Perceptions of the effects of floods and droughts on livelihoods: lessons from arid Kenya

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Abstract

Purpose – The purpose of this paper is to understand how people practicing natural resource-based livelihoods in arid Kenya perceive that their livelihoods are being affected by floods and droughts and how to integrate these local perceptions of impacts into larger-scale climate change adaptation initiatives and policy.

Design/methodology/approach – In Isiolo County, Kenya, 270 households were surveyed in seven communities, six focus group discussions were held and a document review was conducted.

Findings – The major livelihood practiced in Isiolo is pastoralism (71 per cent), but agriculture and non-agro-pastoral activities also play an important role, with 53 per cent of the respondents practicing more than one type of livelihood. In Isiolo, floods have a large impact on agriculture (193 respondents out of 270), while droughts impact both agriculture (104 respondents) and livestock (120 respondents), and more specifically, cattle-keeping (70 respondents).

Research limitations/implications – The research may have implications for the importance of using local perceptions of the effects of climate change on livelihoods for larger-scale interventions. It also provides a case study of local perceptions of the effects of floods and droughts on livelihoods in an arid area with natural resource-dependent livelihoods.

Practical implications – To understand local perceptions and use local perceptions for larger-scale adaptation interventions and policy.

Originality/value – This paper provides a specific example of a climate change adaptation initiative integrating local perceptions of the impacts of floods and droughts into livelihood-focused interventions.

Keywords Kenya, Governance, Livelihoods, Flood, Adaptation, Drought

Paper type Research paper

This research was conducted in Isiolo County, Kenya, as part of the PfR Project. The Partners for Resilience Project is a collaborative effort of several Dutch-based organizations including: The Netherlands Red Cross (NLRC), The Catholic Organization for Relief and Development Aid (Cordaid), CARE Netherlands, Red Cross/Red Crescent Climate Centre (RCCC) and Wetlands International (WI) and operating in nine countries (Kenya, Uganda, Ethiopia, Mali, Indonesia, Philippines, India, Nicaragua and Columbia). In Kenya, they are also partnered with the Kenya Red Cross Society, Merti Integrated Development Project and Waso River Users Empowerment Platform. The authors wish to thank all these organizations for their logistic and financial contributions to this research. The Partners for Resilience Project partners funded all aspects of the research in the field, while Quandt served as a Junior Researcher. In addition, the authors would like to thank all of the Kenya Red Cross Society volunteers who helped conduct surveys and the communities themselves for participating in this study. Lastly, the authors would like to thank three anonymous reviewers for their valuable comments.

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Introduction

Globally, floods and droughts impact rural livelihoods dependent on natural resources. For example, in times of drought, communities relying on natural resources may have their crops affected and their cattle may perish (UNDP, 2010). As the impacts of climate change continue to impact rural communities by threatening livelihoods, there is an immediate need to understand those impacts and implement climate change adaptation strategies at multiple scales, from the local to the global (Urwin and Jordan, 2008; Amaru and Chhetri, 2013). However, it has been acknowledged that integrating adaptation strategies, interventions and policies at various levels is difficult (Cannon, 2000; Van Aalst *et al.*, 2008; Ayers, 2011; Amaru and Chhetri, 2013). Macro-level adaptation policy and interventions can be disconnected with the needs of these marginalized, rural communities, where local adaptation needs may exist independently from larger-scale global or even national interventions and policies (Amaru and Chhetri, 2013). This has been called the global governance/local reality paradox and exists in many policy arenas, not just climate change adaptation. To address this paradox, not only is understanding how livelihoods are impacted by climate change important (Halder *et al.*, 2012), but more specifically what livelihoods are impacted by what types of disturbances at a local level to create appropriate adaptation policy and intervention at larger scales.

