2010, Berkes 2007). Consequently, measures to address climate change have emphasized mitigation of greenhouse gas emissions. This is a necessary undertaking that enjoys wide consensus. However even with successful mitigation measures, climate change impacts from the greenhouse gases already in the atmosphere, are presently impacting many communities and projected to continue long into the future with even more drastic effects than have been observed to date. Thus the importance of pursuing mitigation strategies in conjunction with adaptation strategies cannot be overstated (Kangalawe 2011, Downing et al. 1997). Perceptions of climate change, actual impacts and the responses to those impacts can be expected to vary depending on location and the sociocultural context (Silva et al. 2010, de Chazal & Rounsevell 2009, Slegers 2008). Thus more place-based studies that take into account the biophysical alongside human dimensions are highly needed (Crate 2011). In this study, it is anticipated that sociocultural factors are important determinants of the strategies varied communities employ to confront climate change impacts.
BACKGROUND

There is an emerging body of work that brings together biophysical and sociocultural factors in an effort to understand human–environment interactions in the context of global climate change (Crate & Nuttall 2009, Berkes 2007). Overall though there has been a lot of research examining how human communities interact with their natural environment, often termed as the socio-ecological system (Adger 2006, Kottak 1999). Within this body of work, the concepts of vulnerability and resilience are used to examine the varied capabilities of diverse communities to maintain well-being, when their socio-ecological systems are exposed to hazards or risks. Vulnerability refers to the extent to which a system is exposed to shocks and hazards, while resilience refers to the ability of a system to withstand shocks and hazards without being radically changed (Berkes 2007, Morton 2007). With both resilience and vulnerability, a couple of interacting components are considered. One is the actual shocks and hazards a system is exposed to, commonly termed as stressors, and can include drought, floods, food insecurity or even challenging socioeconomic or political conditions (Silva 2010). Stressors are considered alongside, the extent of the exposure, the response of the systems as well as the capacity of the system to cope and adapt to the stressors (Berkes 2007, Eriksen et al. 2005). Coping and adaptation are concepts that are often confounded, however a useful distinction, considers coping, as activities undertaken shortly after an adverse event in order to manage under the impacts of a stressor, for instance actions undertaken immediately after a flood. Adaptation refers to proactive long-term strategies aimed at reducing overall vulnerability, and often involves
changing the sociocultural frameworks around which coping takes place (Morton 2007, Ericksen 2005). In comparison to other stressors for instance floods or food insecurity, relatively little is understood about climate change as a stressor, specific impacts it has on livelihoods in varied communities and in turn the strategies employed to cope and adapt (Crate & Nuttall 2009).

Many communities that rely most directly on their environments are currently considered the most vulnerable to climate change, but yet have contributed the least to greenhouse gas emissions (Crate & Nuttall 2009). This includes smallholder farmers in Africa who rely on rain-fed agriculture, as a key part of their livelihoods. Smallholders are generally characterized as communities that engage in agriculture on relatively small landholdings, typically less than roughly 3 ha (7.4 acres). Farming is a family endeavor, however different members of each household may engage in other provisioning or income generating activities in order to contribute to the overall well-being of the household. Nonetheless, farming remains a key source of food and income in smallholder households in many areas of the world (Morton 2007, Netting 1993). It is estimated that worldwide 50% of all rural residents are smallholders. In Africa the figure is approximately 73% (Morton 2007).

Farming and food provisioning both provide an important context around which to understand coping and adaptation strategies employed by smallholder communities. Vulnerability, resilience and in turn adaptive capacity are factors that depend on the sociocultural context and thus perceptions and experiences with climate change or any stressor for that matter, are intimately tied to people livelihoods (Scoones 2009, Eriksen 2005). Ellis (2000) considers livelihoods as consisting five asset
categories or capitals, namely natural, physical, human, financial, and social. Natural capital includes natural resources for instance land used for farming, while physical capital includes produced goods for instance food harvests. Human capital consists of number of people available to contribute to maintaining the well-being of a household, for instance farm labor as well as their knowledge of farming. Taken together all these assets or capitals determine the livelihood or well-being gained by a household. Factors that undermine access of an individual or household, to these capitals are also considered stressors. As such the extent to which one has access to a varied mix of the assets determines their resilience or vulnerability. Thus for smallholder farmers, shifts in farming and food provisioning, undoubtedly important aspects of their livelihoods serve as key window into coping and adaptation strategies employed in response to climate change.

For many smallholder communities in non-industrialized countries, diversification of activities that makeup a livelihood is usually the norm. Diversification can occur at the individual or household level, the former referring to one engaged in multiple occupations, for instance farming in conjunction with a number of temporary or seasonal wage generating activities, while the latter refers to different members of a household specializing in specific occupations, but in the aggregate resulting in a household engaged in a diverse range of activities. It is widely noted that diversification makes sense as a risk mitigation strategy that enhances resilience (Nyasimi et al. 2007, Eriksen et al. 2005, Bebbington 1999). While many researchers to date have employed the concept of livelihoods and diversification as a research approach, most of the emphasis has been within the contexts of economic development and poverty
alleviation (Scoones 2009, Ellis 2000, Bebbington 1999, Chambers & Conway 1992). Less attention has been afforded to diversification of farming practices, within the context of climate change, and with it, consideration of current climate change impacts or future uncertainty, as a stressor undermining the capacity for many to enhance or maintain their livelihoods. Emphasis on economic development and by extension poverty alleviation is also an emphasis in discourses around agricultural change, which tend to emphasize aspects of agricultural intensification prevalent in industrialized countries as the preferred measure for progress (Keys & McConnell 2005). The unstated implication is that economic development is synonymous with enhanced resilience or increased adaptive capacity. In Africa dominant narratives that inform agricultural research and policy carry similar implications. Population growth is emphasized as a major driver of change necessitating agricultural intensification, once again along the lines of practices seen in industrialized countries. Environmental degradation is often blamed on poor land management practices informed by indigenous practices and knowledge systems (Amanor & Pabi 2007). This view, not unique to Africa, is premised on the stance that farming practices based on indigenous knowledge systems are inferior to modern agricultural techniques, and as such farming practices should evolve along a linear trajectory from practices characterized by high labor inputs and limited technology to those characterized by high external inputs and labor saving technologies that enhance efficiency and yield. In other words from “traditional” to “modern” (Amanor & Pabi 2007, Humphries 1993). In general this stance serves as a narrow definition of agricultural intensification that in effect marginalizes indigenous and local practices that are culturally salient for a given community.
Contrary to dominant narratives of agricultural change, indigenous or local knowledge systems are acknowledged as key assets for smallholder farming communities, and serve as a source of inspiration for innovative strategies that have enabled many communities to adapt to challenging circumstances (Derbile 2013, Amanor & Pabi 2007, Humphries 1993). For instance in the African Sahel, farmers have been able to adapt to highly variable and extreme climatic conditions such as drought for many generations (Nyong et al. 2007). Furthermore agricultural intensification among many smallholder communities in Africa, is often associated with high levels of agrobiodiversity (Connelly & Chaiken 2000). Cultivation of multiple crops highlights yet another dimension of diversification that mitigates risks thus enhancing the ability to cope and adapt to challenging circumstances (Ogalleh et al. 2012). There is an emerging body of work examining how indigenous and local knowledge systems influence perception and understanding of climate change in farming communities. In these communities projections of risk associated with climate variability or present impacts are observed and felt through aspects directly linked to daily livelihoods, such as changes in growth patterns of wild plant species, crop failure, changes in rain patterns among others (Ogalleh et al. 2012, Kanagalawe 2011, Rao et al. 2011, Orlove et al. 2010, Slegers 2008). However given the high levels of threat and uncertainty posed by global climate change more studies are needed, that link perceptions of climate change in varied sociocultural context to coping and adaptation strategies favored by varied communities.
RESEARCH AREA

Figure 1: Maps of Kenya and Rusinga Island

Demographic Profile

Rusinga Island is located on Lake Victoria, only a few hundred yards off the Kenyan mainland a short causeway connects the island to the mainland. In 2012, Rusinga Island officially became part of the Homa Bay County following a country-
wide reorganization of districts into counties. It was formerly part of Suba District. Both the new and old political boundaries consist of Kenyan communities that are a part of the larger Lake Victoria Basin communities. Rusinga Island and the surrounding communities that were formerly part of Suba District are mainly from the Luo ethnic group. The current population of Rusinga Island is approximately 24,275, with a population density of approximately 538 per km$^2$ (1380 per mi$^2$) (Suba DDP 2008). In 1979 the population was estimated at 9900 inhabitants a density of about 230 per km$^2$ (590 per mi$^2$) (Conelly 1994). The region has continued to experience high population growth with 58% of the population currently under 20 years of age. In Rusinga, land tenure is male-dominated with land holdings being apportioned among sons.

**Climate and Ecology**

Rainfall patterns in Rusinga Island and surrounding areas of Kenya is bimodal with annual averages ranging from 700 to 1200 mm. Temperatures range from 17.1 °C – 34.8 °C (63F to 95F). In general the climate is considered dry and hot relative to the rest of the country. December to February is considered the hottest period (Suba DDP 2008, Geheb & Binns 1997, Conelly 1994). In the last 20 years Rusinga Island has experienced high incidences of drought and shifts in rain patterns which has posed serious challenges for Island residents. The community also faces other ecological challenges such as desertification (Suba DDP 2008, Conelly 1994). District officials place much of the responsibility for regional environmental degradation on human activities, referring to poor farming practices, encroachment on protected lands,
charcoal burning and pollution among others. They specifically cite what they refer to as basal fallow farming as a contributing factor. Basal fallow farming is described as a practice where new farmland is cleared cultivated for a couple of years and then left to lie fallow while farmers move on to clear another plot of land. However, local officials do acknowledge poverty as one of the drivers of practices considered detrimental to the local ecology (Suba DDP 2008).

**Livelihoods and Socioeconomics in Rusinga Island**

On a number of measures, Rusinga Island and Suba District region in general is considered poor and marginalized relative to the rest of the country. In Suba district 52% of households live below the poverty line (Suba DDP 2008), compared to the national average of 46%, as determined by the national government. Metrics for what constitutes the poverty level in Kenya are not specified in accessed reports, however they indicate that Suba District is at an economic disadvantage relative to the rest of Kenya where national annual income averages US$ 650 (IMF 2010). In Rusinga food insecurity is a major concern, with local officials estimating that roughly 78% of food is sourced from outside the district. This is despite the fact that over three quarters of households in the district cultivate maize and sorghum. The area also suffers from lack of infrastructure for instance the road network is poorly developed, and electricity coverage is extremely limited. The two major centers in Suba District, Mbita and Sindo were only connected to the national electricity grid in 2008 (Suba DDP 2008).

Despite the socioeconomic hardships researchers cite that communities in the
Lake region of Kenya have found ways to cope and adapt, by virtue of the wide natural resource base. Rusinga Island has access to arable farming land and Lake Victoria which has a variety of edible fish species, that include tilapia, nile perch and sardines among others (Kokwaro 1998). The ability to engage in farming, livestock rearing and fishing is termed by Geheb and Burns (1997) as a tri-economy, which for a long time served as a source of resilience for lake region communities. Common livestock animals reared include cattle, goats and chicken. In Suba district the households on average rear 4 heads of cattle, 5 goats and about 11 chicken.

Alternating between fishing, farming and livestock rearing customarily depended on the season, with farming coinciding with the long rain season, and the major fishing period coinciding with the dry season. Settlement of the Luo ethnic group around the lake region dates back to the period between 1400s and 1500s. Thus they have developed extensive ethnobiological knowledge of the local biota. This knowledge incorporated into farming and food provisioning has traditionally been a key part of their livelihood strategies (Kokwaro 1998).

During the mid–20th century, colonialism ushered in a cash-based economy, and wage employment emerged as an additional livelihood strategy. Increasing exposure to market economies affected resource use and extraction as fishing became a major source of income for communities around Lake Victoria. During the 1950s introduction of non-indigenous fish species such as the nile perch and exotic species of tilapia led to steadily increasing yields which resulted in a fishing boom during the 1980s. At one point during this period the lake region accounted for 85% of the nation’s fish supply. Fish from Lake Victoria was also exported to a number of European
markets. During this period dependence on farming declined. This period is now debated as one of the contributing factors to the declining ecology of the lake. First the need for cash incomes is considered as one of the factors that led to overfishing. Second, the introduction of the nile perch, an aggressive, predatory fish, destabilized the lakes ecosystem leading to mass extinctions of lake biota. In general the resulting decline in fish stocks has adversely impacted the ability of surrounding communities to secure their well-being. Consequently increased dependence on farming has been observed as one of the key coping strategies employed by community members (Geheb & Burns 1997).

With dependence of farming re-emerging as a major livelihood strategy both for subsistence and cash income, this study seeks to uncover how local perceptions of climate variability as an added factor, are driving change in local farming practices.

RESEARCH METHODS

Data for this research study was collected in 2012 between the months of June and September during which I established residence in the community and engaged in participant observation. Semi-structured interviews were used to elicit informants' perceptions of climate and shifts in farming practices, specifically having to do with land use and crops cultivated.
Study Sample

A total of 24 interviews were conducted. Eighteen of the informants were active farmers and 6 were key informants. Interview informants were identified using snowball sampling which was based on referrals from initial respondents (Bernard, 2011). This approach helped target key informants, specifically elderly individuals who are knowledgeable about farming and food provisioning practices that have been customary for the Rusinga Island community. Key informants, also knowledgeable about the history of Rusinga Island, could attest to recent changes in farming practices and climatic conditions. In order to gain heterogeneity of viewpoints, age and gender were taken into consideration while sampling. The key informants consisted of 4 men and 2 women, with ages ranging from 58 – 76 years. Farmers interviewed consisted of 8 women and 10 men farmers with ages ranging from 27 – 70 (Table 1). The links between age, gender, farming and food provisioning practices, or in general knowledge and practice with regards to natural resource use has been observed in a variety of communities around the world (Lastarria-Cornhiel 2008, Quinlan & Quinlan 2007, Nguyen 2003).

The average age of the informants is 48 years (table 1). Given that 58% of district population is under 20 years of age, the participants represents experiences of middle-aged community members most of whom are caretakers (Suba DDP 2008)
Table 1: Age distribution of farmers interviewed

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Mean (sd)</th>
<th>Median</th>
<th>range</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>18</td>
<td>48 (15)</td>
<td>48</td>
<td>27 – 70</td>
</tr>
<tr>
<td>Female</td>
<td>8</td>
<td>46 (15.1)</td>
<td>46.5</td>
<td>27 – 66</td>
</tr>
<tr>
<td>Male</td>
<td>10</td>
<td>50 (15.5)</td>
<td>49.5</td>
<td>27 – 70</td>
</tr>
</tbody>
</table>

Although sample approaches an equal gender balance with 8 women and 10 men, many in the community agree that it is mainly women who carry out most of the farming activities in a majority of households. However it proved difficult to get more women participants as they are not only busy with farm work, but are also responsible for numerous household chores. The men in the study described themselves as very active farmers, more so than the average male in the community particularly younger men. In general the men echoed the sentiments expressed by women informants, that farming is mainly dominated by women.

Overall the average the formal education level of farmers interviewed, mirrors the district average (table 2). However, when gender is considered, the men have an average 3 more years of formal schooling than women.

Table 2: Years of formal schooling undertaken by farmers interviewed
(district average = 8.3 years)

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean (sd)</th>
<th>Median</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>18</td>
<td>9.2 (3.7)</td>
<td>8.5</td>
<td>0 – 16</td>
</tr>
<tr>
<td>Female</td>
<td>8</td>
<td>7.1 (3.5)</td>
<td>8</td>
<td>0 – 12</td>
</tr>
<tr>
<td>Male</td>
<td>10</td>
<td>10.9 (3)</td>
<td>11.5</td>
<td>6 – 16</td>
</tr>
</tbody>
</table>
The gender disparity in education levels corresponds with trends in the district where dropout rates are high overall but even higher for women (58%) than men (32%). In the data presented above, 8 years of schooling represents completion of primary school, 12 years represents completion of secondary school and 16 years represents completion of a college education. According to district reports, many of those who complete high school and then go on to attain some college education tend to out migrate in search of professional or formal employment opportunities. Therefore the population of the district is generally skewed towards those who have less in the way of formal education that they can leverage towards formal employment. In any case there are few such employment opportunities in Rusinga. Only two of the informants, both male, have a college education and are employed formally, one as a school teacher and the other in local government administration.

Comparing livestock holdings of the participants to the district averages we see a significant difference with the district at large.

Table 3. Livestock holdings of farmers interviewed (n=18)

<table>
<thead>
<tr>
<th></th>
<th><strong>Mean (sd)</strong></th>
<th><strong>Median</strong></th>
<th><strong>Range</strong></th>
<th><strong>District Mean</strong></th>
<th><strong>Number with none</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>1.7 (2)</td>
<td>1</td>
<td>0 – 7</td>
<td>4.3</td>
<td>9</td>
</tr>
<tr>
<td>Goats</td>
<td>3.2 (3.5)</td>
<td>3</td>
<td>0 – 12</td>
<td>5.3</td>
<td>5</td>
</tr>
<tr>
<td>Chicken</td>
<td>2.6 (5.2)</td>
<td>0</td>
<td>0 – 19</td>
<td>11.6</td>
<td>13</td>
</tr>
</tbody>
</table>

On average the study participants have much lower livestock holdings than the district average, for all three prevalent livestock species cattle, goats and poultry. What’s more there is a skewed distribution where a minority have a large number while a majority
have very few or none. Those without either goats or chicken outnumber those with at least one of either. With cattle half have none while half have at least one. For Rusinga livestock represent a key asset often convertible to cash.

