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Adapting livelihoods to floods and droughts in arid Kenya: Local perspectives and insights

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ABSTRACT

Adaptation of rural livelihoods to climate change hazards such as floods and droughts is critical. However, policy has focused on large scale adaptation policies that often ignore local knowledge. In this paper, we explore local perceptions and insights about viable livelihood adaptation strategies in arid Isiolo County, Kenya. Research included 270 household surveys and 6 focus group discussions in 7 communities. Results indicate that the three livelihoods that communities saw as being a viable option for themselves in the context of future climate change included camel keeping, business, and modern agriculture. Camels were cited as being resilient to drought. Business was seen as an option less impacted by floods and droughts than other livelihood options, and modern agriculture could improve food security and income. These local insights should be included in climate change adaptation policy in order to sustain, and even improve, the livelihoods of vulnerable communities in the future.

Key words: Adaptation, drought, flood, Kenya, livelihoods, policy

RÉSUMÉ

L'adaptation des moyens ruraux d'existence aux aléas du changement climatique comme les risques d'inondations et les sécheresses est critique. Toutefois, cette politique a porté sur l'adaptation à grande échelle de politiques qui ignorent souvent les connaissances locales. Dans ce document, nous explorons les perceptions locales et des éclaircissements sur le mode de subsistance viable des stratégies d'adaptation dans les zones arides à Isiolo, Kenya. La recherche a pris en compte 270 enquêtes auprès des ménages et 6 discussions de groupe dans sept localités. Les résultats indiquent que les trois moyens de subsistance que les collectivités percevaient comme étant une option viable pour eux-mêmes dans le contexte de futurs changements climatiques inclus, le maintien de chameau et l'agriculture moderne. Les chameaux ont été cités comme étant résistants à la sécheresse. Le commerce a été considéré comme une option moins touchée par les inondations et les sécheresses que d'autres moyens de subsistance, et l'agriculture moderne pourrait améliorer la sécurité alimentaire et les revenus. Ces aperçus locaux devraient être inclus dans la politique d'adaptation au changement climatique afin de maintenir et même d'améliorer les moyens de subsistance des communautés vulnérables dans l'avenir.

Mots clés : adaptation, sécheresse, inondation, Kenya, moyens de subsistance, politique

INTRODUCTION

Livelihood adaptation to climate change

Climate change is expected to cause an increase in natural hazards such as floods and drought (Blanco, 2006; Porter *et al.*, 2014). These impacts are often found to be more severe at the local scale where lives and livelihoods are affected (Shaw, 2006). For example, climate change is likely to cause or increase food insecurity (Porter *et al.*, 2014), livestock disease and death (Niang *et al.*, 2014), environmental degradation through unsustainable resource use, and

to negatively impact human health (Morton, 2007). Particularly, economically poor, natural resource-dependent rural households are likely to experience a disproportionate burden of these adverse impacts of climate change (Agrawal and Perrin 2008; Olsson *et al.*, 2014).

To cope and survive under the impacts of climate change, households, communities, and countries must adapt (Speranza, 2012). Adaptation refers to the process of adjusting to actual or expected climate

change and its impacts. Adaptation of natural resource-dependent livelihoods is particularly critical. Generally, livelihoods depend on access to natural, human, physical, social, and financial assets (Bebbington, 1999; Dahlquist *et al.*, 2007); and adaptation needs are highly diverse and context specific (Noble *et al.*, 2014). Therefore, adapting livelihoods to climate change at a small scale means households need to adjust their livelihood assets and activities to maintain the ability to make a living under the impacts of climate change.

Adaptive strategies to cope with change are nothing new. People have adapted their livelihoods to changing contexts in the past, are actively engaged in this presently, and will continue to adapt in the future (Matthews and Sydneysmith 2010). Livelihoods change and people adapt to disturbances and opportunities provided by many variables, climate change being one variable (Campbell and Olsson, 1991; Thomas and Twyman, 2005; Thomas *et al.*, 2007). Livelihood diversification has long been used by households in Africa to cope with climate shocks, and can also assist in building resilience for longer-term climate change by spreading risks (Niang *et al.*, 2014). However, because of the potentially severe impacts climate change is expected to have on food security (Brown and Funk 2008), agriculture (Verhot *et al.*, 2007), and livestock (Nardone *et al.*, 2010), it will continue to be especially important for poor, rural, natural resource-dependent communities to adapt their livelihoods to impacts such as floods and droughts in order to subsist.