This paper provides a case study of how understanding the perceived effects of floods and droughts on livelihoods in seven communities in Kenya was a useful tool for creating larger-scale adaptation interventions at the county level for the Partners for Resilience (PfR) Project, a collaboration of Dutch-based organizations. Local perceptions are important because households in Kenya have been found to act on perceptions of environmental conditions, regardless of the trends indicated by scientific research (Rao *et al.*, 2011). There are two main objectives of this paper. The first is to better understand how floods and droughts affect rural, natural resource-dependent livelihoods by using Isiolo County, Kenya, as an example. The second objective is to better inform potential livelihood-related climate change adaptation strategies and policies in Kenya and inform how to integrate strategies at various scales. This paper can therefore play an important role in linking adaptation policy to local livelihoods by understanding how those livelihoods are being impacted by floods and droughts. Isiolo County, Kenya, serves as an excellent case study because of the projected impacts of climate change (Funk *et al.*, 2010), widespread food insecurity (Garrity *et al.*, 2010) and a predominately agro- and pastoral-based livelihood system (Acacia Consultants, 2011).

Impacts of floods and droughts on livelihoods

A livelihood consists of a household's assets, capabilities and activities required for a means of living (Dahlquist *et al.*, 2007). A household's livelihood may rely on one activity or be a diverse portfolio of assets, capabilities and activities, which, in combination, support the household. However, livelihoods dependent upon natural resources may be particularly vulnerable to climate change or weather-related events such as floods and droughts. Vulnerability to climate or weather-related events can be defined as "the extent to which a natural or social system is susceptible to, or unable to cope with, adverse effects of climate change, including variability and extremes" (Berry *et al.*, 2006). Poor and food-insecure people are often less resilient to such stresses and disasters, thus creating a cycle of vulnerability (Oluoko-Odingo, 2011).

Vulnerability to the impacts of climate change, such as floods and droughts, can seriously, and negatively, impact rural livelihoods. Climate change is projected to increase global temperature. This could affect the agricultural growing season, negatively impact human health, increase drought and increase precipitation variability (IPCC, 2007). In turn, this could have major impacts in areas where livelihoods are dependent on water availability for farming or livestock. Agriculture, in particular, is inherently sensitive to climatic conditions and is one of the most vulnerable livelihoods to the impacts of global climate change (Reilly, 1995; Smit and Skinner, 2002). Specifically, rain-fed agriculture is very susceptible to changes in water availability, and communities relying on rain-fed agriculture could lose their livelihoods (Gentle and Maraseni, 2012). On the other hand, floods can be just as problematic for natural resource-dependent livelihoods. For example, floods can destroy crops and cause both livestock and human disease, which in turn, can impact labor availability for livelihood activities (Armah *et al.*, 2010). Adapting to the impacts of climate change is therefore critical to reduce vulnerability to floods and droughts and maintain rural, natural resource-based livelihoods (Speranza, 2012).

Floods, droughts, and livelihoods in Kenya

Rural livelihoods in East Africa are often based around natural resources which serve as important household assets. In sub-Saharan Africa as well, agriculture remains one of the most vulnerable livelihoods to climate change because of potential declines in agricultural production which may negatively impact food security (Odingo, 1990; McCusker and Carr, 2006). In East Africa, droughts and precipitation variability, in general, are among the most important livelihood stressors (Misselhorn, 2005; Paavola, 2008). This is particularly true for communities who rely on rain-fed agriculture or pastoralism for their livelihoods. Such communities, many already struggling to cope effectively with the impacts of current climate variability, will face the challenging task of adapting to future climate change (Cooper *et al.*, 2008).

Climate models for Africa predict between a 3° and 4°C increase in Africa by the end of the twenty-first century, which is roughly 1.5 times the global mean increase (Bryan *et al.*, 2013). In Central Kenya specifically, the long rains have declined by more than 100 mm and there has been a warming of more than 1°C since the 1970s, thus leading to a decline in the amount of arable land (Funk *et al.*, 2010). Additionally, arid and semi-arid mixed crop-livestock systems are projected to see reductions in maize and bean production by 2050 (Thornton *et al.*, 2010). These types of climatic and food production changes caused by floods and droughts force natural resource-dependent communities to adapt. Policy interventions that aim to assist in this adaptation process may help vulnerable communities adapt more effectively. One specific example from Kenya is the 2011 drought that resulted in 3.75 million Kenyans and 500,000 refugees requiring food aid (Osano, 2012). This event led to the formation of the National Drought Management Authority to deal with such events in the future (Osano, 2012).