When considered together these statistics indicate that study sample represents a demographic of lower socioeconomic status relative to the rest of the district, a factor that favors even higher reliance on farming relative to the rest of the district. This is significant since already more than three-quarters of households in the district cultivate at least sorghum and maize.

**Data collection**

All interviews and interactions with the study's participants were conducted in Luo the native language in Rusinga and Kiswahili, the national language. My entry into the community was through a local community-based organization that is focused on promoting sustainable farming practices some of which include preservation of indigenous crop varieties. It afforded me the opportunity to initially meet and observe local farmers. Participant observation was an ongoing activity throughout the data collection phase. Initial interactions with farmers were important in revealing keywords and phrases community members use to describe their farming practices. These keywords proved crucial to uncovering emic perceptions during the interview process. It also enabled observations of farmers on their farms thus validating the key practices elicited during interviewing. With regards to identifying key informants the term *Jadoung* was particularly relevant and helpful. *Jadoung* is a Luo word commonly used
in reference to elderly people who are respected in the community, having raised a family and having grandchildren. Officially the term is reserved for men and not explicitly used for elderly women although it is common to hear *mon ma jodongo*, in reference to elderly women. In general, *jodongo* (plural) is inclusive of both elderly and respected men and women with the implication that they are knowledgeable in matters concerning tradition and history of the community.

Key informant interviews focused on eliciting past farming practices that have long been customary in Rusinga Island in addition to changes that have occurred in recent years. Key informants were asked to describe, plants that were traditionally cultivated and their uses, land uses associated with farming, seasonal timing of farming activities, other traditional food provisioning activities, their perceptions of climate patterns associated with farming as well as other challenges that farmers have traditionally encountered in Rusinga Island.

Interviews with active farmers focused on similar questions but with emphasis on eliciting currently prevalent practices. Farmers were asked; to list plants they cultivated and their uses, the number of plots they used, how they divided crops across different plots, seasonal timing of farming activities, other food provisioning practices, perceptions of current climate patterns as well as other challenges they encounter in providing for their households. The farmers were also asked to describe their perceptions of past farming practices, whether they have observed any change and key factors that have influenced change.

During the interviews, informants were not prompted with specific or predetermined time frames around which to discuss their perceptions of change. Once
again it was anticipated that allowing informants to describe their own perceptions of the time frames along which farming and food provisioning practices have undergone change, would allow for more emic perceptions and thus strengthen the salience of factors that mark present climatic conditions as well as those that mark past conditions.

**Analysis**

All interviews and field notes were transcribed and coded using a grounded theory approach in order to uncover emic perceptions and allow for other culturally salient themes to emerge (Bernard 2011) Dedoose a qualitative analysis software program was used for coding. In the analysis phase frequency of mention was utilized to elicit factors that were most salient. First, current perceptions of climatic conditions associated with farming, were extracted. Similarly perceptions of change in climatic conditions were extracted. Both were plotted on a yearly calendar and compared, to establish emic perceptions of change. Second a list of plants currently cultivated and their uses was extracted and organized according to frequency of mention. A similar list was extracted for plants reported by key informants in order to illustrate plants traditionally cultivated. All the plants listed, were cross referenced with the Luo Biological Dictionary an extensive ethnobiological survey of plants and cultural uses among the Luo of the Lake Victoria Basin (Kokwaro 1998). The lists were then compared to establish changes in plant selection. Land use strategies reported by current farmers were compared with those reported by key informants to once again establish changes between past and present practice. A matrix created to establish how plant cultivation is related to land
use. Both land use and plants cultivated were analyzed with regards to the seasonal timing of farming activities. The most salient perceptions of climatic conditions were analyzed alongside farming practices in order to understand how farmers’ perceptions have influenced shifts in farming practice.

**FINDINGS**

In Rusinga Island subsistence farming, particularly for the older generation is considered simply a way of life such that general references to pur, farming in Luo or jopur farmers, can be in some cases interpreted, as if referring to professional farmers or large-scale farming observed in other areas of Kenya where commercial farming is more developed. In day to day conversations, it is more commonplace to hear comments such as “ng’ama puro matek” which translates to “one who farms actively” or “a hardworking farmer”. Among the key informants it was generally expected that in any given household, someone should be farming, and distinctions are made mostly in reflecting on the degree to which people in a given household engage in farming.

In characterizing farming practices long held as traditional or customary, key informants and older farmers, would often use phrases, such as “...ka ne wange wa oyepo...”, which translates to “...when we became aware of our surroundings...” or “...when we were born...” and “...chon ka ne watindo...” translating to “...when we were young...” as well as “...ndalo ukoloni...” which translates to “...during colonial times...”. Thus characteristics of past farming practice in this study refers to what the key
informants experienced in their lifespans as they learned farming alongside their elders in addition to the growing influence of colonialism during the 1950s and onwards. What results, is a mix of mostly indigenous practices plus some practices associated with early efforts of colonial administrators to organize farming, which mainly constituted the introduction of a few cash crops. Elicited views of past practice and perceptions of climatic conditions, serve as a baseline from which shifts in current practices can be understood. Furthermore shifts attributed to the changing climatic conditions are of particular importance, in understanding how the community in Rusinga Island are confronting the impacts of climate change.

**Traditional farming and food provisioning practices**

*Seasonal Timing*

Most informants characterized farming in Rusinga Island as having only one major growing season timed to coincide with the long rain season, locally referred to as *chiri*. Onset of the long rains occurred between mid-February and March, and lasted approximately four and a half months through June or a little into July. Plowing of plots in preparation for the main growing season, *pur mar chiri*, usually began in December, or even earlier when virgin land, or previously fallow plots, were being prepared. During the long rain season the focus was on growing staple grain crops that included sorghum, maize, beans and cowpeas. Sowing was timed with the onset of the long rains, after which most of the work in the early season revolved around weeding. Harvesting
began in July and went through August. Beans and cowpeas were typically harvested first followed by maize and sorghum. Seeds for the next season's crop were selected and stored in pots usually mixed in with cooking ash to protect against weevils or any pests that might destroy the seeds. Alternately maize cobs were hung by their husks above the smoke path of cooking fires in traditional kitchens, also to protect from pests. Timing of practices is illustrated in figure 2 below.

Figure 2: Seasonal timing of traditional farming, food provisioning and land use practices

The short rain season referred to as *opon* occurred between the months of September and early November. Rains during the *opon* season however was considered relatively unreliable. During this period it was customary to shift the focus towards
lakefront plots where one could irrigate crops with lake water. Cassava and potatoes were the main crops grown in the lakefront plots and they were tended to all year round. During *oportun* other plants and vegetables were cultivated and include *dek* or spider herb (*Gynandropsis gynandra*), *susa* (*Cucurbita pepo, Cucurbita maxima*) a local pumpkin variety with edible leaves, and *boh* (*Vigna unguiculata*) in reference to the leaves of cowpeas.

*Traditional land Use*

Cultivating multiple plots, has long been customary practice in Rusinga Island. Households commonly cultivated at least two plots, one located on the lakefront and other plots located within or close to the homestead, *miere* as illustrated in figure 3 below.

Figure 3. Traditional land use patterns

Lake Victoria represents an important resource for the community not only as a source of fish but also for manual irrigation during dry seasons. It is one of the main reasons that people in Rusinga customarily cultivate multiple plots in a season.
“Chon ne orundu ng'eny moloyo kawuono....... e dho nam wa kacha ka ochkre tie got ma mwalo kocha cha, ma oluorore dho nam ma odhi chwo got machielo cha, neonge space...... Ne onge space kata matin....”

“In the past there many more orundus....... on the lakeshore there, starting from the hill there all the around to the hill on that side of the island there was no space...... there was hardly even a small space left open......”

Jadoung’ Omolo

People in the community distinguish lakefront plots from any generic plots *puodho* located anywhere. *Orundu* is the term commonly used in reference to lakefront plots, however it is not exclusive to plots located near the lake. An *orundu* is a fenced plot that is used to grow what local farmers refer to as *chambe matindo machiek pio pio*, that is, small plants like vegetables that mature fast. The local definitions do not explicitly reference plot size except that they are fenced and distinguished from the main plots in which staple crops such as sorghum and maize are cultivated. Fencing was, and still is very important in guarding crops against livestock. Cattle, goats and chicken are livestock species that were commonly reared by people in the community. Cattle and goats especially, were left to roam freely after the main growing season that coincided with the long rains, therefore it was important to guard plants cultivated outside of the main season from grazing livestock, and hence the need for fencing. *Orundus* are commonly located close to the lakefront or within the homestead close to the house. The fact that they are regularly associated with the lakefront underscores the importance of the lake as a water source.

Certain plants were customarily cultivated in specific plots. Staple grain crops, sorghum, maize beans and cowpeas, were usually cultivated in the plots within or close
to the homestead during the long rain season (figure 2). Cassavas and potatoes are the primary crops that were cultivated in lakefront plots and were tended to all year round. Other crops commonly grown along the lakefront during the short rains included *dek,* or spider herb (*Gynandropsis gynandra*) *susa* (*Cucurbita pepo, Cucurbita maxima*) a local pumpkin variety with edible leaves, and *boh or cowpeas* (*Vigna unguiculata*). When cultivated on lakefront plots cowpeas were usually harvested as vegetables and referred to as *boh or alot-bo.* Cowpeas are also referred to as *ngur,* when cultivated for its seeds and used as a grain crop, usually with other staples grains in the homestead plots. During the long rain season the emphasis of farming activities was on the staple crops in homesteads plots or other plots away from the lakefront that were more rain dependent. Outside of the long rain season, emphasis shifted to the lakefront plots as illustrated in figures 2 & 3 above.

*Traditional food Provisioning*

While people farmed during the long rain season they relied on three key food sources which were, stored grain harvest from the past season, fish from the lake and indigenous vegetables. As a number of key informants reported, in past years, one season's harvest of grain was usually enough to last through an entire year, sometimes even two years. Recalling abundant rains that yielded abundant harvests in the past Jadoung' Ondiek exclaimed

“... ochuti ni en bel moro ma, ne ochiek ka wie ochomo piny..... chon ne koth ng'eny, .....kendo nochiek kabisa ka koth ng'eny....”
“...ochuti was a type of sorghum that ripened with its head pointed down.... in the past there was a lot of rain.... and it did very well when there was a lot of rain...”

*Ochuti* is an indigenous variety of sorghum that is widely revered among Luo communities who reside in Lake Victoria Basin. It yields a large red head of grain such that the stalks bend over due to its weight. It is considered by farmers to require at least 4 months of rain for a decent harvest. Fishing was and still is conducted all year round. Fish, a staple food, holds a lot cultural significance for the Rusinga Island community.

Indigenous vegetables are the third and also very significant source of nutrition for the community. During the long rainy season many species of wild vegetables were reported as either cultivated or found growing wild within or near farm plots. Some of these include *osuga* (*Solanum nigrum*), *apoth* (*Corchuras olitorius, Corchuras trilocularis*), and *atipa* (*Asystasia mysorensis*). Some other species such as *odielo* (*Commelina africana*), and *dindi* (*Acalypha volkensii, Tinnea aethiopica, Vigna schimperi*), were only found wild. Gathering of wild indigenous vegetables was predominantly done by women.

*Coping during times of drought*

The traditional farming system offered the Rusinga community a number of options for coping during times of drought or prolonged drought. Coping was facilitated by their use of the lake water for irrigation and the varying mix of plants that they cultivated and used as food sources. Potatoes and cassava were especially...
important as food security crops, and substitute staples when stocks of sorghum or maize were dwindling. Cassava particularly is considered to be relatively drought resistant and better able to withstand dry spells than maize or sorghum. In addition, during times of drought or seasons with abnormally low rainfall, proximity to the lake made it easy to manually water the cassava and potato plants. The benefits of the lake extend to wild indigenous vegetables as well. *Dindi* (*Acalypha volkensii, Tinnea aethiopica, Vigna schimperi*), especially was considered and important wild vegetable as it grows predominantly along the moist soils of the lakefront and is available during the dry season as well. Therefore, it was and still is an important source of nutrition during the dry periods when other vegetables are not readily available.

One other important cultural coping strategy is what is locally termed as *rundo*, which refers to exchanging items of value for staple grains. This was often undertaken during prolonged dry periods that resulted in people depleting their stocks of stored grain harvested in prior seasons. The importance of staples is underscored by the fact that most people consider Rusinga as only having one main growing season, despite all the activities that were undertaken throughout the year (figure 2). *Rundo* traditionally involved trading livestock, fish or some other item of value for staple grains, used to prepare porridge or *kuon* (*ugali in Kiswahili*) the staple dish in Rusinga Island and most of Kenya. Unlike the generic Luo term used to signify a purchase, *nyiewo*, the term *rundo* is specific to provisioning of staple foods. *Rundo* then and now signifies difficult times, a period of food insecurity.
Changing rain patterns

“wang’ni ne wa komo due mar ang’wen nikech koth ne onge…”
“this time we sowed seeds in April because there were no rains…”
Mama Dani

“...ka koth ochwe ka dueche adek... mano hawi. Rusinga ka sani koth tin”
“... if it rains for three months... it is a blessing. Rusinga here, now, there is little rain”
Mama Akeyo

Among farmers in Rusinga Island the changing rain pattern is considered the biggest challenge and one of the main factors driving farmers to shift their practices. A large majority of the farmers and key informants interviewed, 19 out of 24, mentioned rain as the number one challenge faced by farmers today.

Recalling past farming practices, many informants expressed the difference simply as, in the past there was a lot more rain. Periods of drought occurred, but they were temporary and the rains always came back. However in the last 15-20 years, lack of rain has become a persistent phenomenon cutting short the long rain season, *chiri*, from a four and a half months to less than two and half months as illustrated in Figure 4.
The short rains *apon* now between mid-September and early November are even more unreliable.

"...any season, gima chanda, en mana wach koth....to ka koth nitiye to onge lokruok moro manyalo betie"

"... any season what challenges me, is just the issue of rain.... but if there is rain, there would be no changes happening "

Jadoung Odongo

"lokruok ma okelo pogruok go ena ena ni change of climate. Chon kade climate change no oko bet pogruok dine oko bet"

"the change that has brought these differences is just the change of climate. In the past if climate change had not happened there would be no differences"

Otegno

Farmers associate many of their current practices to the declining rain patterns. The shifts in practice associated with the changing climatic conditions highlighted here focus on mix of crops cultivated and used in food provisioning, changes in land use patterns, and changes in overall food provisioning. Of particularly concern to many in the community is the need to buy additional food supplies, to supplement their harvest,
a major challenge for a community where subsistence farming has been a key aspect of local livelihoods. This is further complicated by the fact that there are few economic opportunities available in Rusinga for earning extra cash income.

**Shifts in plants cultivated or used in food provisioning**

“*Ka ji oneno ni ng'ato uso cham ne ji choge to gi woro ni 'kaka piny rach ni ang'o momio ng'ano uso '..."*  
“When people saw a person selling their *cham*, people would curse them and wonder 'as bad as things are why are they selling'...”

Jadoung Odaga.

Those who sell their staple grain harvest have traditionally been frowned upon by others in the community. Traditionally the practice was rare. However, as a number of the key informants and farmers reflected further, they did acknowledge that farming practices have undergone a major shift with more and more members of the community engaging in small-scale cash crop operations alongside their subsistence farming activities. A number of respondents observed that it is a transition that has escalated since the 1990s. It is in this way that different contexts around the use of the word *cham* come into play. On its own, the Luo word *cham* refers primarily to staple cereal or grains. Only after qualifying the word or placing it in context, is it clear that one is referencing other crops for instance *cham matindo kaka alode*, (small plants like vegetables) with *alot* or *alode* for plural, referring directly to vegetable plants. None of the informants mentioned a Luo word that is general and inclusive of all cultivated plants, essentially an equivalent for crops, and occasionally some resorted to using the
Kiswahili word mimea. Table 4 shows the range and average number of plants cultivated by farmers interview as part of this study.

Table 4. Distribution of plant species cultivated by 18 farmers

<table>
<thead>
<tr>
<th>Range</th>
<th>Mean (sd)</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 – 20</td>
<td>11 (4.6)</td>
<td>10.5</td>
</tr>
</tbody>
</table>

The distinctions implied by word cham, therefore brings to light the varying ways in which people of Rusinga Island regard different plant species, both traditionally and in current times, and the roles they play in the livelihoods.