Adaptation strategies do occur autonomously in households or communities, and can have positive impacts on poverty reduction and building resilience, particularly when supported by policy (Adger *et al.*, 2003; Urwin and Jordan 2008). Households undertake incremental adaptation where they extend or modify actions or behaviors that are already in place (Denton *et al.*, 2014). In this paper we explore local experiences and perspectives on future livelihood adaptation options in the face of floods and drought in rural, arid Isiolo County, Kenya. We ask, in the context of the climate change hazards floods and droughts, what do local residents see as the way forward for their own lives and livelihoods?

Isiolo County provides an excellent case study because it generally fits the description of a poor, rural, natural resource-dependent area (Acacia Consultants Ltd, 2011). Furthermore, this paper focuses on floods and droughts because in East Africa, droughts and precipitation variability are among the most important livelihood stressors (Misselhorn 2005; Paavola 2008). The region where this research took place is already experiencing climate change; the long rains have

declined more than 100 mm and there has been a warming of more than 1°C since the 1970s (Funk *et al.*, 2010). There are also issues of food insecurity in the county (Garrity *et al.*, 2010) as arid and semi-arid mixed crop-livestock systems in Kenya are projected to see reductions in maize and bean production by 2050 (Thornton *et al.*, 2010). Therefore, understanding local insights and perspectives on livelihood adaptation in Isiolo County is important for understanding potential livelihood adaptation options for the future.

Importance of local perceptions and insight

But why focus this paper on local perspectives of climate change adaptation when there is a large body of scientific literature on adaptation at larger scales already? There are two answers to this question we wish to address: 1. the importance of local knowledge and experience, and 2. the role local insights can play in policy and decision making.

To address the first point, local knowledge and experience are important because it is these people's livelihoods that are directly impacted by floods and droughts (Morton, 2007; Agrawal and Perrin, 2008; Gentle and Maraseni, 2012). Communities in some areas of the world are already reporting the effects of variation in climate and are now responding to these new conditions (Blanco, 2006). Through direct experience and learning, these communities may be capable of generating livelihood adaptations that could likely work for them (Gupta and Hisschemoller, 1997; Blanco, 2006). Through bottom-up learning-by-doing, communities generate their own locally-driven adaptation strategies in what is called community-based adaptation (Noble *et al.*, 2014). Communities are equipped with local knowledge and insights, and this should be considered important knowledge about viable livelihood adaptation options. As explained by Haraway (1988) there are a multiplicity of knowledges and viewpoints that exist (i.e. scientific, local, feminist, poor, etc.). Scientific knowledge is not the only valid type of information about climate change adaptation, and therefore it is important to also consider local knowledge and experience. Indeed, there is a need to bridge the gap between scientific and local knowledge in order to create interventions and policy capable of withstanding natural hazards like floods and droughts (Blanco, 2006).

Secondly, local insights can and should play a role in policy and decision making. However, in the climate change adaptation literature, there has been little focus on the community-based adaptations taking place and attempting to integrate those adaptation methods and experiences into the larger policy perspective (Shaw, 2006). Instead, macro-level adaptation policy is often disconnected with the needs of poor, rural

communities where local adaptation needs can exist independently from larger-scale policy and interventions (Amaru and Chhetri, 2013). Top-down decision making policy processes are often not adequate because of their potential inability to create viable solutions for local communities (Blanco, 2006). On the other hand, bottom-up research employs the experience and knowledge of community members to characterize adaptive strategies and decision making processes for livelihood adaptations in the future (Smit and Wandel, 2006). There is a need to identify desired and successful adaptation responses that can be scaled up into national, and even international policy frameworks (Blanco, 2006). Therefore, documenting local perspectives and insights as this paper aims to do can assist in the integration of adaptation policy at all scales and create solutions that work. As described by Agrawal and Perrin (2008), “adaptation is inherently local.”