Adaptation interventions and the issue of scale

Climate change adaptation occurs at various levels: from farmers adapting farming practices to national and international policy. The UNDP (2009) specifically defines adaptation as "changing existing policies and practices and/or adopting new policies and practices so as to secure Millennium Development Goals in the face of climate change and its associated impacts". Adaptation encompasses dealing with change both in the policy arena and in individual action. Climate change therefore requires responses and policies at all

spatial scales (Urwin and Jordan, 2008). Local, national and international policy should be integrated and linked across scales (Björklund *et al.*, 2009). These different scales are linked and climate change policy and adaptation planning at one scale will play an important role in creating environments conductive for appropriate adaptation measures at lower scales and *vice versa* (Adger, 2001). Local response to climate is increasingly embedded in the global response (Rodima-Taylor, 2012). Therefore, understanding the impacts of climate change at a local scale is important for making adaptation policy and interventions at not only the local scale but also for the regional and national scales. This is highlighted by Thomas and Twyman (2005) who state that a key element for reducing vulnerability to the impacts of climate change is involving local communities in the decision-making and policy process.

Climate change adaptation has often been framed as a matter of international governance (Sarkar, 2011). Because of this, early approaches to adaptation took a top-down perspective (Van Aalst *et al.*, 2008). Since then, many observers have criticized globally uniform and top-down approaches to managing climate change risks, showing that such approaches have overlooked the contextual nature of risks, livelihoods and the factors that make people vulnerable to climate change (Cannon 2000; Ayers, 2011). This growing dissatisfaction with the top-down approach has led to the search for adaptation methods relevant at the local scale, and for ways to work from the bottom-up (Van Aalst *et al.*, 2008). Thus, documenting local communities' perceptions of climate change is important for policy-making because it reflects local concerns, focuses on the perceived impacts of climate change on livelihoods and suggests what adaptive measures should be taken (Berkes and Jolly, 2001; Alessa *et al.*, 2008; Halder *et al.* 2012). It is important to understand the local context of vulnerability to floods and droughts (Ayers, 2011). Thus, this paper aims to illustrate one case of an adaptation intervention project in Isiolo, Kenya, aiming to understand local perspectives of the impacts of floods and droughts on livelihoods, and how this might be integrated into interventions and policy at other scales.

Methods

Research motivations and purpose

This livelihoods survey was conducted for the PfR Project. PfR is an alliance of Dutch-based non-profit organizations, namely: The Netherlands Red Cross (NLRC), The Catholic Organization for Relief and Development Aid (Cordaid), CARE Netherlands, Red Cross/Red Crescent Climate Centre (RCCC) and Wetlands International (WI), and operates in nine countries, namely, Kenya, Uganda, Ethiopia, Mali, Indonesia, Philippines, India, Nicaragua and Colombia. In Kenya, PfR is implementing the Climate-Proof Disaster Risk Reduction (CPDRR) programme in Ewaso Nyiro North River basin through local partners, namely, Kenya Red Cross Society (KRCS), Merti Integrated Development Programme (MID-P) and Wetlands International Kenya chapter. The program aims at increasing resilience of vulnerable communities to increased disaster risks, the effects of climate change and environmental degradation. The translation of their intervention strategy into practice is characterized by an innovative integration of three approaches: disaster risk reduction (DRR), climate change adaptation (CCA) and ecosystem management and restoration (EMR).