A comparison between past and present practice is presented in tables 2 & 3 below. The plants reported are predominantly those that were or are actively cultivated for food, but also included in both tables are wild food plants. Table 5 immediately below lists plants reported by key informants as being prevalent in traditional practice, while Table 6 lists plants cultivated currently by farmers interviewed.
Table 5. Plants associated with past farming practice and food provisioning.  
(organized by frequency of mention)

<table>
<thead>
<tr>
<th>Luo names</th>
<th>English name</th>
<th>Botanical Name</th>
<th>mentions</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>bel (ochuti)</td>
<td>sorghum</td>
<td>Sorghum bicolor</td>
<td>6</td>
<td>Grains ground and used as flour for porridge &amp; ugali. Medicinal, provides relief for stomachaches</td>
</tr>
<tr>
<td>ngur, bo, alot-bo</td>
<td>cowpeas</td>
<td>Vigna unguiculata</td>
<td>6</td>
<td>Seeds consumed as grain (ngur) and leaves as vegetables (Alot bo, boh)</td>
</tr>
<tr>
<td>rabuon</td>
<td>potatoes</td>
<td>Ipomoea batatas</td>
<td>6</td>
<td>Commonly consumed, but also important during times of food scarcity</td>
</tr>
<tr>
<td>mariwa, omwogo</td>
<td>cassava</td>
<td>Manihot esculenta</td>
<td>5</td>
<td>Local distinction between mariwa &amp; omwogo. Mariwa is boiled &amp; eaten like potatoes. Omwogo is fermented, dried &amp; ground into flour. Both are commonly consumed, but also important during times of food scarcity</td>
</tr>
<tr>
<td>oduma, bando</td>
<td>maize</td>
<td>Zea mays</td>
<td>5</td>
<td>cob roasted whole and eaten, or kernals shelled and cooked with beans or cowpeas beans (nyoyo). Was only ground and used as flour after mechanized mills introduced in the 1960s</td>
</tr>
<tr>
<td>budho, susa</td>
<td>pumpkin</td>
<td>Cucurbita pepo, Cucurbita maxima</td>
<td>4</td>
<td>Pumpkin boiled (budho) . Leaves consumed as vegetables (susa). Leaves perceived to be high in nutrition and have medicinal properties. Also harvested wild in the past.</td>
</tr>
<tr>
<td>dek</td>
<td>spider herb, spider flower</td>
<td>Gynandropsis gynandra</td>
<td>4</td>
<td>Leaves consumed as vegetable Leaves perceived to be high in nutrition with medicinal properties. Cultivated and also harvested as wild food plant</td>
</tr>
<tr>
<td>ochiago</td>
<td>-</td>
<td>-</td>
<td>4</td>
<td>Seeds consumed as grain</td>
</tr>
<tr>
<td>Plant Name</td>
<td>Common Name</td>
<td>Scientific Name</td>
<td>Cultivation</td>
<td>Uses</td>
</tr>
<tr>
<td>------------</td>
<td>-------------</td>
<td>-----------------</td>
<td>-------------</td>
<td>------</td>
</tr>
<tr>
<td>osuga</td>
<td>black nightshade</td>
<td>Solanum nigrum</td>
<td>4</td>
<td>Leaves consumed as vegetable Leaves perceived to be high in nutrition with medicinal properties. Cultivated and also harvested as wild food plant.</td>
</tr>
<tr>
<td>apoth</td>
<td>jewel's mallow, jute, sunnhemp</td>
<td>Corchuras olitorius, Corchuras trilocularis</td>
<td>3</td>
<td>Leaves consumed as vegetable Leaves perceived to be high in nutrition with medicinal properties. Cultivated and also harvested as wild food plant.</td>
</tr>
<tr>
<td>atipa</td>
<td>-</td>
<td>Asystasia mysorensis</td>
<td>3</td>
<td>Leaves consumed as vegetable Leaves perceived to be high in nutrition with medicinal properties. Cultivated and also harvested as wild food plant.</td>
</tr>
<tr>
<td>oganda</td>
<td>beans</td>
<td>Phaseolus vulgaris</td>
<td>3</td>
<td>Seeds consumed as grain</td>
</tr>
<tr>
<td>odielo</td>
<td>-</td>
<td>Commelina Africana</td>
<td>3</td>
<td>Leaves consumed as vegetables. Harvested as wild food plant.</td>
</tr>
<tr>
<td>dindi</td>
<td>-</td>
<td>Acalypha volkensii, Tinnea aethiopica, Vigna schimperi</td>
<td>2</td>
<td>Leaves consumed as vegetables. Harvested as wild food plant. Important during times of food scarcity.</td>
</tr>
<tr>
<td>njugu</td>
<td>groundnuts</td>
<td>Arachis hypogaea</td>
<td>2</td>
<td>Seeds eaten raw or roasted</td>
</tr>
<tr>
<td>ogaka</td>
<td>-</td>
<td>Aloe spp.</td>
<td>2</td>
<td>Planted as barriers to control soil erosion</td>
</tr>
<tr>
<td>olayo</td>
<td>-</td>
<td>Glycine max</td>
<td>2</td>
<td>Seeds eaten as grain</td>
</tr>
<tr>
<td>pamba</td>
<td>cotton</td>
<td>Gossypium barbadense, Gossypium hirsutum</td>
<td>2</td>
<td>Cash crop introduced during colonial era</td>
</tr>
<tr>
<td>Afuoto</td>
<td>watermelon</td>
<td>Kalanchoe glauca</td>
<td>2</td>
<td>Fruit. Cash crop associated with colonial era</td>
</tr>
<tr>
<td>apoyo</td>
<td>paw paw</td>
<td>Carica papaya</td>
<td>2</td>
<td>Fruit</td>
</tr>
<tr>
<td>awayo</td>
<td>Oxygonum sinuatum, Oxalis corniculata, Rhus vulgaris, Oxalis latifolia</td>
<td>1</td>
<td>Leaves eaten as vegetable. Perceived to have high nutritional content.</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>---------------------------------------------------------------------</td>
<td>---</td>
<td>----------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>bad maro,</td>
<td>Brassica oleracea</td>
<td>1</td>
<td>Leaves eaten as vegetables. More commonly referred to as sukuma in present times. Bad maro used to distinguish past variety with current variety. Use spread during the colonial era. Now widely popular countrywide.</td>
<td></td>
</tr>
<tr>
<td>(sukuma)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mitoo</td>
<td>Crotalaria Brevidens, Crotalaria Ochroleuca</td>
<td>1</td>
<td>Leaves eaten as vegetable. Perceived to have high nutritional content.</td>
<td></td>
</tr>
<tr>
<td>ndemra</td>
<td>Basella alba</td>
<td>1</td>
<td>Leaves eaten as vegetable. Perceived to have high nutritional content.</td>
<td></td>
</tr>
<tr>
<td>obwanda</td>
<td>Portulaca Quadrifida</td>
<td>1</td>
<td>Leaves eaten as vegetable. Perceived to have high nutritional content.</td>
<td></td>
</tr>
<tr>
<td>ojuok</td>
<td></td>
<td>1</td>
<td>planted as a barrier for erosion control</td>
<td></td>
</tr>
<tr>
<td>omboga</td>
<td>Amaranthus spp.</td>
<td>1</td>
<td>Leaves eaten as vegetable.</td>
<td></td>
</tr>
<tr>
<td>rabolo</td>
<td>Musa spp.</td>
<td>1</td>
<td>Fruit</td>
<td></td>
</tr>
<tr>
<td>tuoro</td>
<td>Agave sisalana</td>
<td>1</td>
<td>cash crop associated with colonial era</td>
<td></td>
</tr>
<tr>
<td>tiang'. niang'</td>
<td>Saccharum officinarum</td>
<td>1</td>
<td>cash crop associated with colonial era</td>
<td></td>
</tr>
</tbody>
</table>
Table 6 – Plants associated with current farming practice and food provisioning.
(organized by frequency of mention)

<table>
<thead>
<tr>
<th>Luo name</th>
<th>English name</th>
<th>botanical name</th>
<th>mentions</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oduma, bando, yellow maize, nyamula, mahindi</td>
<td>maize</td>
<td>Zea Mays</td>
<td>17</td>
<td>Primarily subsistence, also sold by a few farmers. Cob roasted whole and eaten, or kernals shelled and cooked with beans or cowpeas beans (nyoyo). Hybrid varieties are common.</td>
</tr>
<tr>
<td>Boh, ngur. Ngur mar boh, ngur mar lecoriadre,</td>
<td>cowpeas</td>
<td>Vigna unguiculata</td>
<td>15</td>
<td>Primarily subsistence, also sold by a few farmers. Seeds consumed as grain (ngur) and leaves as vegetables (Alot bo, boh) Indigenous varieties considered to be high in nutrition.</td>
</tr>
<tr>
<td>Sukuma, sukuma wiki, Kandhira, bad maro</td>
<td>collards</td>
<td>Brassica oleracea</td>
<td>15</td>
<td>Popularly for both as subsistence and cash crop. Leaves eaten as vegetable</td>
</tr>
<tr>
<td>bel</td>
<td>sorghum</td>
<td>Sorghum bicolor</td>
<td>14</td>
<td>Only for subsistence. Local variety “Ochuti” considered to be high in nutrition. Considered to be medicinal provides relief for stomachaches. Hybrid varieties are also common</td>
</tr>
<tr>
<td>rabuon, potatoes, sweet potatoes</td>
<td>potatoes</td>
<td>Ipomoea batatas</td>
<td>13</td>
<td>Used as both subsistence and cash crop. Still important for food security Occasionally cited as cover crop, soil cover</td>
</tr>
<tr>
<td>nyanya</td>
<td>tomatoes</td>
<td>Lycopersicum esculentum</td>
<td>13</td>
<td>Mainly cultivated as cash crop.</td>
</tr>
<tr>
<td>Name</td>
<td>Plant Family</td>
<td>Uses</td>
<td>Notes</td>
<td></td>
</tr>
<tr>
<td>-------------------------</td>
<td>-----------------------------------</td>
<td>----------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>dek spider herb, spider flower</td>
<td>Gynandraopsis gynandra</td>
<td>10 Popularly used as subsistence and cash crop. Leaves consumed as vegetable. Leaves perceived to have high in nutrition with medicinal properties. Indigenous varieties grow wild and nurtured. Hybrid varieties are actively cultivated.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>osuga, osuga (nyakaliPFE) osuk nyamusung u, osuk nyaluo</td>
<td>Solanum nigrum,</td>
<td>10 Popularly used as subsistence and cash crop. Leaves consumed as vegetable. Leaves perceived to be high in nutrition with medicinal properties. Indigenous varieties grow wild and nurtured.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mariwa, omwogo, mariwa madoung</td>
<td>Manihot esculenta</td>
<td>9 Mainly for food subsistence, occasionally used as cash crop. Local distinction between mariwa &amp; omwogo. Mariwa is boiled &amp; eaten like potato. Omwogo is fermented, dried &amp; ground into flour. Both are commonly consumed, but also important during times of food scarcity. Also cited as important for soil management (litter fall).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kitungu, kitungu saumu</td>
<td>Allium spp.</td>
<td>9 Mainly cash crop.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>oganda</td>
<td>Phaseolus vulgaris</td>
<td>8 Mainly for subsistence. Seeds consumed as grain.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>budho, susa (pumpkins)</td>
<td>Cucurbita pepo, Cucurbita maxima</td>
<td>6 Used for both subsistence and as cash crop (fruit). Pumpkin boiled (budho). Leaves consumed as vegetables (susa). Leaves perceived to be high in nutrition and have medicinal properties.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>apoyo, popo, papaya</td>
<td>Carica papaya</td>
<td>6 Both subsistence and as cash crop.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>rabolo bananas</td>
<td>Musa spp.</td>
<td>5 Fruit, mainly for subsistence.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant Name</td>
<td>Type</td>
<td>Scientific Name</td>
<td>Use</td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td>-------------------</td>
<td>-----------------------</td>
<td>------------------------------</td>
<td></td>
</tr>
<tr>
<td>apoth</td>
<td>jem's mallow, jute, sunnhemp</td>
<td>Corchuras olitorius, Corchuras trilocularis</td>
<td>4, Mainly subsistence, occasionally as a cash crop. Leaves consumed as vegetable. Leaves perceived to be high in nutrition and have medicinal properties. Grows wild but there is increasing attempts at cultivation.</td>
<td></td>
</tr>
<tr>
<td>niang', tiang'</td>
<td>sugarcane</td>
<td>Saccharum officinarum</td>
<td>3, mainly subsistence</td>
<td></td>
</tr>
<tr>
<td>pili pili hoho</td>
<td>chili pepper</td>
<td>Capsicum frutescens</td>
<td>3, mainly for sale</td>
<td></td>
</tr>
<tr>
<td>spinach</td>
<td>spinach</td>
<td>Spinacia oleracea</td>
<td>3, Both for subsistence and for sale. Leaves eaten as vegetable.</td>
<td></td>
</tr>
<tr>
<td>afuoto</td>
<td>watermelon</td>
<td>Kalanchoe glaucens</td>
<td>3, Fruit mainly for sale.</td>
<td></td>
</tr>
<tr>
<td>avocado</td>
<td>avocado</td>
<td>Persea americana</td>
<td>2, Fruit mainly for sale.</td>
<td></td>
</tr>
<tr>
<td>dania</td>
<td>cilantro</td>
<td>Coriandrum sativum</td>
<td>2, mainly for sale.</td>
<td></td>
</tr>
<tr>
<td>maembe</td>
<td>mango</td>
<td>Mangifera indica</td>
<td>2, Fruit mainly for sale.</td>
<td></td>
</tr>
<tr>
<td>moringa</td>
<td>moringa</td>
<td>Moringa oleifera</td>
<td>2, Mainly for subsistence.</td>
<td></td>
</tr>
<tr>
<td>marubaini, arobmaji, mbogoomi</td>
<td>Neem</td>
<td>Azadirachta indica</td>
<td>2, Mainly for subsistence.</td>
<td></td>
</tr>
<tr>
<td>achak</td>
<td></td>
<td></td>
<td>1, used as an erosion barrier and fencing of plots.</td>
<td></td>
</tr>
<tr>
<td>carrots</td>
<td>carrots</td>
<td>Daucus carota</td>
<td>1, mainly for sale</td>
<td></td>
</tr>
</tbody>
</table>
The list of plants elicited together with the way farmers describe cultivation practices, highlights change in two key ways. Most apparent from tables 2 & 3 were new crops cultivated mainly for sale. The second aspect revealed in conversations with farmers were shifts from indigenous varieties to conventional hybrid varieties, which are now available through local agricultural supply stores. The changes particularly with respect to the transition from indigenous to hybrid varieties were mainly attributed to the changing rain patterns. Once again when plants are considered within the context of local livelihoods, where *cham* commonly refers to staples, and *cham kaka*
alode, refers to vegetables and cham ma moko refers generally to other food plants, a broad categorization emerges. These broad categories are not entirely mutually exclusive and are interpreted here to include staple grain crops, staple root crops, indigenous vegetables some of which were traditionally wild and crops now grown mainly for sale. Specific changes within these broad categories are discussed below.

Staple grain & root crops

Cultivation of staple crops such as sorghum, maize, cowpeas, beans, mainly during the long rain season remains a key aspect of farming in Rusinga Island. It is still common now as was customary in the past to inter-crop sorghum or maize with either cowpeas or beans.

“....those seeds sani koro lal. Ochuti was so big, and it was resistant to most of the pests, en kata mana weevil ok time gimoro, en onyalo budho e granary for many years to bod olinga linga. And it is now no more, nikech changing weather conditions. ......odwaro koth ma dhi chiegni dueche abich"

“... those seeds are now disappearing. Ochuti was so big and it was resistant to most of the pests even weevils could not do anything to it. It can stay in granary for many years and nothing happens to it. And now it is no more because of changing weather conditions...... it needs rain that lasts close to five months"

Jadoung Odaga

There is a marked increase in the use of fast maturing hybrid maize and sorghum seeds in accordance with the shortened rain season. Despite this many farmers express their preference for indigenous varieties. Unlike the hybrid seeds, indigenous varieties are seen as more nutritious and less susceptible to pests during storage or birds feeding on
them in the field. This is especially true for ochuti, a revered indigenous variety of sorghum. However as expressed by many farmers ochuti is dependent on 4 – 5 months of rain, a rain pattern that has grown increasingly rare in recent years. Root crops primarily potatoes and cassava are very common in local diets and still regarded as very important crops for food security. They are cultivated throughout the year in plots close to the lakefront.

Indigenous Vegetables

“…..kienyeji go seeds mage be tin. he seeds onge. Nikech gin gik ma tii kend gi. Lakini mana ka iluoro kama obedo fenced kama onyalo donge. Ipo mana ka owuok, koro irite..... chon ne gi ng’eny. Chon negi ng’eny. To koro sani to otin.”

“.... the indigenous ones, there are very few seeds. Yah there are no seeds. Because they grow on their own. But if you fenced a particular area, an area where they can grow, you will just find that some of them have germinated, so now you just take care of them..... in the past they were many. They were many. But now they are few”

Jadoung’ Ongere

“....it grows along the rivers and lakes, dindi, it is like boh (cowpeas as vegetables). .... this dindi it does not disappear, you only see it dry, but when it rains it is just there. So this one is an advantage because by around December there are absolutely no vegetables. So you see women coming to ask you can I go pick dindi from your farm, because in Rusinga we always have fish but sometimes we go without vegetables....”

Jadoung’ Oloko

Wild vegetables are an extremely important source of food for the Rusinga Island community Wild vegetables predominantly gathered by women both now and in
the past are still considered to be very nutritious as well as medicinal. Some wild vegetables specifically mentioned included *dek* (Gynandropsis gynandra), *atipa* (Asystasia mysorensis), *osuga* (Solanum nigrum), *odielo* (Commelina africana) and *apoth* (Corchuras olitorius). These vegetables were found in a number of locations, sometimes growing naturally as weeds in cultivated plots, along the lakeshore or streams or generally in bushy areas between and around homesteads. *Dek* (Gynandropsis gynandra) and *susa* (Cucurbita pepo, Cucurbita maxima) were reported as a having been both wild growing species as well as actively cultivated species.