RESEARCH APPROACH

Research purpose

The research presented in this paper was part of a larger livelihoods study conducted for the Partners for Resilience Project (PfR). PfR was a cooperative project undertaken by Dutch-based organizations including the Netherlands Red Cross, the Catholic Organization for Relief and Development Aid, Red Cross/Red Crescent Climate Centre, and Wetlands International; as well as Kenya-based partners the Kenya Red Cross Society, Merti Integrated Development Program, and the Wetlands International Kenya chapter. The overall aim of PfR was to increase the resilience of vulnerable communities in Isiolo County, Kenya while addressing disaster risks, the effects of climate change, and environmental degradation. PfR undertook this livelihoods study in order to better understand how livelihoods are being impacted by floods and droughts and how to build livelihood resilience against these risks in an environmentally-friendly way.

Study area

Isiolo County is located in the Upper Eastern Region of Kenya; bordering Marsabit, Wajir, Garissa, Tana River, Meru, Samburu, and Laikipia Counties. It covers approximately 25,000 km², and is divided into 10 administrative wards. According to the 2009 census it has an estimated population of 143,294 people (Kenya National Bureau of Statistics 2009). The Borana are the largest ethnic community but the county is also home to sizable Turkana, Samburu, Meru, and Somali communities. Most of the county is flat, low lying plain, but there are volcanic hills and the foothill slopes of Mount Kenya. Isiolo is hot and dry for most of the year, with a mean annual temperature of 29°C and has biannual rains in October – November and March –

May (Republic of Kenya 2013). The average rainfall ranges from 400 – 650 mm and is erratic and often unreliable (Republic of Kenya, 2013).

Data collection and analysis

The data presented in this paper comes from household surveys and focus group discussions that were conducted in 7 different communities around Isiolo County. These communities were selected by PfR staff members because of their diversity in livelihood practices and ecology. The communities included Burat, Basa, Bulesa, Merti, Kinna, Manyangalo, and Gotu.

Data collection was conducted between June 18th and July 9th, 2013. In total, 270 household surveys were conducted and 6 focus group discussions. The household surveys were created by Quandt and Kimathi with the assistance of the Kenya Red Cross Society – Isiolo Branch Office. Three practice interviews were conducted to ensure the quality of the survey. The household surveys were translated into English, Swahili, and Borana and the surveys were conducted in the language of the respondents’ preference. Surveys were conducted by local enumerators, and answers were recorded in either English or Swahili. Households were randomly selected by surveying one household, skipping two, surveying the next, and so forth. Female enumerators surveyed female household heads and male enumerators surveyed male household heads, with the goal of a 50/50 breakdown in gender. The survey was semi-structured and focused on understanding the respondents’ perspectives on livelihoods during times of flood and drought and what livelihoods they thought would thrive in the future with a changing climate. Household surveys were analyzed with Microsoft Excel. The household survey data was entered into Microsoft Excel, cleaned, and translated into English before analysis.

Additionally, six focus group discussions were conducted in Basa, Kinna, and Burat; one discussion with men and one with women in each community. The focus group discussions were organized by the community leadership and took place in the community government offices. Each focus group discussion had between 10 to 20 participations and took approximately 1.5 hours. The focus group discussion included participatory ranking of livelihood activities and how well each does in drought, flood, and high temperature. Notes were recorded during the discussions. The main purpose of the focus group discussions was to help triangulate the data from the household surveys and provide a more nuanced narrative of local perspectives on livelihoods and the impacts of climate change.

RESULTS

Livelihoods in Isiolo

This study found that livelihoods in Isiolo are largely natural resource dependent. Pastoralism was the most common livelihood (43% of respondents), followed by agriculture (29%). Surprisingly, 6% of respondents reported having no livelihood. Almost a quarter of households practiced a non-agro-pastoral livelihood, including casual labor, business, and charcoal burning.

Furthermore, food security is important in the face of climate change and therefore understanding where households obtain their food is critical to effective adaptation. The most common source of food for the households surveyed was the store (36% of respondents). Additionally, almost a fifth (17%) of households depended on food aid to feed themselves and 2% of households relied on other people (neighbors, friends, family) for food. Only 22% of respondents farmed their own food.