PfR aims to take a "livelihood" approach at the community level, and encourage people to diversify and strengthen their livelihoods to reduce the risk of disaster, adapt to climate variability and change and manage/restore their ecosystems. Therefore, PfR Kenya wished to carry out this survey to assess how livelihoods in Isiolo County, Kenya were being impacted by floods and droughts, and understand the possible options that could be best promoted and encouraged by the program. Using the perspectives of the communities, the assessment aimed to identify livelihood options that are both climate-smart and ecosystem-

friendly that could be implemented and/or encouraged in the project areas by the PfR partners and implementing organizations. This study serves as an excellent case for examining the objectives of this paper because the study aims to understand local livelihoods and then use that information to promote climate change adaptation strategies.

Study area

Isiolo County is located in the Upper Eastern region covering approximately 25,000 km^2 and has an estimated population of 143,294 persons according to Kenya National Bureau of Statistics census (KNBS, 2009). Isiolo County borders Marsabit County to the north, Wajir and Garissa Counties to the east, Tana River and Meru Counties to the south and Samburu and Laikipia Counties to the west. Isiolo contains three sub-counties, namely, Isiolo, Merti and Garbatulla. It is further sub-divided into ten administrative wards, namely, Oldonyiro, Ngaremara, Isiolo East, Bulapesa, Burat, Kinna, Garbatula, Sericho, Chari and Cherab. Most of the county is a flat, low-lying plain. To the west are the volcanic hills and foothill slopes of Mount Kenya and Nyambene Hills. There are four perennial rivers in the county, including Ewaso Nyiro which originates from Mt. Kenya and the Aberdare Range, and Kinna and Bisanadi which originate from the Nyambene Hills. Isiolo County is hot and dry for most of the year. It has two rainy seasons: long rains in October and November and short rains which fall between March and May. The average rainfall ranges from 400 to 650 mm and is erratic and unreliable (Republic of Kenya, 2013). High temperatures are recorded in the County throughout the year, with a mean annual temperature of 29°C (Republic of Kenya, 2013). Borana are the most populated ethnic community, with Turkana, Meru, Samburu and Somali also present.

Data collection

The livelihoods assessment used a mixed-methods approach that included document review, field observations and notes, household surveys and focus group discussions. This study took place in seven different communities in Isiolo County (Figure 1). The communities included in this study were selected based on different, locally classified, environment types as follows:

- *Riverine* – Gotu, Manyangalo, Burat;
- *Town* – Merti, Kinna;
- *Charri* – Bulesa; and
- *Cherap* – Basa.

Document review took place between May 23 and June 3, 2013. The document review was accompanied by visits to government and organization offices in Nairobi and Nanyuki. These offices supplied electronic and hard copies of documents based on their past work. Offices visited include the National Drought Management Authority in Nairobi, the Ministry of Northern Kenya ASAL Secretariat in Nairobi, Cordaid, Kenya Red Cross Society Headquarters, Water River Management Authority in Nanyuki and the National Drought Management Authority in Nanyuki.

Surveys and focus groups were conducted between June 18 and July 9, 2013. Overall, 270 household surveys were collected along with six focus group discussions. The household surveys were carried out by enumerators in English, Swahili or Borana based on the respondents' preference, and answers were recorded in English or Swahili. The focus group discussions were moderated by Quandt with assistance in translation from Borana to English/Swahili for four of the six focus group discussions. The other two focus group discussions were conducted in Swahili.