The declining rainfall however has dramatically reduced the availability of wild indigenous vegetables that were prevalent in the past. At present some farmers are actively cultivating newly introduced varieties of these vegetables such as *dek* (Gynandropsis gynandra) *osuga* (Solanum nigrum), *apoth* (Corchuras olitorius, Corchuras trilocularis). Currently these vegetables are used both for home consumption and for sale. Despite the growing availability of hybrid seeds for plant like *dek* (Gynandropsis gynandra) and *osuga* (Solanum nigrum) many still prefer, the indigenous varieties as for their superior nutrition quality. Thus some farmers resorted to actively identifying and caring for indigenous varieties that germinate on their own within or around their farm plots. They consider their plots not merely as a farm but also as a habitat for varied plant species. Attempts by farmers in Rusinga Island to cultivate hybrid versions of indigenous vegetables or actively manage naturally growing wild varieties constitutes an attempt to conserve an important source of nutrition and well-being that is threatened by the changing rain patterns.
Cash Crops

“When it is really hot wild vegetables are not available, so that is the time you can plant vegetables like sukuma wiki (collard greens) and you know you get some money for them.... so we schedule them based on the season. When it is raining you don't plant vegetables because people simply go for the vegetables that are not sold but growing wild on plots”

Philip

Sukuma or collard greens is probably the most commonly consumed vegetable in Kenya. It is not indigenous to Rusinga Island but in the past some farmers cultivated a variety of collards that is locally referred to as kandhira or bad maro. Collard greens or sukuma wiki as it is referred to in Kiswahili is now grown widely in Rusinga Island and enjoys wide demand countrywide. In Rusinga Island Sukuma alongside nyanya, tomatoes are the two crops most associated with farming as a source of income.

Kitungu, onions are another non-indigenous vegetable closely associated with sales. Out of 18 farmers, 15 reported cultivating collard greens, 13 reported cultivating tomatoes, and 9 reported cultivating onions. Other vegetables such as dek (Gynandropsis gynandra), osuga (Solanum nigrum) are also sold but their use is more mixed with more emphasis on home consumption and thus not as closely associated with earning a cash income. Seeds for tomatoes and collard greens are mostly all hybrids varieties sourced from the agriculture and veterinary supply stores, plus all farmers growing
either or both collards greens and tomatoes, reported using pesticides especially for those very crops.

Once again farmers characterize their practice based on the lack of rain. Farmers who are active all year round time their cultivation so that their vegetables are available during the dry months when there is a shortage of wild vegetables that can be easily gathered or when people are not growing their own vegetables, a period that has gotten longer with the changing rain patterns.

**Shifts in land use and plant selection**

Customary land use patterns among farmers in Rusinga Island, reveals a more complete picture of the links between land, plants cultivated, and cultural aspects of local livelihoods, in which the lake is considered as a very important asset. Foremost, the impacts of the changing rain patterns and in response the strategies farmers are adopting, emerges even more clearly, when the shifts in land use practices are examined.

“...orundu thurwa ka, en kamichielo ma inyalo tie seche te. inyalo tie e oro, inyalo tie e chiri. Inyalo chiele kata dala, inyalo chiele kata yo nam....”

“...orundu for us is a fenced plot that you can use all the time. You can use it in the dry season, you can use during the long rains. You can fence it at home or by the lakefront....”

Jadoung’ Odongo

Cultivation of multiple plots in a single season is still the preferred practice, and the most common manner in which farming plots are distinguished, remains an *orundu*
a fenced plot, and *puoisko* a generic plot that is all inclusive. It is a customary practice that has persisted but with a key distinction, a place for continuous cultivation all year round. A majority of respondents reported cultivating multiple plots, again in a fashion similar to past practice albeit with varying mix of plants (table 7). Out of the 18 farmers interviewed 16 cultivated more than one plot. Of the 2 remaining, one cultivated only a lakefront plot, while another cultivated only one plot located within their homestead. Thus 17 out of 18 cultivated at least a lakefront plot. Table 7 below shows the mix of crops cultivated and where they were cultivated, either in the homesteads or on lakefront plots.

Table 7. Plant and plot selection reported by 18 farmers

<table>
<thead>
<tr>
<th>Luo name</th>
<th>English name</th>
<th>Total Mentions</th>
<th>Plots</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lakefront</td>
</tr>
<tr>
<td>Oduma, bando, mahindi</td>
<td>maize</td>
<td>17</td>
<td>9</td>
</tr>
<tr>
<td>Boh, ngur. Ngur mar boh.</td>
<td>cowpeas</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>Sukuma, sukuma wiki, Kandhira,</td>
<td>collards, kale</td>
<td>15</td>
<td>14</td>
</tr>
<tr>
<td>bad maro</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bel</td>
<td>sorghum</td>
<td>14</td>
<td>5</td>
</tr>
<tr>
<td>nyanya</td>
<td>tomatoes</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>rabuon, potatoes, sweet potatoes</td>
<td>potatoes</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>mariwa, omwogo, mariwa madoung</td>
<td>cassava</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Quantity</td>
<td>Quantity</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------------------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>dek</td>
<td>spider herb, spider flower</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>osuga, osuk</td>
<td>black nightshade</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>nyaluo</td>
<td>onions, garlic</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Kitungu, kitungu saumu</td>
<td>beans</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>apoyo, popo, papaya</td>
<td>paw paw</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>budho, susa</td>
<td>pumpkin</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>rabolo</td>
<td>bananas</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>apoth</td>
<td>jew's mallow, jute, sunnhemp</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>afuoto</td>
<td>watermelon</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>niang', tiang'</td>
<td>sugarcane</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>pili pili hoho</td>
<td>chili pepper</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>spinach</td>
<td>spinach</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>avocado</td>
<td>avocado</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>dania</td>
<td>cilantro</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>maembe</td>
<td>mango</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>marubaini, arobaini, mboga miti</td>
<td>Neem</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>moringa</td>
<td>moringa</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>achak</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>butternut</td>
<td>butternut squash</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>carrots</td>
<td>carrots</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>dindi</td>
<td></td>
<td>1</td>
<td>-</td>
</tr>
</tbody>
</table>
The reported distribution of plants across multiple plots, reflects a major shift where a majority of plants are now cultivated on lakefront plots. Homestead plots are still preferred for the staples sorghum, maize, beans and cowpeas, however slightly more than half of informants reported growing maize in both plots, while 5 out of 18 reported doing so for sorghum. In past practice, different plots were never considered mutually exclusive with regards to associated varieties of plants cultivated, however farmers preferred to cultivate mainly cassava, potatoes and assorted vegetable crops along the lakefront, focusing on homestead plots for staple grains during the long rain seasons.

"sani ji ok pur malo kono ahinya nikech problem of drought, koth thin. They would prefer to work a little down this way...... he machiegni gi nam"

"now people are not farming up here much, because of the problem of drought. There is little rain. They would prefer to work a little down this way...... yes close to the lake "

Jadoung' Ndae

The shift towards intensive cultivation of lakefront plots all year round is a very marked phenomenon. Fallow periods are very limited, if at all, usually only about three months.
on small sections of a plot. Figure 5 below illustrates the current seasonal calendar as reported by farmers interviewed as part of this study.

Figure 5. Current seasonal timing of farming practices

A majority of respondents reported cultivating staples grains in the homestead plots during the long rain season, focusing the rest of the year on other plants that include cassava, potatoes and vegetables. Focus on the lakefront plots however is now all year round.

*pur wan gi seasons adek ma wa pidho e iga. Nikech ka ipidho kodhi to tieko dueche adek to ikaye, koro kelo nwa go seasons adek e iga*. 

"we farm for three seasons in a year. Because if you plant a seed and it takes three months and it is ready for harvest, it enables us to complete three seasons in a year"

Philip
A number of respondents reported being active all year round, following the main growing season, with two shorter and successive 3–month seasons when they shift attention to vegetables and other crops that can be sold for income or supplement the harvest from the main season. Two of the respondents reported farming up to 3 seasons within one year, on 3–4 month cycles, a schedule that reduces reliance on annual rain patterns. This is a schedule that depends on using plots adjacent to the lakefront that can be manually irrigated all year round. Crops cultivated in this manner include maize, collard greens, tomatoes, as well as cowpeas. Similar to past practice, cassava and potatoes are still cultivated along the lakefront all year round. Therefore not only are people cultivating lakefront plots for longer periods, but they are also growing more crops a marked phenomenon given that these plots are usually smaller in size than homestead plots.

**Overall shifts in food provisioning**

As would be anticipated, overall food provisioning practices have shifted right alongside farming practices.

*Wa tío gi pesa mang'eny e *rundo* moloyo gimora mora*

“we are using more money to buy food than on anything else.”

Stella

*Alode kwa pidho to wanyalo chamo, wanyalo uso to wa *rundo* godo mogo makwonge go chande*

If we grow vegetables, we can eat them, we can sell them and buy flour that we don't have*

Anyango
According to Stella a young woman farmer raising a family in a household with seven children, the rains lasted relatively longer this year (2012) and would probably yield sorghum and maize harvests worth a few months of food. Many farmers assess yields based on their annual food needs, and in recent years even “good” seasons yield perhaps four to five months of food, hardly enough to last until the next harvest. Many in the community are then forced to resort to what is locally termed as *rundo*, which in the modern context, refers to using money to buy food once harvest supplies are depleted. According to some accounts this has been the situation for the past 15 to 20 years. Prior to that harvests were typically adequate for a whole year, with some surplus that would tide households over through the difficult seasons that were reportedly less frequent than currently. *Rundo* traditionally involved trading livestock, fish or some other item of value for *cham*, staple grains, used to prepare porridge or *kuon* (*ugali* in kiswahili) the staple dish in Rusinga Island and most of Kenya. Unlike the generic Luo term used to signify a purchase, *nyiewo*, the term *rundo* is specific to provisioning food. *Rundo* then and now signifies difficult times, a period of food insecurity. It is a phenomenon that was cited by almost all the farmers interviewed.

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Declining rainfall has seriously undermined the communities' ability to produce enough staple harvest to last them a full year, hence *rundo* is now common practice. Self-sufficiency, most especially for staples grains, is an important measure of well-being in Rusinga Island. People in the community are forced to redirect their already
limited cash incomes towards food provisioning. Furthermore the current climatic conditions, presents a threat to indigenous seeds forcing farmers to transition to fast maturing seeds more conducive to the shorter rain season. Seed saving, a vital part of subsistence food provisioning, is on the decline, especially for the important indigenous staples that are not adapted to current climate patterns. The shift to continuous cultivation and the resulting mix of crops emphasized, is predicated on fast maturing hybrid seeds that are widely available, as well as proximity to the lake, a water source available all year round. Few of the farmers interviewed reported that they are still saving indigenous varieties, for instance 6 out of the 18 respondents reported that they are actively saving and trying to keep cultivating indigenous varieties of sorghum, while only 4 reported actively saving seeds of cowpeas. A majority of the respondents reported sourcing seeds from either the local agricultural and veterinary supply stores or at the open markets. Seeds stocked by agricultural and veterinary supply store are largely hybrid seeds. Seeds at the open markets are reportedly cheaper than store bought seeds, and in some cases are indigenous seeds saved by other farmers and brought to the market for sale. Seeds for indigenous vegetables such as *dek* (*Gynandropsis gynandra*), *boh* (*Vigna unguiculata*), and *osuga* (*Solanum nigrum*) are reportedly available in markets. It is not clear however if these seeds are truly the indigenous varieties as hybrid varieties of these same plants are now also available from the agricultural supply store. The need to purchase seeds in addition to other inputs such as pesticides associated with new seed varieties constitutes another drain on the meager cash incomes that residents have.
DISCUSSION AND CONCLUSION

Changing climate is undoubtedly an unprecedented phenomenon for the Rusinga Island community, a perpetual stressor that has thrust the community into a mode where they are now perpetually coping with declining rainfall. The current rainfall patterns has had serious and adverse impacts, undermining indigenous varieties of staples such as sorghum and maize, as well as indigenous vegetables a number of which were harvested wild. What has resulted is an overall decline in yields such that harvests from food crops typically last less than a half a year. Many in the community have responded in three key ways. One, farmers are resorting to fast maturing hybrid seed varieties more conducive to a shortened rain season. Second, farmers are cultivating lakefront plots more intensively, by increasing the number of crop species cultivated there as well as cultivating the lakefront plots all year round. Despite undertaking these two strategies the people in the community still find they have to purchase additional food to cover their household needs for a full year. Purchases of food marks the third key way that people in the community are responding to changing climatic conditions. In Rusinga Island a subsistence farming community, rundo, the practice of exchanging items of value or currency for staple foods has long been a cultural indicator of difficult times.

The ways in which local farmers in Rusinga perceive and understand the impacts of the changing climate conditions in Rusinga provides contrasts with official reports of climate conditions and in general, the emphasis on quantitative measures of
the biophysical aspects within climate change discourse. Local observations of extremely poor rainfall in recent years, is matched by meteorological reports of severe droughts in Kenya between the years 2008 and 2011 (Kioko 2013). In Kenya available precipitation data collected at meteorological stations consists of daily or annual rainfall totals often aggregated and reported as annual averages with rainfall patterns characterized as bimodal or unimodal (Speranza et al. 2010, Mugalavai et al. 2008, Suba DDP 2008). In contrast, for farmers in Rusinga Island, the duration of the long rain season is only the starting point from which they perceive the changing climate. Farmers are constantly associating climatic conditions with culturally salient staples crops, food provisioning practices and in general their farming seasons. A number of research studies have noted similar observations as subjective, questioning their accuracy relative to meteorological data. Farmers are perceived to emphasize the bad weather seasons, a phenomenon referred to as negative bias, that is, paying more attention to negative events associated with risks, and less to positive events (Rao et al. 2011). Other studies note that this is a function of including the sociocultural contexts, and important lessons can be drawn from emic perspectives especially as it relates to how local communities evaluate risk or explore strategies for coping and adaptation. Farmers in Rusinga Island look at weather patterns in the local context, relating it to crop performance, using the local ecology as proxy indicators and essentially relating it to their livelihoods. It is an approach that goes against scientific distinction between biophysical and human realms, such that a drought defined strictly on meteorological terms differs from a drought defined from farmers’ perspectives which tend to incorporate the sociocultural context. There are emerging studies that highlight the
importance of emic perspectives which are in fact crucial determinants of the coping and adaptation strategies that people in a given communities adopt (Kangalawe 2011, Rao et al. 2011, Slegers 2008, Roncoli et al. 2002). Given the unprecedented challenges that climate change poses this point cannot be overstated.

In much the same vein, the way in which farmers in Rusinga view climate change as a perpetual phenomenon is in contrast to the dominant ways in which stressors are viewed within the resilience and vulnerability literature. Dominant views tend to characterize climatic or natural stressors such as droughts or floods for example, as discrete, finite events with defined before and after periods. This makes it easier to see the distinctions between coping that is, short-term responses during or right after an event, and adaption, longer-term or proactive strategies that can modify the socioecological system which in turn forms the context around which coping takes place (Adger 2006, Eriksen 2005).

Conceptual distinctions between coping and adaptation are clearer with respect to farming and food provisioning practices that were customary in Rusinga Island. First off, the farming and food provisioning system, in other words the socioecological system was for a long time quite resilient to stressors such as droughts, with many built-in options for coping. During times of drought, people could rely on food security crops such as potatoes and cassava cultivated along the lakefront and manually irrigated using lake water. Indigenous vegetables growing wild along the lakefront also provided nutrition when other vegetables found or grown further inland were scarce due to dry spells. Wild foods plants have been recognized as an overlooked source of nutrition for many communities worldwide (Price 2006), and no less one of the strategies
communities use to cope with food scarcity (Ocho et al. 2012). In Kenya's Lake Victoria Basin there is wide knowledge and use of wild indigenous vegetables many of which are considered highly nutritious as well as medicinal (Orech et al. 2007, Ogoye-Ndegwa 2003, Geissler et al. 2002, Kokwaro 1998). Trading and exchange of fish or livestock with staple grains from other communities in the mainland, referred to as *rundo*, constituted another coping strategy during times of acute food scarcity that resulted from prolonged droughts. These coping strategies occurred within the context of a socioecological system that was highly adaptive and therefore resilient to droughts. The adaptive capacity of the traditional farming and food provisioning system in Rusinga Island was facilitated most apparently by two factors. One is a well-developed ethnobotanical knowledge of the local ecology, exemplified by the way in which they incorporated wild growing indigenous vegetables into their diet at various times of the year. The second most apparent factor is a land tenure system that guaranteed access to lakefront plots and in turn year-round water access to most households in the community. In relation to the local ecological knowledge the land tenure system was designed to take full advantage of varied microecological niches that are available. The two most apparent in this study are homestead plots dependent on rain, and the lakefront dependent on lake water. Similar practices, which in general constitute simultaneously utilizing different ecological niches, is not unique to Rusinga Island, and is recognized as one aspect of diversification of activities that many communities employ to maintain or enhance their livelihoods (Ogalleh 2012, Connelly & Chaiken 2000). Within the context of vulnerability and resilience, diversification with respect to biodiversity makes sense as a risk mitigation strategy. In Rusinga this was particularly
the effective along two dimensions. Land use that exploits different micro-ecological
niches can be understood as distribution of risk across space, while customary
scheduling of farming and food provisioning practices in different times of the year, can
be understood as distribution of risk across time (Agrawal 2010). These customary
practices, contributed to a highly resilient socioecological system, that provided the
context in which coping took place, serving the community for many generations.