Adapting livelihoods for the future: local perspectives

Household survey respondents were asked what livelihood activities do well in times of drought, high temperatures, and floods (Figure 1). As seen in Figure 1, certain livelihoods were named relatively equally for all three scenarios (such as agriculture and casual labor), while others were named as being particularly well-suited to a specific hazard such as flood (i.e. livestock generally) or drought (i.e. camels). Some respondents (20 to 40) also stated that nothing does well during drought, high temperatures, or floods.

In summary, some livelihood activities were perceived to do better in drought, while others were perceived to do better during floods. But what about livelihood activities that locals perceived as being able to prosper,

or at least survive, during *both* drought and flood? This question was also asked to household survey respondents (Figure 2). Responses were similar to Figure 1, where livestock, and specific livestock species were included, but different from above was the perceived viability of business and modern farming methods. Modern farming refers to farming methods other than rain-fed agriculture and includes utilizing generators, pipes, water canals, greenhouses, tractors, irrigation ponds, etc.

Similar perspectives as illustrated in Figures 1 and 2 were noted during the focus group discussions; particularly the viability of modern types of agriculture and business under both drought and flood conditions. For example, in Kinna the men’s focus group talked about how businesses such as small stores can do well in drought because people do not have food so they have to buy it.



Figure 2: Respondent perspectives on which livelihoods and livelihood activities do well in BOTH floods and droughts, by percent of respondents (n = 270); Respondents could name more than one livelihoods

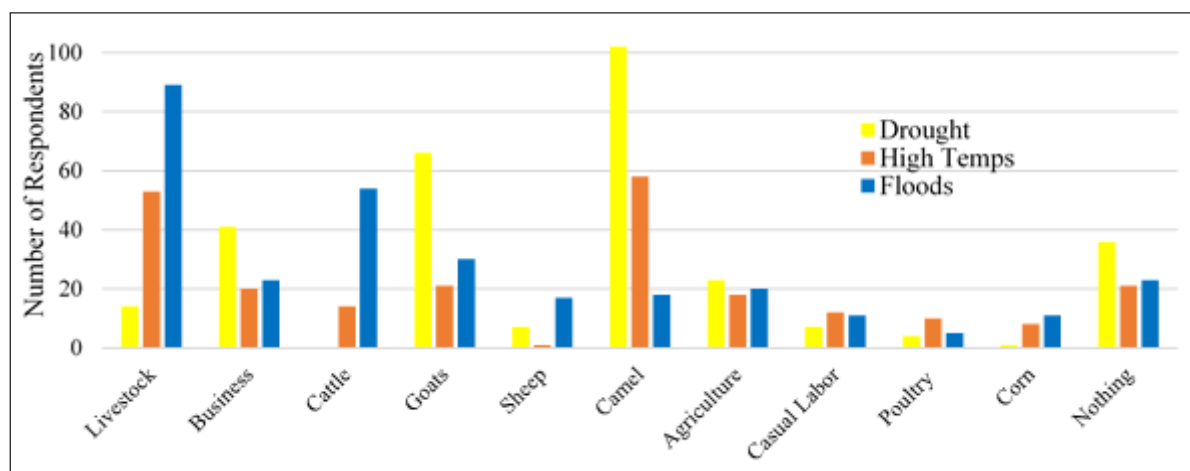


Figure 1: Respondent perspectives on major livelihoods and livelihood activities that do well in drought, high temperatures, and floods. Respondents (n=270) could name more than one livelihood that does well

In addition to understanding local perspectives of what livelihood activities *currently* do well in different conditions, it is important to explore how local residents perceive livelihoods in the future. With climate change-related risks in mind, what livelihood activities are perceived as being more sustainable and which are more desired in the future? Household survey participants were asked, given the impacts of climate change, what livelihood activities they would like to adopt in the future (Table 1) and what livelihood activities they would like to learn more about (Figure 3). These questions were meant to help guide PfR in understanding what types of livelihood improvement projects local populations might be interested in. As seen in Table 1, business was by far the livelihood most desired in the future under uncertain climate change related risks. This corroborates the results presented above as business being perceived as less vulnerable to floods and droughts. Agriculture was second on the list and also more specifically modern farming and large-scale farming. Figure 3 supports these findings in illustrating the desire of household survey respondents to learn more about business and agriculture in order to improve their livelihoods in the future. Lastly, household survey