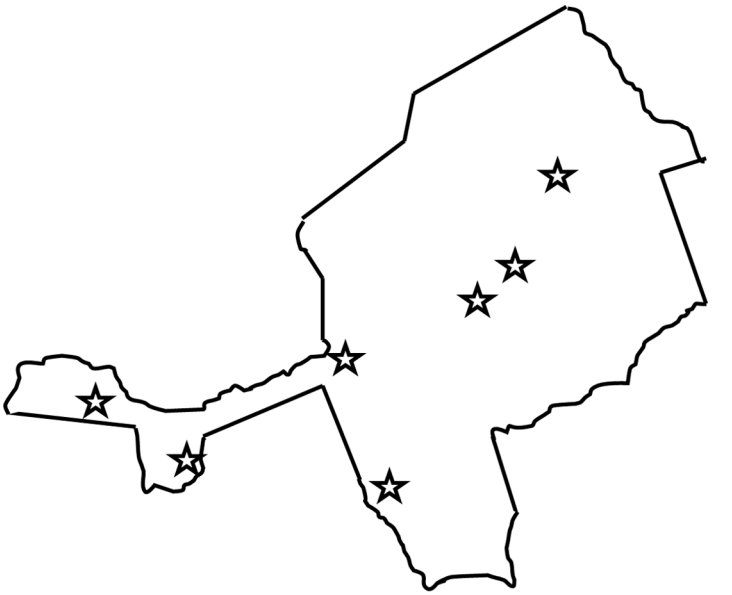

Figure 1.
Map of Isiolo County and the starred research sites

The household survey was created by Quandt and Kimathi with assistance from the Kenya Red Cross Society – Isiolo Branch Office. Before conducting the household surveys, the enumerators were given a training manual and an hour-long training with Quandt and Kimathi. Male enumerators surveyed males, while female enumerators surveyed females. Enumerators selected households randomly by surveying one household, skipping two, surveying the next, and so forth. A summary of the household surveys is provided in Table I.

The survey was semi-structured and open-ended. It included information about household livelihoods, sources of income, food security and demographic information. Household livelihood classification were grouped into pastoral (livestock keeping), agricultural (farming), agro-pastoral (both livestock-keeping and farming) and non-agro-pastoral (neither livestock-keeping nor farming). The meaning of words such as "flood" and "drought" were intentionally left open to interpretation by the respondent. This was done

Community	# Surveys	# Male respondents	# Female respondents
Basa	30	10	20
Bulesa	30	11	19
Merti	73	29	43
Gotu	15	8	7
Kinna	41	18	23
Burat	40	18	22
Manyangalo	41	21	20
Total	270	115	154

Table I.
Summary of household surveys

*__Note:__ For some surveys, the gender was not recorded by the enumerator and thus the total number of surveys is higher than that in the male and female respondent categories

because the impacts of climate change are felt at an individual level and this survey aimed to capture perceptions of individual respondents. Additionally, we did not want to constrain the respondents to a particular, scientific definition of flood or drought. The open-ended nature of this survey allowed the respondents to answer each question without being constrained by having to select from a range of answers, which makes it different from many quantitative surveys. The survey was not meant to be a representative sample of the seven communities. Instead, the goal was to capture a wide, diverse range of thoughts and opinions through more qualitative, anthropological techniques. Randomly selecting households to survey helped ensure that a diversity of responses was captured, as well as nuances. Nuance is important when trying to understand human experiences because every household may have different experiences and nuance is about showing that things are "not always true or not true" (Rubin and Rubin, 2005).

Overall, six focus group discussions were conducted in Basa, Kinna and Burat. In each of these three communities, one women's focus group and one men's focus group discussion were conducted. The focus group discussions were organized by the community leadership and took place in community government offices. Each focus group discussion had between 10 and 20 participants and lasted from 1.5 to 2 h.

Data analysis

Data were analyzed using Microsoft Excel and STATA 13. Both the household survey and focus group data were entered into Microsoft Excel, cleaned and translated into English, where needed. Statistical analysis was conducted using the same software. Participant observation and field notes were left in their original form and used to add depth to the survey and focus group data. The various sources of data (household survey, document review, focus group discussions and field notes) were used to help increase the general understanding of the research objectives through iterative triangulation. Iterative triangulation is a theory development process that takes place by using evidence, existing scholarly literature and intuition to compare and contrast emerging constructs, ideas and theories (Lewis, 1998).