Currently, as a result of the increasingly uncertain climate conditions, residents
of Rusinga Island have to engage in all of these strategies in an effort to meet their basic
needs and thus are thrust into a mode of where they are perpetually coping, with the
effects cascading into other aspects of their livelihoods. The need to draw on their
already limited incomes to supplement food harvests or afford new inputs such as fast
maturing hybrid seeds and associated pesticides, exemplifies how climate change is
exacerbating the already precarious socioeconomic situation of many households in
Rusinga. Even those who farm for income are forced to turn around and use that money
to purchase staple grains. Local government officials report that the district that
includes Rusinga has become a net importer of food (Suba DDP 2008). Varied aspects of
this phenomenon, of multiple stressors interacting and compounding the adverse
impacts has been observed in a number of other communities (Gabrielsson et al. 2012,

Overall, what emerges most prominently in this study is that for residents of
Rusinga Island are being left with fewer and fewer options for further diversification or
mitigation of future risks or uncertainties. Climate change in its' perpetual nature, is
pushing the socioecological system of Rusinga Island to its current limits such that
practice once reserved for coping are now commonplace.
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CHAPTER 5 – BROADENING THE SCOPES OF ENGAGEMENT:

COLLECTIVE ACTION AS AN ADAPTATION STRATEGY FOR CLIMATE CHANGE IN THE LAKE VICTORIA BASIN, KENYA

ABSTRACT

This study examines how members of the Rusinga Island community in Kenya are employing collective action as a way to cope and adapt to the impacts of climate change. Like many smallholder farming communities in the Africa, communities in the Lake Victoria Basin are highly vulnerable to climate change, a phenomenon that overlaps with the prevalence of intervention initiatives aimed at alleviating poverty or managing natural resources in Kenya. Community-based initiatives are seen as the preferred way to approach interventions. However, little is understood about how communal or collective action in many vulnerable communities is directed at enhancing adaptive capacity to climate change. The concept of social capital is used to examine the collective action within this context. In conjunction, a resilience and vulnerability framework is used to understand how specific communal strategies employed, enhance adaptive capacity to climate change. The findings reveal that through collective action community members, mostly women, are able to pool their resources, distribute risk, and broaden their reach beyond their immediate community. Also revealed is a trend towards increased formalization of community groups. The study enables a critical look back at the concept of social capital, specifically the
tendency to confound long-term community resilience with measures of economic development. This in turn foregrounds broader issues of power and politics that exist between disadvantaged communities and intervention initiatives, particularly in setting the context around which communities are exploring alternatives to enhance reduce their vulnerability to climate change.

INTRODUCTION

Communities within the Lake Victoria Basin currently face considerable socioeconomic and ecological challenges, one of which is climate change. In Kenya many of those within the Lake Victoria Basin are smallholder farmers who draw a large part of their livelihoods from farming and it is in this arena in which they confront the impacts of climate change most directly. There are numerous organizations and community groups active in fostering initiatives aimed at alleviating challenges that undermine the ability of people to maintain or enhance their standard of living (Gabrielsson et al. 2013, Muyodi et al. 2010, Swallow et al. 2009). Both of these phenomena are not unique to the Lake Victoria Basin of Kenya. Many farming communities in the global south are considered to be disproportionately vulnerable to the impacts of climate change, by virtue of their relatively high reliance on natural resources (Kangalawe et al. 2011, Morton 2007). Concurrently, there has been a marked increase in the presence of NGOs and intervention initiatives in many areas of the global south. Numerous studies have documented such initiatives which are often
targeted at natural resource management or poverty alleviation (Kottak 1999).

In recent years community–based or community–driven initiatives have been
lauded as the preferred model for interventions, based on the premise that communal
efforts confer benefits to a wider section of people including the most vulnerable
(Mansuri & Rao 2004). As of yet however, there has been relatively little documented on
the varied ways communal efforts or collective action is being employed to address
vulnerability to climate change (Crate 2011). This study based in Rusinga Island Kenya,
examines the community groups as the most readily apparent manifestation of
collective action. Specifically the study seeks to ascertain how people in the community
use groups to enhance their adaptive capacity to the impacts of climate change. The
concept of social capital is utilized to examine the emerging social networks through
which community members access resources that they deem important. The resources
in question and the emerging social network are also examined from the standpoint of
specifically how they enhance the adaptive capacity to climate change impacts.

Based on the findings and analysis this study identifies four strategic ways that
community members in Rusinga Island are using collective action to expand the scope
around which they are seeking options to cope and adapt to the impacts of climate
change. The study also finds that it is mostly women who are most actively participating
in community groups. In addition the study highlights some limitations with how the
concept of social capital is predominantly employed, questioning the emphasis on
measures of economic development that are prevalent in development discourse.
Furthermore through the findings, issues of politics and power are brought to the
forefront. This is specifically in reference to how the emerging social and political
context marked by the increased interaction across different entities that include NGO and government agencies and local community members influence the options available for coping and adapting and, in turn, the trajectories of how collective action emerges and evolves.

**BACKGROUND**

Collective action is acknowledged in many studies as a strategy that has potential to enhance adaptive capacity of many communities to the impacts of climate change. The growing body of work in this area of research reveals how climate change is exerting pressure on the natural resources that many communities depend on to achieve well-being and enhance their livelihoods (Washington-Ottombre & Pijanowski 2012, Adger 2010). Stewardship of natural resources through communal management practices has long been the norm in many societies, giving rise to social norms based on trust and reciprocity, that curtail the over-exploitation of natural resources. It has been observed that the decline of such social institutions in favor of individual or private management has led to the depletion of natural resources in many areas of the world (Grandia 2012, Igoe 2004, Pretty & Ward 2001). Yet a great number of modern day interventions and government policies aimed at natural resource stewardship, have emphasized individual action and privatization. It reveals a gap that exists between many communities that depend directly on their natural environment on the one hand, and formal government and policy-making agencies or professional researchers on the
other hand. The gap exists particularly with regards to how they perceive and value the links between, cultural norms that influence collective action and natural resource management (Grandia 2012, Igoe 2004, Pretty & Ward 2001). This presents at worst, the potential for external interventions to undermine the adaptive capacity in many communities. This is particularly pertinent with regards to climate change. Currently many communities are faced with the urgency of finding ways to adapt, as they confront the current impacts of climate change in addition to ever greater uncertainty in the future. Climate change impacts are likely to stress the natural resource base of many communities beyond limits that have been previously encountered. The corresponding communal efforts are influenced by sociocultural norms that vary cross-culturally. Thus more place-based research that accounts for the influence of sociocultural norms in specific communities is needed in order to provide an improved understanding of how varied groups of people are mobilizing to adapt to climate change (Crater 2011).

One branch of inquiry in this research arena, draws from vulnerability and resilience frameworks in order to determine how sociocultural factors determine adaptive success (Crater 2011). Within the resilience framework adaptive capacity of a system is considered alongside two other interacting components, stressors or in other words the shocks a system is exposed to, and its sensitivity, that is, the extent to which a system can be exposed to stress before it is radically changed. To date a lot of research has been conducted on adaptive capacity of households to various stressors and shocks, but less is known empirically about the links between collective action and adaptive capacity particularly to climate change (Washington-Ottombre & Pijanowski 2012).
The adaptive capacity to climate change involves the interaction of biophysical and sociocultural factors as well as existing institutions, all of which set the context around which collective action unfolds (Washington-Ottombre & Pijanowski 2012, Agrawal 2010). This has engendered a lot of debate on how best to conceptualize collective action. Within this debate the concept of social capital features prominently and has emerged as the most prevalent framework employed by scholars examining collective action (Castle 2002, Rankin 2002, Woolcock & Narayan 2000). The most commonly cited definitions of social capital emphasize the view that collective action does not take place in a vacuum, but rather is always situated in sociocultural context from which three key elements emerge, namely trust, reciprocity and social networks that facilitate exchange (Anderson & Gabrielsson 2012, Adger 2010, Pelling & High 2005, Castle 2002, Pretty & Ward 2001). Trust in both individuals and social institutions encourages cooperation with greater confidence that other people one interacts with are likely to live up to their obligations, which in turn engendering reciprocity. One commonly cited result of this phenomenon, are networks of exchange that are mediated by a moral economy based on social norms of a given community (Pretty & Ward 2001).

Social networks are thus understood as a critical asset that is directly related to how people group themselves in a community, which is in turn associated with how much social capital they possess. Among researchers who draw from the livelihoods framework, social capital is considered one among five key asset types or forms of capital that are crucial to maintaining or enhancing the livelihood and well-being of an individual, household or a community. The other four include; financial capital, physical capital, natural capital and human capital. Physical capital constitutes of goods
produced, for instance food harvested, while natural capital constitutes natural resources such as land available for farming. Human capital constitutes the number of people available to contribute to maintaining the well-being of a household in addition to the knowledge base they possess, for instance their level of formal education or their farming knowledge (Scoones 2009, Ellis 2000, Bebbington 1999). Aside from identifying the assets available to specific individuals or households, it is important to explore that links between asset types and dynamics that constrain or mediate access to different asset types or forms of capital. For instance more social capital increases one's potential capacity to exchange knowledge which enhances their human capital. Thus social capital has gained prominence as a proxy for social networks that facilitate greater access to resources (Ellis 2000, Bebbington 1999). Similarly within resilience and vulnerability frameworks, it is widely acknowledged that the extent to which a person or groups of people are connected to others within or outside of their community, correlates with their capacity to adapt to stressors (Agrawal 2010). Stressors are understood as forces or phenomenon that undermine people's ability to maintain their well-being and can include drought, floods, poverty, unfavorable government policies or food shortage among others (Silva 2010, Morton 2007, Eriksen et al. 2005).

To a large degree inspiration for considering the effects of social and political factors on a community's vulnerability, stem from Amartya Sens's seminal research on food insecurity (Scoones 2009, Flynn 2005). In the entitlements framework three important and interacting elements are outlined. One is the endowment bundle which consists of tangible and intangible resources owned by a person. Second is the
entitlement set, which refers to the various combinations of goods and services that a person can acquire at any given time by exchanging their endowment bundle. Third is the exchange entitlement, which refers to the possibilities of exchange at any given time, which is understood to be inversely related to food insecurity (Flynn 2005). The third factor exchange entitlement, once again highlights the central role of social networks through which individuals or groups of people mobilize to gain access to much needed resources.

A lot of attention is currently focused on examining social networks, particularly in relation local organizations or institutions that serve as conduits through which resources flow within a community or, into a community from external sources. How individuals, households or groups of people are situated in relation to networks of exchange is conceptualized as their social capital. These networks constitute relationships between the individuals themselves, communal groups as well as cultural and formal institutions active within the community. Social capital in this context is then correlated to their adaptive capacity to stressors such as climate change. This is a critical point of departure for a number of studies that seek to examine the links between collective action and adaptive capacity (Washington-Ottombre & Pijanowski 2012, Agrawal 2010).

One branch of research on social capital emphasizes what we might call the structure of the networks, highlighting how individuals, households and organizations are connected, how they interact and how resources flow. In relation are issues of scale, which consider the extent to which connections transcend immediate social circles, and extend to groups, organizations or institutions outside the community. Bonding social
capital and bridging or networking social capital are common concepts employed to frame this phenomenon. Bonding social capital refers to the social ties between close-knit social groups residing within the same community and often based on factors such as kin and ethnicity. Bridging or networking social capital on the other hand refers to ties external to close knit community groups. Bonding social capital is based on strong relationships of trust while bridging or networking social capital is based on weaker levels of trust and therefore dependent on legal and formal institutions such as local government agencies (Adger 2010, Woolcock & Narayan 2000). Varying combinations of bonding and bridging social capital, or in other words, the levels of interaction between local collectives and formal institutions, influence the adaptive capacity of a community. Proponents of this view argue that the ideal situation for enhancing adaptive capacity is high levels of both, implying high levels of connectivity within a community in conjunction with high levels of connectivity with government institutions or external organizations. High levels of connectivity within a community amidst the absence of formal government institutions or external organizations, presents a less than ideal scenario where local community groups substitute for absent or dysfunctional governments. Low levels of both bonding and bridging social capitals lead to high vulnerability and poor adaptive capacity to stressors (Adger 2010, Woolcock & Narayan 2000). Implied from this perspective is the importance of having access to resources external to the community. Another important factor that particularly relates to the scale of a network is whether it spans to include organizations that are civic, public or private. A review of case studies with regards to climate change adaptation practices reveals that currently civic or informal organizations are most
active in fostering adaptive practices, with the most common collaboration happening across civic and public sectors. The private sector is largely absent (Agrawal 2010). We could easily interpret these findings to imply that collaborations between community groups, governments and what we generally term as NGOs make up a large share of initiatives seeking to shore up the adaptive capacity of many communities confronting the impacts of climate change.

Two additional areas of focus that feature prominently in research on social capital involve examining the actual organizations or groupings that constitute a social network and assessing the benefits that communities garner from collective action or social capital (Adger 2010, Place et al. 2004, Castle 2002). A great deal of the research on social capital has been conducted by researchers examining development initiatives and interventions in the global south (Rankin 2002, Woolcock & Narayan 2000). In the resulting body of literature NGOs and community-based organizations are commonly cited, which parallels their rise and proliferation in the development arena in recent years. They are now seen as the preferred vehicles for carrying out development work, more effective than governments or multinational agencies, such that large donor agencies such as the World Bank, now increasingly channel funds towards such initiatives (Mansuri & Rao 2004, Kottak 1999, Fisher 1997). Thus NGOs feature prominently in the discourses concerning social capital and collective action, however the term confounds many different types of organizations (Fisher 1997). Emerging research however acknowledges the presence of many other types of organizations or social groupings, such as self-help groups (SHGs), rotating savings and credit associations (ROSCAs), microfinance organizations (MFOs) and rural producer

Despite the scholarly accounts of the diverse of community groups now emerging in many communities in the global south, little is understood of processes and dynamics around which collective action develops and furthermore how existing forms of collective action give way to new forms as circumstances change (Castle 2002, Pretty & Ward 2001). Historically, past development paradigms viewed existing forms of social capital in target communities as impediments to modernization and adoption of new technologies deemed crucial by development agencies (Hopper 2012). In recent years there has been a shift towards acknowledging that existing forms of collective action and social capital are indeed beneficial. However to date a wide range of research still emphasizes economic development as the framework around which outcomes are valued (Adger 2010, Rankin 2002). For instance existing social networks based on trust are viewed as mechanisms to lower the costs of vetting who in a rural community is credit-worthy, increasing the likelihood of repayment. This approach is most exemplified by micro-finance organizations (Rankin 2002, Lyon 2000).

Furthermore, the diversity in the forms of collective action, together with constantly shifting priorities, is cited as a challenge to developing widely applicable proxy indicators for social capital or collective action (Place et al. 2004, Woolcock & Narayan 2000, Lyon 2000).

There is growing consensus however that many forms of social capital and collective action often overlooked by development agencies working in the global south are indeed beneficial and in many cases enhance adaptive capacities to stressors
(Woolcock & Narayan 2000). The approach adopted in this study draws from the concept of social capital and broadens the perspective in one key dimension. Rather than merely examining reported outcomes, attention is also focused on examining the evolution of community groups, how they emerged and how priorities have shifted over time. The presence or absence of community groups serves as an important proxy for social capital, however it is only the most readily visible manifestation of collective action, a result of processes that have been unfolding over time. Understanding how collective action evolves depending on circumstances is crucial given the uncertainties of climate change.
RESEARCH AREA

Figure 1. Map of Kenya and Rusinga Island

Demographic Profile

Rusinga Island is a part of the larger Lake Victoria Basin which consists of communities that surround Lake Victoria, as well as communities that reside within the Islands of the lake. The lake basin spans three countries, Kenya, Uganda and Tanzania. Rusinga Island is close to the Kenyan mainland, connected by a causeway that spans a few hundred yards. Prior to 2012, Rusinga Island was officially a part of the Suba District in Kenya, which covered lake region communities residing south of the Winam Gulf. In 2013, districts country-wide were reorganized into counties, and Rusinga Island is now officially part of Homa Bay County. However, much of the accessible demographic data available reference district level administrative units. Suba District
currently has a population of about 204,000 inhabitants with a growth rate of 3%. Rusinga Island itself has a population of about 24,275, with a population density of approximately 538 per km$^2$ (1380 per mi$^2$) (Suba DDP 2008). The island has experienced large population increase. In 1979 the population was estimated at 9900 inhabitants a density of about 230 per km$^2$ (590 per mi$^2$) (Conelly 1994). At present, approximately 58% of the Suba District population which includes Rusinga Island is under the age of 20 years. The inhabitants of the Island are primarily from the Luo ethnic group. Land tenure among the Luo is male dominated, and influenced by a virilocal settlement pattern after marriage. Customarily land holdings are successively apportioned amongst sons.

**Climate and Ecology**

The climate of Rusinga Island and the surrounding lake region is considered dry and hot, relative to the rest of the Kenya. The rainfall pattern is bimodal with annual averages ranging from 700 to 1200 mm. Temperatures range from 17.1 °C – 34.8 °C (63F to 95F), with the hottest period occurring between the months of December and February (Suba DDP 2008, Geheb & Binns 1997, Conelly 1994). Over the last 20 years, Rusinga Island has faced considerable ecological challenges that are adversely impacting the livelihoods of the local community. There is increased incidences of drought and unreliable rain patterns in addition to serious desertification (Suba DDP 2008, Conelly 1994). District officials place much of the responsibility for regional environmental degradation on human activities, referring to poor farming practices,
encroachment on protected lands, charcoal burning and pollution among others. They specifically cite what they refer to as basal fallow farming as a contributing factor. Basal fallow farming is described as a practice where new farmland is cleared, cultivated for a couple of years and then left to lie fallow while farmers move on to clear another plot of land. However, local officials do acknowledge poverty as one of the drivers of practices considered detrimental to the local ecology (Suba DDP 2008).