Table 1: Livelihoods that respondents would like to adopt in the future

Major livelihoods	Number of respondents
Business	73
Agriculture	43
Camels	21
Livestock	15
Larger-scale farming	16
Goats	14
Cattle	14
Kiosk	7
Modern farming	6
Livestock business	6

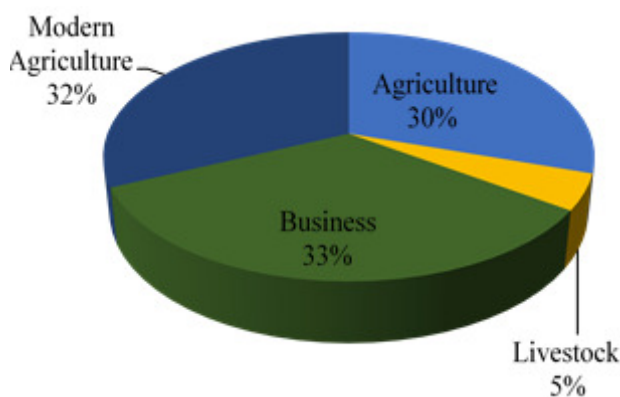


Figure 3: Types of activities that household survey respondents would like to learn more about, in percentage of respondents (n = 270)

respondents were asked specifically how PfR could support their livelihoods and the top four answers were all are related to business or farming.

The emphasis on ‘modern’ agriculture and business as desired future livelihoods perceived to be more resilient to climate change-related risks was also reflected in the focus group discussions. In Basa, the men stated that as they look ahead the most sustainable livelihood is farming and they want to learn more about farming. The women in Basa also stated a desire to learn more about farming because they are new to farming and want more skills to make them more successful. In Kinna, interest was shown by both focus group discussions for help with both capital for business and business capacity building. The men in Kinna stated an interest to learn about business and also practical skills to start their own businesses including construction, tailoring, driving, and mechanics. The women in Kinna wanted to combine their interests in business and agriculture to learn more about how to time their crops with the market when they could get the highest prices.

DISCUSSION

That data presented above illustrates local perspectives and insights into what respondents considered to be livelihoods that can cope with the impacts of climate change both under the present conditions and into the future. Livelihoods in Isiolo County are predominantly natural resource-based, which, according to Agrawal and Perrin (2008), means that these communities may be disproportionately impacted by floods and droughts because their livelihoods are highly dependent on rainfall and water availability for both farming (Gentle and Maraseni, 2012) and livestock keeping (Nardone *et al.*, 2010).

The fact that respondents perceive certain types of livestock herding such as camel keeping to be a viable livelihood adaptation option is not surprising due to the fact that pastoralism is the main livelihood in Isiolo County. However, the dominance of agriculture and business as adaptation strategies is unexpected given the arid, rural environment of the area.

Camel keeping to survive drought

Loss of livestock during prolonged droughts is a major risk given the impacts of drought on rangelands and water availability (Niang *et al.*, 2014). While livestock keeping in general was highlighted throughout the results, respondents perceived camel keeping as a viable livelihood adaptation strategy specifically in the context of drought (Figure 1). Livelihood adaptations that can survive drought are particularly important given the local context in Isiolo County, which falls into three agro-climatic zones, semi-arid (5% of the land), arid

(30%), and very arid (65%) (Mati *et al.*, 2010) and where rainfall has been decreasing since the 1970s (Funk, 2010).

The local perspective and insight of camel keeping as a viable livelihood adaptation in the context of drought is supported by scientific research. Camels have been documented to be uniquely adapted to hot and arid environments (Schwartz *et al.*, 1991; Khan and Iqbal, 2001; Farah *et al.*, 2004). East Africa already contains about 60% of the world's camels (Farah *et al.*, 2007) and for the Somali community in Isiolo camels already play an important role in their local economy (Farah *et al.*, 2004). Camels can also have an important contribution to food security and nutrition. Kenyan camels produce from 1,300 to 2,500 liters of milk over a lactation period of 9 to 18 months (Khan and Iqbal, 2001). This is a good supply of nutritious milk to the household, and in some pastoral communities camel milk contributes up to 30% of their annual caloric intake (Onono *et al.*, 2010). Nevertheless, because camel milk seldom enters into a formal marketing system, its contribution to the national economy is often underestimated and camel keeping has been given little attention in national development planning (Farah *et al.*, 2004). For example, in Kenya, the major livestock development effort between 1969 and 1982 which was aimed at developing range areas simply ignored the camel (Njiru, 1993). Thus, the combination of local insights from Isiolo County, scientific research, and a historic lack of priority in development planning mean that there is a great opportunity to expand upon and promote camel keeping as a viable livelihood adaptation to drought specifically.