Results

Livelihoods practiced

Figure 2 illustrates the livelihoods practiced by respondents from the household survey in all seven communities surveyed in Isiolo County, Kenya. Livelihoods were grouped into

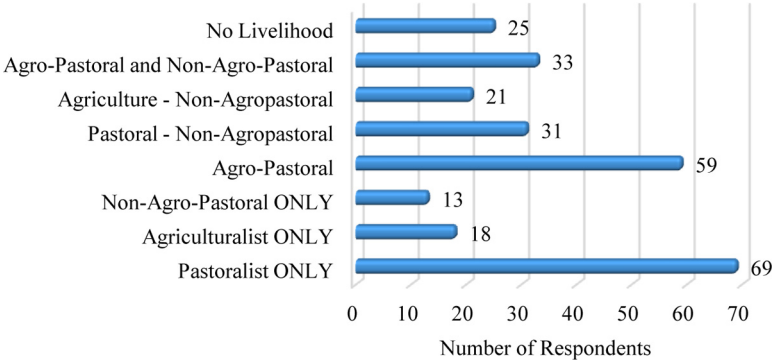

Figure 2.
Livelihood types practiced in Isiolo County, Kenya ($n = 270$)

three categories: agriculture, pastoralism and non-agro-pastoral livelihoods, as explained above. These categories are not mutually exclusive, and about half (53 per cent) of the households practice more than one livelihood and 33 respondents (12.2 per cent) practice all three livelihood categories. About half (132) of the respondents practice agriculture, while 71 per cent (192 respondents) practice livestock-keeping. It is important to note that 25 respondents (9.25 per cent) reported having no livelihood activities. This could be related to the fact that 52 respondents (19.3 per cent) said that their main source of food is food relief/food aid. Additionally, respondents were asked what the major source of income was for their household. The top three answers were livestock sales (80 respondents), selling crops (65 respondents) and casual labor (56 respondents).

During the focus group discussions, participants were asked to list all the livelihoods practiced in their communities. Along with pastoralism and agriculture, groups named many non-agro-pastoral activities including: temporary paid labor, selling firewood and charcoal, working as a tailor, cooking, washing clothes, owning small stores, being maids, selling used clothes, construction, repairing shoes, driving and fetching water. The household survey results support these results and the top three non-agro-pastoral livelihoods named by respondents were casual labor (50 respondents), business (29) and charcoal making (17). These responses show the wide variety of livelihood activities outside of natural resource-based livelihood activities.

Impacts of floods

Floods and droughts have different perceived effects on livelihoods, as presented in Figure 3. According to survey respondents, agriculture was perceived to be affected by floods more than livestock, and 192 respondents said that floods impact agriculture. The focus group interviews provide a more nuanced understanding of the impacts of flood, and the women in Kinna stated that their "farms are swept away and the farmers lose morale, the plants are swept away."

Livestock was also perceived to be affected by flood and the male focus group in Kinna mentioned that goats in particular suffer during floods because their "hooves are hurt and diseased during flood." While livestock can be swept away in floods, livestock disease may be a bigger problem caused by floods, as suggested in the quote above. Lastly, many of the

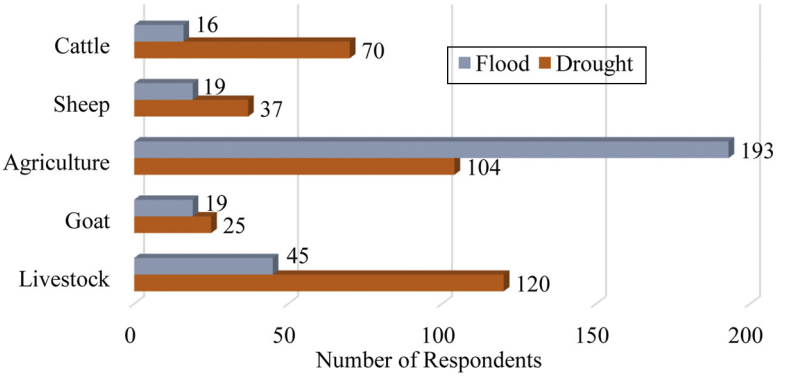

Figure 3.
Main livelihoods that were named by respondents as being impacted by floods (blue) and droughts (red)

Note: The number of respondents who gave each response is illustrated

focus groups discussed how flood indirectly impacts their livelihoods by creating poor or impassable road conditions (Table II). This impacts their ability to access markets both to buy and sell agricultural crops and livestock.