Livelihoods and Socioeconomics in Rusinga Island

On a number of measures, Rusinga Island and Suba District region in general is considered poor and marginalized relative to the rest of the country. In Suba district 52% of households live below the poverty line (Suba DDP 2008), compared to the national average of 46%, as determined by the national government. Metrics for what constitutes the poverty level in Kenya are not specified in accessed reports, however they indicate that Suba District is at an economic disadvantage relative to the rest of Kenya, where the annual income averages US$ 650 (IMF 2010). Food insecurity is a major concern, with local officials estimating that roughly 78% of food is sourced from outside the district. This despite the fact that over three quarters of households in the district cultivate maize and sorghum. Another major concern is the prevalence of HIV in Suba district, considered the highest in the country. The area also suffers from lack of infrastructure, for instance the road network is poorly developed, and electricity coverage is extremely limited. The two major centers in Suba District, Mbita and Sindo were only connected to the national electricity grid in 2008 (Suba DDP 2008).
Despite the socioeconomic hardships, researchers cite that communities in the Lake region of Kenya have found ways to adapt by virtue of the wide natural resource base. Rusinga Island is considered to have a wide resource base available to its inhabitants, natural resources that include arable farming land and proximity to Lake Victoria which has a variety of edible fish species, that include tilapia, nile perch and sardines among others (Kokwaro 1998). The ability to engage in farming, livestock rearing and fishing is termed by Geheb and Burns (1997) as a tri-economy, which has been a source of resilience for lake region communities. Alternating between fishing, farming and livestock rearing customarily depended on the season, with farming coinciding with the long rain season, and the major fishing period coinciding with the dry season. During the mid-20th century, colonialism ushered in a cash-based economy, and wage employment emerged as an additional livelihood strategy (Geheb & Burns 1997, Connelly 1994). Nonetheless, due to the social and economic challenges highlighted here, communities in Rusinga Island and Suba District in general still face considerable challenges.

In official reports, the national government of Kenya has prioritized poverty alleviation and climate change as major areas of to be addressed as part of the guiding vision of governance going forward (IMF 2010). Seeking to harmonize local priorities with the vision laid out by national policy makers, local government officials in Suba District have prioritized poverty alleviation and more effective management of natural resources. Going forward district officials hope for more community involvement and participation, which they anticipate can be achieved via stronger and more active civil society, composed of various community groups as well as NGOs (Suba DDP 2008).
RESEARCH METHODS

Data for this research study was collected in 2012 between the months of June and September. In depth semi-structured interviews were conducted to elicit informants' experiences with collective action and their perceptions of how collective action has influenced farming practices in the community. Informants were asked to describe; their history of involvement with community groups, factors that led them to initiate or affiliate themselves with community groups, activities conducted within community groups, interaction between group members, and interactions between their groups and other groups and organizations.

Study Sample

Snowball sampling was utilized to identify informants. A total of 24 informants were interviewed, 18 of whom were local farmers. Among the other 6 informants, 2 were staff members at two different community-based organizations, and another 2 were members of local women's community groups, each from a different group. The remaining 2 informants were staff members at NGOs active in the community, one of which is an international organization and the other a national research organization. To gain heterogeneity of viewpoints, age and gender were taken into consideration while sampling. Social life among the Luo is in general understood to be gendered and divided across different age cohorts (Cohen & Odhiambo 1989). Given that most of the inhabitants of Rusinga Island are of Luo descent, it was anticipated that gendered and
age–determined social spaces might have an influence on the perceptions and trajectories of collective action. The links between age, gender, social life as well as and natural resource use has been observed in a variety of communities around the world (Lastarria–Cornhiel 2008, Quinlan & Quinlan 2007, Nguyen 2003).

Of the 24 informants interviewed, 22 are residents of Rusinga Island. The 2 NGO staff members reside and work out of Mbita, a nearby urban center right across the short causeway that connects the island to the mainland. The household sizes of informants as well as years of formal education for the 22 island residents were elicited to provide a demographic profile of the informants (Tables 1 – 3 below).

<table>
<thead>
<tr>
<th>n</th>
<th>Age range</th>
<th>Mean (sd)</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>22</td>
<td>27 – 70</td>
<td>48 (14.8)</td>
</tr>
<tr>
<td>Female</td>
<td>11</td>
<td>27 – 67</td>
<td>48 (14.3)</td>
</tr>
<tr>
<td>Male</td>
<td>11</td>
<td>27 – 70</td>
<td>48 (15.9)</td>
</tr>
</tbody>
</table>

Table 2. Years of formal schooling (district average = 8.3 years)

<table>
<thead>
<tr>
<th>n</th>
<th>Range</th>
<th>Mean (sd)</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>22</td>
<td>0 – 16</td>
<td>10 (3.7)</td>
</tr>
<tr>
<td>Female</td>
<td>11</td>
<td>0 – 16</td>
<td>8 (4)</td>
</tr>
<tr>
<td>Male</td>
<td>11</td>
<td>6 – 16</td>
<td>11 (2.9)</td>
</tr>
</tbody>
</table>
The demographic information presented in tables 1–3 above, provide a sense of how the study participants fit with within the district at large. Despite the wide range in age, the median and average ages of the study's participants (48 years), indicates that the sample represents a middle-aged demographic, essentially those who are in caretaker roles in the community. This is significant given that 58% of the district population is under 20 years of age. The level of formal schooling for the women in the study (8 years), closely matches the district average of 8.3 years, while male participants have an average of 11 years. However this is may not be an indication that the male participants have on average more years of schooling than other males in the district. Official district statistics report higher dropout rates for women (58%) than men (32%). Thus the gender disparity in education levels among the study participants may be representative of the district at large. There is a significant difference though with regards to household sizes. The average household size for the both men and women in the study is 8 individuals, compared to approximately 5 for the district at large (Suba DDP 2008).

Overall the study sample represents a section of the district population that is faced with relatively more challenges than the district at large, a major consideration given that the region as a whole is considered a poor and marginalized relative to the

Table 3: Household size (district average = 4.8)

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<tr>
<th></th>
<th>n</th>
<th>Range</th>
<th>Mean (sd)</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>22</td>
<td>2 – 14</td>
<td>8 (3.1)</td>
<td>9</td>
</tr>
<tr>
<td>Female</td>
<td>11</td>
<td>3 – 12</td>
<td>8 (2.8)</td>
<td>9</td>
</tr>
<tr>
<td>Male</td>
<td>11</td>
<td>2 – 14</td>
<td>8 (3.5)</td>
<td>9</td>
</tr>
</tbody>
</table>
rest of the country. This is mainly exemplified by the fact that the participants have larger households to care for. In addition with limited formal schooling, and few formal employment opportunities in Rusinga it may be even more difficult for those within the island to find steady sources of income from formal employment. These factors underscore their dependence on farming as a key aspect of their livelihoods. This is especially true of women who not only have fewer opportunities to continue their formal education, but are also the primary caretakers of the relatively larger households represented in this study.

**Analysis**

In the first stage of analysis interviews were transcribed and coded together with fieldnotes using the grounded theory approach in order to uncover emic perceptions and allow for other culturally salient themes to emerge (Bernard 2011). In the analysis phase, frequency of mention, was used to determine the most salient forms of collective action, the associated practices, as well as factors reported as influencing trajectories of action. First, resources that informants deemed important were extracted from the interview data and examined with regards to how they enhance community efforts to adapt to climate change. Second the community groupings and organizations reported by the informants were extracted. This was followed by extracting instances of resource access reported by informants. The extracted list focused on resources accessed through collective action and revealed instances of access for each of the resources deemed important and the originating sources. Means of access, in other words the specific way
in which farmers accessed resources in each instant, were also examined in order to reveal the network through which the key resources flow within or into the community. Informant responses describing group histories and interactions were coded and analyzed for recurring themes related to the formation and evolution of community groups and their activities. This provided background information on the networks associated with resource access, but more importantly it also reveals the processes through which collective action geared towards responding to climate change have emerged, and the factors that influence the past and present trajectories.

FINDINGS

Community groups & organizations

“riuruok ber nikech riuruok no be e teko...”
“groups are good because these groups really are strength"
Nyateko

Badilisha ..... *Imekua kama* NGO (has become like an NGO)......So if I have to have access to a seminar, I will go though Badilisha, because ICODI does not reach that level, of connecting with big organizations,
Kwach

Community groups are a common phenomenon in Rusinga Island. Out of 18 farmers interviewed 14 are affiliated with a local community group. The community groups encountered are predominantly gendered. Out of the 18 farmers interviewed, all the
women informants, 8 in number, are active in community groups, with 6 active in women-only groups. For the male farmers 6 out of 10 are active in gender mixed groups, and 4 work independently of any community groups. As reported by Kwach many of the farmers distinguished between the groups they were involved in, and more formally organized groups in the community that offered more exposure and support to smaller groups. Kwach himself founded a local community group which has been active in the community for over 5 years and has since, continuously sought training opportunities and exposure for group members. Kwach and a number of other farmers encountered are well versed with the specific terms NGO (non-governmental organization) and community-based organization, often mentioning them without prompting. This is not surprising given the prevalence of different development initiatives in many communities around the world and the Lake Victoria Basin is no exception. However what emerges as notable is the manner in which farmers in Rusinga Island distinguished between different types of organizations, a distinction that is often based on the level of exposure a local organization has with other entities outside the community. Based on informants' reports and perceptions as well as terms prevalent in literature describing community-based groups, the following categories are used to distinguish between various groups and entities active in fostering initiatives in the Rusinga Island community.

- **Self-Help Groups (SHG)** – a group composed of local community members with the goal of addressing one or more immediate concerns. Usually organized and run by volunteers, operating out of members’ homes without any paid or professional staff. They may or may not have a formally defined mission.
• Community-based organization (CBO) – A group with a formally defined mission and managed by one or more professional staff as well as volunteers. They operate out of a center or small office and support one or multiple local initiatives that correspond with their mission.

• Non-governmental Organization (NGO) or Development Agency (DA) – Large organizations with broad scope of operation that can be regional, national and international. Have a formal mission and enough resources to fund large professional staff and a wide number of initiatives.

• Government – includes local administration such as Chiefs, Assistant Chiefs, and District officers representing national ministries as well as agricultural extension officers.

Out of 18 farmers interviewed, 14 are members of at least one community group. 12 are members of a SHG while 2 are members of a CBO. 2 farmers are members of more than 1 group. The farmers interviewed represented a total of 9 different SHGs and 2 CBOs active in the community. Of the 11 groups represented, 6 are women-only groups while 5 are open to both men and women. As was reported by the informants, the 2 CBOs have been particularly helpful in supporting the collective efforts of the farmers and SHGs in the community. In general the farmers reported ongoing interaction between their respective community groups, CBOs, NGOs, and development agencies as well as official government administrators. NGOs and development agencies encountered by the informants include; the Italian organization CEFA (European Committee for Agriculture and Training), Slow Food international, a Kenyan research
organization ICIPE (International Center for Insect Physiology and Ecology), USAID (US Agency for International Development), CARE Kenya (Cooperative for Assistance and Relief Everywhere) and AMREF (African Medical and Research Foundation). Farmers interviewed considered their collective efforts and interaction between the various entities, as an important aspect of their effort to gain access to resources they deem crucial to enhancing their farming practices as they confront declining rain patterns and economic hardships.

**Resources that enhance adaptive capacity**

By virtue of their group membership informants reported that they had gained access to important resources that enabled them to cope with existing challenges. They all expressed the hope that continued membership would enable them to confront a future in which climate uncertainty and economic hardships are likely to feature as ongoing realities. Of the 4 farmers not affiliated with a group, 2 reported that they had gained benefits from participating in locally organized farmer training events even though they were not directly involved with any one group. Knowledge in addition to farming equipment or supplies, lakefront plots and money to purchase farming inputs are key resources cited as benefits of collective action and group membership, particularly in relation to climate variability.
Knowledge Exchange and farmer trainings

Interest in new farming methods has been on the rise in recent years as indigenous plant varieties and practices that were customary, are now perceived as not being conducive to the changing climate patterns. The knowledge consists of new seed varieties and practices associated with their cultivation. Virtually all informants lament the declining and unreliable rainfall specifically during the long rain season which was customarily expected to last between 3 ½ to 4 ½ months. Now it typically lasts from mid-March or early April until mid-May a shortened duration of 1 ½ to 2 months. This has had an adverse impact on a number of indigenous crop varieties particularly sorghum and maize that are part of the staple diet for the community. Many farmers express that in order to cope with current climatic conditions they are forced to adopt new fast maturing hybrid varieties of sorghum, maize and other vegetable crops that are bred for short rain seasons. Some farmers however are seeking ways to maintain the cultivation of indigenous varieties of staples sorghum and maize as well as nurturing wild vegetables varieties perceived as being highly nutritious and in some cases also possessing medicinal properties. Water conservation and irrigation practices are particularly important in this endeavor.

Other knowledge sought after is associated with cash-cropping of new varieties that are not customary but now seen as potential income sources, for instance tomatoes and collards. There is divergence in practice as with some farmers preferring high yield plant varieties, some favoring ways to preserve, shore up or revitalize indigenous plants, while others prefer hybrid between the two depending on the plant variety. Thus there
is a growing divergence among farmers as they explore ways to adapt.

*Land – Lakefront plots*

Lakefront plots locally referred to as *orundu* are growing in importance. Proximity to the lake, an important water source, enables farmers to irrigate their crops and farm for longer periods of the year, thus reducing their reliance on the increasingly unpredictable rainfall. This shift represents another key coping strategy to present climatic conditions in Rusinga Island. However not all farmers own lakefront plots. Some of those who do, desire additional plots, driven by the need to grow more food for their households as well as engage in cash-cropping for income.

_He ng’ato ka ne onge gi lo kata en go lo to tin, koro okoni ‘ni mia puothi madoung maneno ka nindo kanyo no?’..._, koro imie amia koro odhi ochiemo. Ka chieng moro orome to a ng’ane kauono lopi cha, koro adware, idware ni he, bas onge wach. To ma kauono ni! Makauono ni ka oki bano note di dhi kwa ng’ato lo?

Yes if someone did not have land or they had little land, they could come to you and ask ‘can I use your land that I see is lying fallow?’... you would let them farm it and harvest from it. Until you would decide I need it and then you would resume to use it without any issue. But today! Could you really get access to a plot without paying money for it?

*Mama Dani*

With exasperation Mama Dani an elderly woman farmer expressed how access to farming land today is primarily dependent on having money, rather than traditional forms of reciprocity. This sentiment was echoed by a number of other informants.
Traditionally those with little land could customarily gain access to fallow or unused plots of other community members. With increasing population pressure and exposure to cash-based economy such arrangements are now much less common. However through community groups, farmers with little or no lakefront land are able to gain access in two ways. Either one of the members donates their unused land to the group or as a group they can collectively pool money and rent a plot together. Out of the 18 farmers interviewed 7 farmers reported that they were able to gain access to a lakefront plot through their membership in a community group. Out of these 7 farmers, 4 do not own an orundu, while 3 who do, were able to gain access to an additional plot. This was specifically the case for the year 2012. Group members farm these plots collectively, either working the plot as a group and sharing the harvest, or divide the plot into sections which each group member can cultivate individually.

In Rusinga Island farmers typically cultivate more than one plot in the course of a year, usually a plot within or close to the homestead and one by the lakefront. Historically the bulk of the staple cereal and grain harvest was grown in plots within or near the homesteads. Lakefront plots, orundus, were customarily reserved for cassava, potatoes and quick maturing vegetable plants that could easily be irrigated manually during the dry or short rain seasons. These plots are now being farmed more intensively than was customary in the past. Farmers are transitioning more crops to these plots and farming the plots for longer periods during the year, in order to take advantage of lake water and reduce their reliance on the increasingly unpredictable rain patterns. This enables farmers to shore up their subsistence supplies of grain crops such as sorghum and maize that were customarily grown mainly in plots within or near homesteads.
Farming Supplies

Irrigation systems and secure fencing were deemed as two very important resources. A number of farmers, report that through community groups they were able to obtain access to water pumps and pipes or fencing materials or both. Despite proximity to the lake, manual bucket irrigation is very labor intensive, hence the need for small scale irrigation systems which usually consist of water pumps and pipes. These are resources that are quite cost prohibitive for most individuals and households to afford on their own. Farmers also desire more secure fencing consisting of wire meshing and cedar poles, in order to more effectively guard against livestock. Due to decline in natural vegetation one consequence of declining rainfall, livestock are more likely to graze on lakefront vegetation and often invade lakefront plots that are fenced with locally available shrubs. In the past this served as adequate deterrence to livestock when natural vegetation was more abundant.

New seeds are another sought after resource, and consist of seeds of non-traditional crops such as tomatoes and collard greens, as well as new fast maturing hybrid varieties of customary staples such as sorghum, maize and cowpeas. Seed saving practices of indigenous varieties is increasingly giving way to annual purchases of commercially available hybrid seeds which are reported as more conducive to the unpredictable rain patterns.
Cash Investments

Through community groups farmers reported that they have been able to pool their financial resources in order to afford farming inputs that are cost prohibitive for individuals or households such as small scale irrigation systems, seeds, pesticides and fencing. A number of farmers are involved with groups that collectively save money, by way of set donations made by group members on a periodic basis, for instance monthly. This money can be disbursed or loaned to individual members on a rotating basis or used in a lump sum to make a large purchase of expensive items like a water pump which is then shared by group members. Many elements of this practice locally referred to as “merry-go-rounds” are similar to rotating savings and credit associations (ROSCAs) that have been observed in many rural and urban communities around the world.