Adapting through starting small businesses

Can starting a business be a viable livelihood adaptation to deal with floods and droughts? As results indicate, local residents in Isiolo County seem to think so. We found these results both surprising and eye-opening because we could not find any other studies reporting the idea that small business could be a viable livelihood adaptation for rural communities to the impacts of climate change. Therefore, while more research needs to be done on business as a potential climate change adaptation, it may warrant consideration in both adaptation interventions and policies.

Furthermore, this finding is significant because it shows a general shift away from livelihoods directly dependent on natural resources. Local residents might perceive business to be a viable livelihood adaptation option because it is somewhat removed from natural resources such as soil, water, and fodder, which can be seriously impacted by floods and droughts. However, it is important to note that most customers likely would still be relying on agriculture or livestock for their own

livelihood, linking business indirectly to natural resource-based livelihoods. If customers have less income due to livelihood destruction from floods or drought, they may have less money to spend at businesses. On the other hand, as suggested in the Kinna men's focus group, shops selling food and basic goods thrive in drought because people often have no choice but to buy their food. This is one area for future research because before promoting business as an adaptation strategy it is important to understand what are, most likely, complex relationships between small, rural businesses and the impacts of climate change.

Additionally, the term business is very broad and respondents were not clear during the household surveys about what specific types of businesses they see as being able to cope with climate change impacts in the future. Typical rural businesses in the area include a variety of activities such as small shops, sewing, selling used clothes, small tea shops, construction, and selling fruits and vegetables (either wholesale directly from the farms or at small kiosks). However, without more detailed information we cannot guess about which types of businesses the respondents were referring to. This is a second area for future research because understanding what types of businesses are perceived to be able to cope with climate change is important before creating adaptation interventions or policies.

Modern agriculture for food security

Agriculture, food security, and nutrition are all very sensitive to changes in rainfall (Porter *et al.*, 2014). A reliance on rain-fed agriculture in Africa's food production system makes it one of the most vulnerable to droughts and floods (Niang *et al.*, 2014). Respondents seem to recognize this vulnerability and in general thought very highly of modern agriculture, not rain-fed agriculture, as a viable livelihood adaptation option. Agriculture was named as one of the top livelihoods respondents want to adopt in the future, about 60% of respondents want to learn more about agriculture, and respondents named projects such as water for farming, farming inputs, and equipment for farming as ways that PFR can support their livelihoods. Even in areas of Isiolo County which are classified as 'very arid', such as Basa, the focus group discussed wanting to know more about agriculture because they are just starting to farm. To put it simply, these traditionally pastoralist communities are getting more involved in agriculture (and want help doing so).

This was an unanticipated finding given the prevalent scientific opinion that agriculture is the most vulnerable livelihood to the impacts of climate change (Smit and Skinner, 2002; Shaw, 2006; Howden *et al.*, 2007; Morten, 2007; Verchot *et al.*, 2007). Particularly, rain-

fed agriculture is susceptible to changes in water availability and households relying on rain-fed agriculture for their livelihoods could be seriously negatively impacted (Gentle and Maraseni, 2012). It appears that respondents have already reached the conclusion that rain-fed agriculture may not be a viable option in the future and that is why they specifically named what they consider ‘modern’ agriculture such as the use of machines, irrigation, farm inputs, and greenhouses as a desired livelihood adaptation. Effective adaptation of agriculture, as perceived by respondents to be ‘modern agriculture’ is critical in enhancing food security and providing sustainable livelihoods (Porter *et al.*, 2014).