Impacts of droughts

Figure 3 illustrates that the most named livelihood activities perceived to be affected by drought were livestock, agriculture and cattle specifically. Cattle were mentioned by the most respondents (70) as being vulnerable to drought, compared to goats (25 respondents) and sheep (37 respondents). Livestock-keeping, in general, can be negatively impacted, and this is particularly important because livestock-keeping was the main livelihood in the area (71 per cent of respondents). The Kinna women's focus group told the story of how "in 2009 there was a severe drought and one person who had 800 cattle lost all but 50 of them." The Kinna men supported what the women said by stating "we used to have a lot of cows, but recently there have been problems and we don't have a plan, we lose all our wealth."

Agriculture was named by 104 respondents as being impacted by drought, and many respondents during both the focus group interviews and household surveys said that crops dry up and access to water is difficult during droughts. Additionally, some respondents seem to be transitioning from livestock-keeping to agriculture to support themselves and the Basa men's focus group went as far to say that "if you look ahead the most sustainable livelihood is farming."

The focus groups had mixed responses about the impact of drought on non-agro-pastoral livelihoods such as business. The Kinna men's focus group stated that "during drought there is no money, so business goes down." However, other respondents said that "during drought business is good because people have no food so they must buy it at stores."

Discussion

There were two main objectives of this paper: to better understand how floods and droughts effect livelihoods, using Isiolo County, Kenya, as an example, and to better inform potential livelihood-related climate change adaptation strategies and policies in Kenya how to integrate strategies at various scales. This section will explore these main objectives.

The effects of floods and droughts on livelihoods

The first step in understanding how livelihoods were perceived to be affected by floods and droughts is to understand what livelihoods are being practiced and are important to people in the area. The results for Isiolo County demonstrate that most respondents practiced one or more of the three livelihood strategy categories: pastoralism, agriculture and non-agro-pastoral livelihoods. From Figure 2, the two most practiced livelihood strategies are pastoralism and agro-pastoralism. Isiolo is predominantly made up of traditional pastoralist

Focus group	Comment
Basa Women	"floods block the roads"
	"roads are bad"
Kinna Women	"the stores suffer because the bad roads prevent transport"
Kinna Men	"no business if it rains"
	"no cars can get here during floods"
Burat Women	"floods can break the bridge"

Table II.
Focus group comments on floods and infrastructure

groups such as the Borana, Somali, Samburu and Turkana, and thus, it is reasonable to expect pastoralism to be the major livelihood. The second major livelihood strategy was agro-pastoralism, and this is indicative of a recent switch to agriculture in the area. It has been noted (Acacia Consultants, 2011) that some households may be adopting agriculture, on top of pastoralism, as a coping mechanism to deal with the impacts of climate change. Additionally, the spread of agricultural technologies, such as greenhouses and generator-powered water pumps, have made small-scale farming increasingly possible in this arid landscape (personal observation).

As seen in the results, many households in Isiolo County, Kenya, have diversified livelihoods. Livelihood diversification involves the "creation of a portfolio of farming and non-farming livelihoods" (Paavola, 2008). Generally, diversification is becoming an increasingly utilized strategy of rural livelihood systems in both developed and developing countries globally, as documented in the literature (Reardon, 1997; Ellis, 2000; Barrett *et al.*, 2001; Niehof, 2004; Rodima-Taylor, 2012). More specifically, studies have found that the traditionally pastoral Maasai (McCabe, 2003; McCabe *et al.*, 2010) and Kuria (Rodima-Taylor, 2012) ethnicities in Tanzania have been diversifying their livelihood strategies for decades to deal with climate change, increased population and a modernization trend towards a monetary economy. This appears to be consistent with what is occurring in Isiolo, where traditionally pastoral groups are now engaging in both agriculture and non-agro-pastoral livelihoods such as business and paid labor.