Resource access networks

The 18 farmers interviewed as part of this study reported a total of 49 instances of access to important resources. The reported instances represent resources accessed from the year 2012, extending back to 2002 (table 4). This however is not intended as a comprehensive survey of resources used or accessed by the informants during the corresponding time period. There may be other important resources farmers are accessing through groups or individually however the resources reported in the study were those most frequently mentioned as being associated with changing climatic
conditions. Table 4 below shows the list of resources and the originating sources.

Table 4 – Resources and originating source

<table>
<thead>
<tr>
<th>Resources</th>
<th>NGO/ DA</th>
<th>Govt</th>
<th>SHG</th>
<th>Community</th>
<th>CBO</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>farmer training</td>
<td>11</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td>19</td>
</tr>
<tr>
<td>lakefront plot (orundu)</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Irrigation system</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>money</td>
<td>2</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Fencing</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Seeds</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>labor</td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Pesticides</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Fertilizer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>27</strong></td>
<td><strong>9</strong></td>
<td><strong>8</strong></td>
<td><strong>5</strong></td>
<td><strong>0</strong></td>
<td><strong>49</strong></td>
</tr>
</tbody>
</table>

By a wide margin NGOs and external agencies were reported as the original source for most of the resources, followed by the government, SHGs and individual members from the local community. Knowledge through farmer trainings was the most prevalent resource accessed. Taken together 13 instances originating from SHGs and community members represent locally available resources that required collective action to access, namely lakefront plots, money and labor sharing. CBOs were not cited as the original source of any of the resources mentioned. Their role emerges more clearly when considering how resources are being accessed, and so too does the government’s role.

Considering the originating source alongside the means of access, provides a
more revealing view of the networks through which resources flow, as well as interactions between community groups, NGOs, development agencies and the local government. It is also here that we see a clearer distinction between the informal groups referred to as SHGs and more formal community groups referred to as CBOs. This is illustrated in table 5 below. The following access scenarios were considered for each of the 49 reported instances of resource access.

- **SHG/indv ↔ CBO ↔ NGO/DA** – Individuals or SHGs gain access to NGO or external organizations through community-based organizations.
- **SHG/indv ↔ Govt ↔ NGO/DA** – Individuals or self-help groups gain access to NGO or external resources through the government.
- **SHG/indv ↔ CBO ↔ Govt** – Individuals or self-help groups gain access to government through the community-based organization.
- **SHG/indv ↔ NGO/DA** – Individuals or self-help groups have direct access to NGO or external resources, bypassing CBOs or government.
- **SHG/indv ↔ Govt** – Individuals or self-help groups have direct access to resources provided by the government.
- **SHG/indv ↔ CBO** – Individuals or self-help groups have direct access to resources provided by the CBO.
- **SHG/indiv ↔ Local Community** – Self-help groups or individuals access resources directly from local community members.
- **SHG/indiv** – resources are generated by group activities and made available to group members.
Table 5 – Resources, original source and means of access

<table>
<thead>
<tr>
<th>Source</th>
<th>NGO/DA</th>
<th>NGO/DA</th>
<th>Govt</th>
<th>NGO/DA</th>
<th>Govt</th>
<th>CBO</th>
<th>community</th>
<th>SHG</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Means of access</td>
<td>CBO → SHG</td>
<td>govt → SHG</td>
<td>CBO → SHG</td>
<td>SHG</td>
<td>SHG</td>
<td>SHG</td>
<td>SHG</td>
<td>SHG</td>
<td>Total</td>
</tr>
<tr>
<td>farmer training</td>
<td>7</td>
<td>4</td>
<td>2</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>19</td>
</tr>
<tr>
<td>Lakefront plot</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Irrigation system</td>
<td></td>
<td>6</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>money</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Fencing</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Seeds</td>
<td>2</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>labor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Pesticides</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Fertilizer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>11</td>
<td>16</td>
<td>2</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>5</td>
<td>8</td>
<td>49</td>
</tr>
</tbody>
</table>

it is just proposal writing. We write proposals, mainly proposals. Nikech you may have a need but if you don't make your needs known, so what. You have a need you have to talk about it, you have to contact people and like minded organizations

Opiyo (Coordinator at a local CBO)

we wrote to them. We wrote to Bread for the World, we wrote to Amref......... we got them through the ministry of health Mbita, Yes because they used to come here and see what we are doing, so they introduced these people to us and they funded us.

Adongo (Coordinator at a local CBO)
CBOs and local government officials have played a large role in facilitating access to NGOs and development agencies. Staff from the two CBOs encountered in this study reported that they have been very active in their efforts to foster connections and collaborations with external organizations in order to support individuals or SHGs participating in their initiatives. They have achieved this by sending out grant and project proposals, networking with other CBOs and individuals outside the Rusinga Island community. There is little evidence that government officials are similarly active in seeking out external organizations. A local project coordinator for CEFA, an Italian NGO, reported that the organization approached local government officials for help identifying community groups. They and local officials followed by soliciting and evaluating proposals for projects they could support as part of their mission to foster poverty alleviation initiatives. Thus it may be more the case that local government officials are being approached by NGOs and development agencies. Local administrators as part of the community are aware of the community groups which undoubtedly enables SHGs to access government officials, a phenomenon that might be related to the limited links reported between government and CBOs. Access to government officials however does not guarantee corresponding responses. Farmer training workshops and visits by agricultural extension officers constitute the main resource gained from the government, albeit in one case where one farmer, the leader of a local SHG reported that they received seeds from agricultural extension officers in the 2012 season. Jadoung Ongere reported that soon after their SHG was formed they actively sought out extension officers who responded by making them aware of training opportunities and workshops. However according to Jadoung Ongere, most of the
government support received by their SHG has been limited to knowledge exchange. Other farmers reported periodic or little engagement with extension officers. Given the role local government officials play in facilitating connections, it is the case that visibility of an SHG among government officials increases the likelihood that they will have more opportunities to collaborate with external organizations whose entry into the community is facilitated by government officials.

“Nitie riuruok mar mon moko kacha mane NGO ochielo negi puodho”
“there is a womens group over there who got help from an NGO to fence their plot”

Oriek

Interactions with external organizations reported in this study were mostly short term relationships, for instance a training workshop, or a one-time sponsorship for resources such as fencing materials. Mostly the SHGs are working on their own or interacting with the CBOs. Few interactions however are long term engagements lasting two to three years. Two such projects were ongoing at the time of the study in 2012. Otieno a young farmer and member of an SHG engaged in such an arrangement reported that after the government facilitated the initial contact with the NGO. Their dealings since the initial contact have been direct between them and the NGO. This was echoed by the NGOs local representative who oversees outreach to a number of SHGs whose initiatives they support. This particular NGO, has provided a number of SHGs in the wider district with water pumps, pipes, fencing material and high yield hybrid seeds particularly tomatoes.

The network of resource flow and interaction between the different entities
represents only a snapshot of the most recent years, but an important one nonetheless. While not explicitly showing it, the access network alludes to the dynamic nature of relationships between local community groups, NGOs and government officials. Different organizations have had a presence in the community at different times and for varying periods. Initial relationships between local groups, external organizations and government agencies are facilitated in varying ways, which then shift depending on the length of the project.

**Group Formation, Evolution and Interactions**

A more revealing picture of how collective action in the community has coalesced to address climate change is revealed by examining how individual groups formed and evolved, the shifts in their priorities, as well as how interactions within and across groups have developed. Currently all 11 community groups encountered in this study engage in farming. It is through farming that both their efforts to address climate change impacts and their interactions with other entities is most apparent. However most groups also engage in other activities that are directly related to their farming efforts and livelihoods. They include collective savings initiatives, micro-enterprises and social support for vulnerable community members. Priorities have shifted over time especially for groups that have been in existence for a long time.
Self-Help Groups (SHGs)

At the outset almost all groups engaged in multiple activities. However most groups traced the original founding to one key factor. Among the SHGs 3 groups had been in existence for 2 or fewer years at the time of the study. Three other groups had been in existence between 4 and 8 years while the oldest three had been in existence between 9 and 14 years. In 6 of 9 SHGs, the original impetus that led to the groups founding, was seeking ways to support their fellow community members who had been affected by HIV/AIDS, particularly widows and orphans. Out of those 6 groups 5 resorted to farming as one form of material support, that is, ensuring food security for their members. Overall 2 SHGs resorted to running a collective savings initiative they commonly referred to as a "merry-go-round" as a way to provide financial support to orphaned or widowed households. Thus in 6 SHGs the initial activities of farming or collective savings were aimed at supporting the most vulnerable members, some of whom were the original founders of the groups. The remaining three groups had farming as their initial motive, with the goal of collectively seeking ways to enhance their crop yields. One group is unique in that it was launched under the auspices of a project spearheaded by USAID, an initiative aimed at alleviating poverty among young women in rural communities. In Rusinga Island, the group which is named "Value Girls" after the USAID initiative, has taken the form of a women's farming group operating under the logic of middle-aged women mentoring younger women on ways to achieve self-sufficiency through cash-crop farming on lakefront plots. A mentor of a value girls project expressed that USAID worked with local government officials in
identifying existing groups to partner with. Eventually a few women with experience working in community groups, formed two new groups and recruited younger women. This is one of the more recently formed groups.

Overtime the groups with longer tenure have incorporated more priorities. The groups that initially started with farming as their main motive, are now also including and supporting vulnerable members of the community, particularly widowed women or those from households in the care of orphans. All groups encountered are engaged in farming not only for subsistence but also as a source for additional income. More of the groups have adopted collective savings initiatives, and almost all, 7 out of the 9 groups have a subset of their members who lack access to adequate land, and are therefore benefiting those members by sharing and communally farming lakefront plots.

One other key phenomenon unfolding is the increasing formalization of local community groups. All but one of groups encountered are officially registered with the Ministry of Social Services. The ministry has officers in the local government headquarters in Mbita, the nearest urban center. Only one of the encountered SHG which is just over a year old, is yet to register but intends to do so as soon as they are able. Registration requires a fee, from the group, proof that the group has bylaws, a few officers, and written records of ongoing activities for instance meeting minutes. Locally these are all perceived as formal processes entailed in interacting with external organizations. Among many of the SHG members familiarity with required formalities is an unfolding process, with some more familiar than others. Two of the SHGs encountered were founded by individuals who returned to Rusinga Island after retiring from low-level civil service jobs with the government. Through their experience they
gained early awareness of trends in government policy in the early to mid-2000s that sought to channel more assistance to disadvantaged communities through locally formed community groups. Despite this trend towards formalization, all the SHGs are still run primarily on a volunteer basis, operating out of members’ homes. This is one of the factors expressed as a key distinction between the SHGs and CBOs.

*Community-Based Organizations (CBOs)*

Both community-based organizations encountered promote and support farming activities as one of their key priorities. Like the SHGs they have grown to include multiple priorities over time but farmers and local group members perceive the most prominent role of CBOs, as connecting them to external groups that can provide resources important to local farmers.

Kibisom, is a well respected CBO that has been active in the community since 1996 and counts over 100 members, mostly local women. The founder herself a woman started the organization after retiring from long career as an accountant in Nairobi, the capital city. After returning to Rusinga Island, her rural home, she quickly noted what she termed as the acute challenges confronted by women from households that had been affected by HIV/AIDS, or those who were caring for orphaned children. Shortly afterward she pledged some of her retirement money, together with donations from other well-to-do friends and started the organization. She also donated part of her rural home which has since become the organization's center, housing a staff of about 4 people some of whom were originally members themselves. Kibisom's original mission
was to function as a women's support group focusing on health based initiatives. They have since ventured beyond health to include vocational programs aimed at enhancing members' ability to be self-sufficient. Farming is one of the activities on which they have focused a lot of attention, seeking and hosting training sessions with government officials and outside groups. Through the years Kibisom's founder has encouraged and supported members to take initiative and start their own groups. One of the SHGs encountered in this study was launched by former Kibisom members and has been in operation for over 7 years. Badilisha, the other CBO encountered also traces its roots back to Kibisom.

Badilisha, in operation since 2008, has become widely known in the community. The founder, a young man of 30 years, worked as a staff member at Kibisom, followed by a short stint with a health based NGO in neighboring mainland communities before returning to Rusinga Island to launch Badilisha. The group's mission is to promote sustainable farming practices, focusing on preservation of indigenous crop varieties and effective water management practices as a way to counteract unreliable rain patterns and extend the farming season. Badilisha operates with two staff members and periodically relies on volunteers to help manage it's demonstration garden and host farmer training sessions at it's center. The organization counts 15 active farmers as members. Prior to launching Badilisha, the founder and a group of other younger individuals started an SHG with the goal of promoting organic farming. Not having a piece of land themselves group members arranged to use a plot from a local community member. The group folded after 2 years shortly after they lost use of the plot they were using as their base, which the owner took back for his own use. After that he gained a
lot of experience working with other groups and NGOs, before returning to launch Badilisha.

Groups form and fold all the time, Badilisha’s founder expressed as he reflected on his own experience working with different organizations, in addition to what he has observed of other SHGs in the community. The ones that last tend to be those founded and led by older individuals who are more likely to exhibit maturity in their interactions, allowing them to more successfully manage competing demands from group members. On the other hand the ability of CBOs to forge links with outside organizations is a function of the founder’s experiences and exposure to formal settings. As a result of a long career working as a professional in the formal sector, the founder of Kibisom expressed an awareness of different funding organizations and how to reach out to them through grant proposals. Funds gained in this way have been instrumental in enabling Kibisom to expand their initiatives. Likewise, Badilisha’s founder worked with a number of organizations through which he learned the formal processes entailed in writing grant proposals, having an internet presence and in general conducting outreach to NGOs, development agencies or well to do individuals interested in supporting their initiatives.

**Interaction within and across groups and organizations**

Current membership in the SHGs ranges between 15 to 25 individuals. The groups are heavily gendered with 5 out of the 9 SHGs describing themselves as women only. The remaining 4 described themselves as open to both men and women, but
admitted that most members are women. Only one SHG encountered in the study reported an almost symmetrical gender balance of 10 men and 8 women. In Rusinga Island men only groups are very rare. Nonetheless women informants admitted that even though they self-identify as women-only groups, that often seek male members but limit it to only 1 or 2. They justify this phenomenon mainly for two reasons. One, men can provide knowledge of, and assistance with labor intensive tasks that are traditionally handled by males, such as early season plowing and constructing and maintaining fencing for lakefront plots. Second having the “right” men as allies can facilitate outreach to other men in the community who might be helpful to the women's groups. The overall agenda and priorities of the groups though remains those that are established by the women members.

… ok wa dwar mio gi dwol, nikech gin gi rieko mang’eny....... wa ng’io ka en dichuo ma jadongruok.

… we don't want to give them voice, because they will dominate....... we look for men who are interested in progress.

Nyateko

Customarily labor division and community interactions in Rusinga are heavily gendered and traditionally men dominate. Women are very selective of the limited numbers of men that they invite in order to guard against the tendency for men to be assertive and dominate group interactions. They assess men on the basis of whether they are, in local terms jadongruok. In general the term can be applied to anyone regardless of gender however in this context it is chiefly used in reference to men who are interested in “progress” which from the perspective of many women in the community
refers to men who are interested in supporting equity for women as well as focusing on farming over fishing. In Rusinga Island, fishing is traditionally dominated by males, particularly young men. Fishing and farming are not mutually exclusive, but go hand in hand as key food provisioning strategies. For the lake people of Rusinga Island, fishing is not only a necessity but is enjoyed by all as a strong marker of cultural identity. Even so, many women lament that as a result of the fishing boom that peaked in the 1980s, young men are now overly reliant on fishing, content to fish, and sell some of their catch for money and as a result shun farming activities that fall squarely on the shoulders of women in their households. While traditionally, a great portion of farming work has always been left to women, men are traditionally expected to occupy important roles particularly in the highly labor intensive tasks such as plowing, harvesting and maintaining fences, activities that mostly occur at either ends of the farming seasons. Thus, women interpret it as a strong signal when men through their daily activities demonstrate strong commitments towards all aspects of farming throughout the entire season. Yet even for those men characterized as jodongruok, care is still taken to ensure that they are likely to remain supportive even when it is women who are setting the priorities and agenda for the groups. Group members also take a lot of care in assessing each other as members as well as other women recruited into the group. Jokinda, are highly valued as potential partners and refer to people who are hardworking and actively focused on addressing challenges confronted by the most vulnerable who are women and children and also important highly likely to reciprocate.

Taken together the terms jokinda and jodongruok encapsulate a set of qualities
that group members look to, not only when assessing potential members but also when looking to collaborate with other local groups as well as the CBOs which are staffed by local community members. “We simply knew each other as community members” expressed Jadoung’ Migosi a local farmer and active member of an SHG, when he described how they came to collaborate with Badilisha, a local CBO. Knowing each other as community members they were able to consult and observe the activities in each others' respective groups before forging a partnership. In other cases SHGs have sought out the CBOs and in other cases it is vice versa. Word of mouth and consulting with other members of the community is also an important aspect of understanding the reputations of potential partners and the likelihood that they will reciprocate.

*omera ok ikel na saga, kel na saga, puothe na omoko*
*hey, organize for me a saga. Get me a saga, I am behind with my farming*

Jadoung’ Oloko

Precedents for collective action exist in traditional labor-sharing practices. It was common for one to organize a *saga*, a group composed of community members, to work one’s farm when they fell behind due to illness or death, and were at risk of missing the onset of rains or any other time dependent activity. *Rika* on the other hand was a longer term arrangement among a group of people to collectively tend each others' plots on a rotating basis. In both *saga* and *rika* people involved others who were most likely to reciprocate. Similarly in modern day community groups jokinda and jodongruok, are those most likely to reciprocate, and in addition those more likely to demonstrate a commitment to equitable relationships with others regardless of gender.
and to supporting those most vulnerable in the community.