Based on the local insights presented in this paper, adaptation policy and interventions should seriously look at how to adapt agriculture to climate change, particularly when considering the importance of food security. Schmidhuber and Tubiello (2007) project that between 5 million and 170 million additional people will be at risk of hunger by 2080 due to climate change. Godfray *et al.* (2010) predict that with current population growth, in addition to a growing middle class, the global demand for food will continue to increase for at least the next 40 years. There is a need to improve food security, and this provides a strong rationale for increasing the focus of climate change adaptation on agriculture (Howden *et al.*, 2007). While the data does not give specific reasons for why respondents want to adopt agriculture, the data on food security from this study is telling. A surprising 36% of respondents rely on stores for food, while 17% rely on food aid. Additionally, only approximately a quarter of respondents grow their own food. These facts suggest that the residents of Isiolo County may *already* be food insecure, and focusing on improving food security in the county is exceeding important, regardless of climate change impacts.

Therefore, a desire to learn about and adopt modern agriculture could reflect respondents’ desire to become more food secure and be able to rely on themselves to provide food for the household. Agricultural technological sophistication, as respondents perceive to be a viable livelihood adaptation, has been shown to determine a farm’s productivity more than its climate (Brown and Funk, 2008). Thus, a wider adoption of modern farming (i.e. more technologically sophisticated) may help improve the residents’ general well-being, and also buffer residents against the impacts of climate change. The livelihood adaptation of modern agriculture, despite its challenges, should be seen as a potential opportunity to attain food security in the food insecure Isiolo County through improved seeds, fertilizer, technologies, and irrigation (Brown and Funk, 2008).

Agriculture in the pastoralist-dominated Isiolo County also represents a livelihood diversification strategy where residents do not necessarily give up practicing pastoralism, but instead practice agriculture as an additional livelihood activity. Diversification of livelihoods in general is a widely recognized strategy for reducing risk and increasing well-being (Ellis, 2000; Ellis and Allison, 2005). The same holds true for climate change risks such as floods and droughts. More diversified farming systems have been documented to suffer less from shocks and maintain the household’s ability to adapt to changing conditions (Verchot *et al.*, 2007; Niang *et al.*, 2014). While there is also an inherent risk of floods destroying farms regardless of modern agricultural practices, the fact that respondents may still continue practicing livestock keeping, which is perceived as a strong livelihood during floods (Figure 1), may help the household cope. Therefore, both on-farm and general livelihood diversity may be important for reducing livelihood risks to flood and drought both currently and into the future.

Connecting local insights to policy

The main goal of this bottom-up research is to identify both desired and successful adaptation responses which can be scaled up into adaptation interventions and policy.

The three major insights (camel keeping, business, and modern agriculture) represent what the respondents perceived as viable livelihood adaptation options for their communities. It is important to integrate these regional-level perspectives into national and even international policy for effective integration of adaptation policy and frameworks at multiple scales (Smit and Wandel, 2006).

As stated by Amaru and Chhetri (2013), large scale adaptation policy can often be disconnected from the needs of poor, rural communities; but how can we connect these needs with policy without first understanding the needs and perspectives of local communities? While more research needs to be done, hopefully this paper can provide some insight into the perspectives and needs of local communities and begin to bridge the disconnect.

PfR itself has taken these findings and integrated them into their livelihood interventions, particularly focusing on modern agriculture by assisting with improved seeds, greenhouses, tree seedlings, and irrigation canals and pipes to some of these communities in Isiolo County. While PfR is a regional intervention focused on Isiolo County, this still illustrates how understanding specific communities can help create region-wide livelihood improvement interventions which aim to adapt livelihoods to be more resilient in the face of climate changes impacts including floods and droughts.

CONCLUSION

Adaptation needs are complex and context specific (Noble *et al.*, 2014). The aim of this paper was to provide specific examples of what local communities in Isiolo County perceive to be viable livelihood adaptation strategies in the context of the climate change hazards floods and droughts. By providing these examples, we hope to have shed some insight into what poor, rural, natural resource-dependent communities see as the way forward for their own livelihoods. Additionally, we hope to have highlighted the importance of integrating these local perspectives and insights into larger scale adaptation policy and interventions in order to sustain, and even improve, the livelihoods of vulnerable communities into the future.

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STATEMENT OF NO CONFLICT OF INTEREST

We the authors of this paper hereby declare that there are no competing interests in this publication.

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