**Desired resources**

Looking forward to what kinds of resources are most desired in Rusinga Island, a community-wide irrigation system was most frequently mentioned by informants (Table 6)

<table>
<thead>
<tr>
<th>Resources desired</th>
<th>Number of mentions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation system</td>
<td>19</td>
</tr>
<tr>
<td>More emphasis on farming rather than fishing</td>
<td>13</td>
</tr>
<tr>
<td>Better control of livestock</td>
<td>6</td>
</tr>
<tr>
<td>Tree planting initiatives</td>
<td>4</td>
</tr>
<tr>
<td>Access to markets for farming produce</td>
<td>3</td>
</tr>
<tr>
<td>knowledge/training/empowerment</td>
<td>3</td>
</tr>
<tr>
<td>Better access to formal education</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total mentions</strong></td>
<td><strong>50</strong></td>
</tr>
</tbody>
</table>

Informants consider the lake a key resource and asset for the community, enhancing resilience in two key ways. Proximity to the lake has historically facilitated manual irrigation of lakefront plots particularly during times of drought. The lake also remains a key source for fish, traditionally a very important food source. However in recent years fish stocks have been dwindling. Thus rather than continued reliance on fishing
many in the community desire a large scale irrigation system that can supply water not only to the lakefront plots but also to the plots within homesteads and in general for household use. Involvement in community groups comes with enhanced potential to collectively pool money in order to afford water pumps for small-scale irrigation. However, many believe that long term resilience can only develop from a community wide irrigation system that not only facilitates water access for lakefront plots but also access for homestead plots far from the lake as well as water for household use. A majority of the informants expressed that only the government can deliver such an infrastructure.

DISCUSSION AND CONCLUSION

In Rusinga Island, community groups that have coalesced around farming are the most readily apparent form of collective action. It is in this arena where they confront impacts of climate change most directly. Generally speaking collective action enables individuals and households in Rusinga to broaden the scope around which they seek ways to cope and adapt to the impacts of climate change. More specifically though, the mix of activities employed are key to enhancing their capacity to confront climate change in four strategic ways.

First of, through community groups individuals are able to pool their efforts and gain access to resources considered crucial to maintaining or enhancing their livelihoods which are heavily dependent on farming. By saving collectively groups are
able to afford and share key supplies such as pumps and pipes used for irrigating lakefront plots. They are also in a stronger position to collectively rent lakefront farming plots from other community members with unused land, facilitating easier access to lake water used in irrigation. Alternatively individuals without lakefront land can also benefit from other group members who avail unused sections of their plots to other members of their respective community group. Common pooling of resources is acknowledged as a significant approach to enhancing adaptive and coping capacity (Agrawal 2010).

A second aspect involves the use of collective action to distribute risk across the community. A majority of groups encountered in this study were initiated with the impetus to provide material support to widowed women and households supporting orphaned children. A majority of the community groups are women only groups. By virtue of their prominent roles and responsibilities as caretakers, women in Rusinga Island understand themselves as being most attuned to the vulnerabilities they confront. They demonstrate this understanding at the individual, household and community level. It is widely acknowledged that most vulnerable members of a given community, are disproportionately women and children, a fact that cannot be overstated for farming communities that have suffered the impacts of HIV/AIDS (Fagbemissi & Price 2011).

Community groups, in particular, SHGs provide support to vulnerable households enhancing their food security, as well as providing opportunities to generate income from farming as a result of their ability to access lakefront plots. Community groups are also beneficial as a source of labor. Able group members are active in helping tend plots of those less able, a key factor in making sure rain-dependent plots are ready in time to
take full advantage of the increasingly precarious rainfall. Such uncertainties associated with a changing climate, are undoubtedly confronted by all in the community, but more pronounced for the most vulnerable members. Essentially community groups are actively distributing risk across households or the community (Agrawal 2010). This is akin to traditional forms of labor sharing, *saga* and *rika*, but rather than a strategy in response to stressors occurring only on occasion or at periodic times, it is now a constant phenomenon throughout the year.

Emphasis on forging links beyond the community in order to access knowledge of new farming techniques, as well as farming supplies, reveals a third aspect of how farmers in Rusinga Island are employing collective action as a strategy. The present ecological conditions marked by declining rainfall and fish stocks from the lake, are seriously undermining food provisioning practices that have long been customary for the Rusinga Island residents. In following, yields of indigenous varieties of staple grains such as sorghum and maize, not adapted to current rain patterns are declining. Consequently there is the perception among some local farmers that under current circumstances indigenous or customary farming practices may not be entirely conducive to meet community demands. Thus broadening the geographic reach beyond the immediate community in search of knowledge and resources is one key trajectory of collective action in Rusinga Island. It is in this endeavor that community-based organizations play a critical role, especially those with the knowledge of the formalities required in conducting outreach to NGOs, development agencies and government officials. In so doing CBOs draw the most clear distinctions between them and other community groups. Surprisingly CBOs rival local government officials in this role.
Within the spheres around where collective action, farming and climate change intersect, the government is most visible in its role facilitating contact between external NGOs and local groups particularly SHGs. They are also active in facilitating knowledge exchange through extension agents however this is not a prominent feature of their engagement with the community, as interactions between extension agents and farmers are few and far between. With regards to providing material resources most desired by the farmers, government officials are virtually absent, and thus farmers are increasingly looking to other external agencies.

The trend towards formalization marks the fourth aspect of how community groups are broadening their scope of engagement. Virtually all community groups are registered with the government's ministry of social services in addition to documenting their activities through records like meeting minutes. Given that local government officials are facilitating the entry of NGOs and external agencies into the community, increased formalization of community group activities is interpreted here as a strategy to increase a group's visibility with government officials and by extension, external organizations thus increasing the likelihood of partnerships that will confer onto the groups, key resources that will enhance their farming activities.

The points at which farming, collective action and climate change intersect, reveals major issues of concerns especially with, how knowledge and external supplies are regarded, as well as with the emerging sociocultural and political context in Rusinga Island. First, the emphasis placed on seeking knowledge raises some crucial questions with regards to how outsider knowledge is valued vis-a-vis indigenous or local knowledge systems. To a high degree, this phenomenon has been observed in the
development arena where knowledge and technologies based on western science have been privileged at the expense local practices and knowledge systems. For a long time agricultural interventions in the global south have emphasized intensification and boosting yields, via the promotion of a narrow selection of cash crops, and increased inputs of fertilizers and pesticides. Essentially western models of economic development operate as the dominant yardsticks for assessing progress (Shepard 2010, Ntumngia 2010, Nygren1999). These approaches undermine indigenous practices and knowledge systems which have been recognized as a key assets that enhance adaptive capacity of many communities (Nyong et al. 2007). In Rusinga Island this was exemplified by land use systems that enabled most in the community to spread their cultivation across different micro-ecological zones and across the different times of the year in addition to labor-sharing norms namely saga and rika that helped individuals cope with unforeseen social circumstances such as ill-health and death. Climate change in its persistence is undoubtedly undermining the natural resource base and corresponding knowledge systems in Rusinga Island driving farmers to seek and experiment with external knowledge. Yet farmers express that they do so only reluctantly, lamenting the potential loss of indigenous varieties. At the same time they understand proximity to Lake Victoria as an important asset, while bemoaning the lack of a community wide irrigation system that would greatly enhance their capacity to preserve and continue cultivating those very same indigenous crop varieties such as sorghum and maize that constitute their staple foods. Farmers and in general community members have in the past petitioned the government for an irrigation systems but without success, which serves as another example of how the community remains marginalized. According to
the farmers this is the kind of infrastructure that only the government can provide. Failing this, one recourse in this economically disadvantaged community is to seek small-scale irrigation supplies and experiment with new techniques from other organizations outside the community. Accordingly the government's absence is telling how the sociopolitical situation has shaped the trajectory of collective action.

The above point, emphasis on external knowledge and resources, brings into sharper focus the emerging sociocultural and political context in Rusinga Island, particularly the roles occupied by different entities and organizations in the community and how they are linked. This is important given that local institutions to a large degree shape collective action and by extension adaptive capacity (Washington-Ottombre & Pijanowski 2012, Adger 2010, Agrawal 2010). In this study we find that government absence in fostering systems that support indigenous farming practices, in effect undermines the ability of the community to seek culturally preferred ways of coping and adapting to climate change. Community-based organizations and external agencies are to an extent filling the void left by the government's absence in availing to the community some resources that they are using to shore up their adaptive capacity. Consequently the agendas and trajectories of collective action have shifted away from potentially petitioning government agencies and holding them accountable for locally salient resources, and are instead directed towards seeking partnerships with NGOs and development agencies. As has been observed with many interventions, external organizations often bring with them varied agendas and emphasizing practices and knowledge systems that conflict with culturally salient options (Shepard 2010). Therefore, the burden of adapting to climate change, a prodigious stressor with wide
scope that is undermining the very basis of their livelihoods, is largely laid upon the shoulders of a community that is already disadvantaged on a number of accounts.

The findings of the study provide added insight into the limitations of how NGOs and community based organizations are perceived in development arena as enhancing adaptive capacity of the most vulnerable members of a community. This is most apparent in reference to politics and power dynamics. One view currently influencing policy in large international development agencies such as the World Bank, is that NGOs and community based initiatives are more effective than governments, and thus the preferred vehicles for development. Considerations of power dynamics tends to be limited to the community, with the goal of assessing whether local elites are capturing benefits of intervention initiatives intended for those most vulnerable (Mansuri & Rao 2004). There is definitely merit in understanding the internal power dynamics in a community, however sole focus in this regard, glosses over the broader political implications that is the power dynamics that inherently exist between a well-resourced external organization and individuals or collectives of people in a disadvantaged community (Shepard 2010). Some argue that such views serve the purpose of justifying the withdrawal of government and public institutions from social welfare provisioning (Rankin 2002). This study illustrates these gaps, specifically how the absence of government in certain respects, and the presence of external organizations, interact to shift the agenda and trajectory of collective action. Essentially, the emerging social and political context in Rusinga Island is limiting the space to advocate for culturally preferred options for coping and adaptation, such as a community wide irrigation system that would benefit a wide section of society rather than small-scale irrigation
systems that benefits select groups that are familiar with, and able to successfully navigate the processes and formalities required in appealing to NGOs and development agencies.

On a related note the findings also serve to illustrate the limitations with predominantly referenced aspects of social capital, often employed to conceptualize collective action as an adaptive strategy. The concepts bonding social capital in reference to close-knit connections within a community, and networking social capital referring connections that transcend the immediate community, are prevalent ways to characterize the networks of exchange or resource flow and how individuals or households are situated within those networks. The prevalence of bonding social capital facilitate coping or “getting by” while the prevalence of networking social capital facilitates longer term well-being or “getting ahead” (Woolcock & Narayan 2000). Consequently, in many initiatives aimed at addressing climate change, social capital has been conceptualized as a way to generate material interventions directed at addressing vulnerability (Pelling & High 2005). In both cases, progress or community resilience is assessed chiefly based on measures of economic development, in this case, the accumulation of material resources or assets by an individual or a household, a process that dominant stances characterize as “getting ahead”. Once again this privileges a benign view of social capital that is devoid of political implications between community groups and larger formal organizations or institutions with more resources (Rankin 2002). As the findings illustrate, farmers in Rusinga Island are embracing communal strategies to pool resources in the hope of collectively affording and managing farming supplies that are cost prohibitive as well as collectively managing access to land. They
are doing so in through dynamic processes that are much less conducive to economic metrics which tend to focus on resource accumulation by individual or households. Furthermore community groups remain only one, and likely the most apparent manifestation of collective action, emerging from underlying process that are based on the local sociocultural context and formal institutions or organizations active in the community.

Many of the insights in this study stem from an examination of the processes along which community groups have emerged and evolved to confront climate change. It is a gap highlighted by Pelling & Hugh (2005), who argue for broader conceptions of social capital and collective action, a necessary step required in order to reveal the potential to foster institutional modifications that can address vulnerability to climate change and thus benefit a broader cross section of the community. Through their collective actions community members demonstrate an understanding of their vulnerabilities on a number of levels and undoubtedly see how climate change interacts with food security and health. This is in contrast to how such phenomena have been studied by scholars, as isolated events with little attention paid to the heightened levels of vulnerability when a number of different stressors are all present, interacting and compounding the adverse impacts (Gabrielsson et al. 2012, Silva et al. 2010).

Recognizing climate change as the ultimate challenge undermining other aspects of their livelihoods, many engage in community groups as a way to broaden the reach of their efforts and simultaneously pursue multiple strategies aimed at increasing the ability to cope and adapt to climate change.
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CHAPTER 6 – GENERAL CONCLUSION

This thesis organized around two manuscripts that present a number responses to climate change in the lake Victoria Basin community of Rusinga Island Kenya. The first set of responses encompasses changes in land use patterns, crop selection and food provisioning, all in relation to local perceptions of climate change impacts. These are discussed in the first manuscript which addresses the first research question; How do farmer's perceptions of climate change influence their farming practices? The second manuscript looks at efforts to access important resources, and collective action both aimed at confronting climate change. This discussion addresses the second and third research questions. What resources do farmers deem important to confronting climate change? And, How are farmers employing communal action to confront the impacts of climate change?

Both manuscripts, are framed around vulnerability and resilience, in order to examine the responses as strategies aimed at coping and adapting to climate change. This study also draws from literature on livelihoods and indigenous knowledge so as to provide a conceptual frame for the context, where farming is a key livelihood strategy and indigenous knowledge and practice provide the basis from which climate change is perceived and understood. Social capital a key concept in livelihoods framework is used to conceptualize collective action which manifests in the form of community groups, and their interactions with external organizations predominantly NGOs and local government officials

This study affirms emerging research focusing on human dimensions of climate
change. The sociocultural context has a major influence on how people perceive climate change, which consequently is a determinant of the coping and adaptation strategies adopted. In Rusinga Island perceptions of climate change are intimately linked to their farming and food provisioning practices. Crop failures and food shortage are considered prominent indicators of the extent to which their socioecological system has been altered.

A significant finding is the need to reorient how stressors to a socioecological system are perceived. Conceptions of stressors or hazards as discrete events are deficient in characterizing true nature of climate change. What emerges in this study is climate change as a perpetual stressor. Rather than observing events as a series of discrete drought or dry periods, long-term lack of rain, or long-term uncertainty become the focal point. As a result people of Rusinga Island have been pushed into a mode of perpetual coping, exemplified by year round intensive farming on the lakefront, facilitated by manual irrigation using lake water and fast maturing hybrid plant varieties replacing culturally preferred indigenous varieties. While this helps shore up food stocks and provides opportunities for income generation through crop sales, it still falls short of guaranteeing a yearlong supply of staple foods, long a customary marker for well-being and food security.

Through collective action community members are seeking to broaden the scope around which they seek important resources that enable them to confront climate change. They include access to lakefront plots and small-scale irrigation systems. Community groups have emerged as crucial avenues for pooling resources as well as a way for the most vulnerable individuals or households to limit risks by forging
partnerships that they can rely on in times of need.

Two interesting and related concluding points have to do with the government's role in Rusinga Island and its influence on trajectories of collective action as well as coping and adaptation strategies. The first concerns the similar roles that community-based organizations and government officials play in facilitating connections between self-help groups and external agencies, currently a crucial link in the resource flow networks. The second concerns the government's absence in establishing other material resources such as a community-wide irrigation infrastructure that would be important in supporting locally preferred options for adaptation such as preserving indigenous crop varieties through irrigation as an alternative to dependence on unreliable rainfall. Consequently the trajectories of collective action as an adaptive strategy is currently aimed at forging links with NGOs.

LIMITATIONS

The fieldwork for this study took place over a short time span of two and half months between late June and early September of 2012. This period coincided with harvesting season thus it was not possible to observe a full season beginning in January in addition to the dry months. Being there through the duration of a full season would have undoubtedly provided further insights into farming activities reported by farmers.

Second, it proved difficult to gather detailed climate reports from Kenya's meteorological department. The aim of the study was to get an emic perception of climate patterns, however comparison with records of precipitation and temperature
would have been a valuable component to this study given that local perceptions of climatic conditions vis-a-vis scientific perceptions was a key aspect of the logic inspiring the approach of this study.

Lastly reports of community group activities were mainly from farmers already within groups. Only 3 of the farmers interviewed were not affiliated with a group at the time of the fieldwork. Thus the study misses viewpoints from farmers who work independently of groups but perhaps desire to join a group, or those who may have been in a group and opted to leave. Those viewpoints would have undoubtedly provided a more complete picture of collective action, especially forms of collective action not expressed in the form of community groups.

**RECOMMENDATIONS FOR FURTHER STUDY**

The findings presented here suggest a number of potential follow up studies;

- It would be useful to establish perceptions of climate change among local government officials as well. A comparison between perceptions of government officials and farmers might reveal areas of consensus or areas where viewpoints diverge. Findings from such a study could be examined within the context of how different viewpoints influence interactions between local farmers and officials associated with government agencies charged with agricultural policy.
- A study could be conducted to examine advocacy that has been aimed at pushing the government to establish an irrigation system in Rusinga Island. Such a study might reveal other forms of collective action or other networks. Once
again a comparison might be telling of whether those networks overlap with the networks aimed at accessing resources, such as those uncovered in this study.
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