The data presented in this paper illustrate the nuanced nature of the perceptions of various impacts of climate change for different livelihoods, particularly agriculture. Overwhelmingly, floods were perceived to be the most destructive to agriculture. This is important because floods could then have a big impact on food security if farms and crops are destroyed in floods. Food security is a serious issue in this already fairly food-insecure area because almost 20 per cent of respondents said that food relief was their main source of household food.

However, agriculture was also named by 104 respondents as being impacted by drought. This makes agriculture a complex, nuanced challenge for adaptation policy and interventions because it was perceived as being seriously impacted in Isiolo County by both floods and droughts. Despite this, many respondents stated that agriculture was a more desirable and sustainable livelihood in the future. However, this only further complicates adaptation to agriculture because it is a desired livelihood, but also perceived as being vulnerable to floods and droughts. This has been documented elsewhere more broadly, and agriculture remains one of the most vulnerable economic sectors in Africa to climate change (McCusker and Carr, 2006). Additionally, the impacts of floods and drought on agriculture may be context-specific and dependent on local ecology, access to water sources, dependence on rain-fed agriculture and technological skills.

Drought was perceived as being overall the most harmful for livestock, and cattle specifically. While goats and sheep were also perceived as being impacted by drought, cattle far outweighed them, with 70 respondents naming cattle specifically. Cattle are, at least traditionally, the most important livelihood practiced by Borana (Rufael *et al.*, 2008) and the perceived severe impact of drought on cattle in Isiolo County is important.

In addition to the direct impacts that floods and drought have on natural resource-based livelihoods, other indirect impacts were discussed. One of the most important was the conditions of the roads which these communities rely on to reach larger markets to sell both their livestock and farm produce. According to the focus groups, these roads are made worse and sometimes are impassable during times of floods. This impacts their livelihoods because stores can no longer obtain merchandise, and it is difficult to access markets to

either buy or sell goods. This means that all three livelihood categories are impacted by a lack of access to markets during floods. Farmers have nowhere to sell their produce, pastoralists cannot sell their livestock and businesses are unable to restock supplies.

Recommendations to better inform adaptation at multiple scales

The second objective of this paper was to provide recommendations for policymakers and climate change adaptation managers in Kenya specifically, while providing an example of how to integrate adaptation at multiple scales. Documenting local communities' perceptions of the effects of climate change on livelihoods, as done in this study, is important to policy and intervention because perceptions reflect local concerns and focus on the impacts of climate change on people's livelihoods (Halder *et al.*, 2012). This, in turn, influences their decisions to act, and suggests what types of adaptation interventions should be undertaken (Berkes and Jolly, 2001; Alessa *et al.*, 2008; Halder *et al.*, 2012). The study was conducted specifically for the PfR Project, but there are four major recommendations that may also go beyond the scope of the project.

First, local livelihood diversity should be taken into account even at larger scales of adaptation interventions and policy. The diversification of livelihoods in Isiolo County may represent an already existing coping mechanism and adaptation strategy to deal with socio-economic and/or environmental change including floods and droughts. The diversity of livelihoods is an important part of rural economies and survival, as documented in this study, but it is often overlooked in the policy community (Ellis, 1999). Failure to acknowledge livelihood diversity may hinder the effectiveness of any intervention or policy because climate change adaptation can only be understood in context, and the context of Isiolo County is one of increased livelihood diversity (Adger *et al.*, 2009).

Second, the perceived threat of both flood and drought on agricultural livelihoods is a serious problem that climate change adaptation interventions and policy need to address. To sustain agriculture and improve food security, both the impacts of floods and droughts must be dealt with at all levels, from the individual farm to the regional farming networks. Adaptation policies aimed at agriculture need to consider the food security of individual farmers but also the entire region during floods or droughts. All of these factors make agriculture both complex and important for adaptation interventions and policy.

Third, adaptation policy and interventions should acknowledge the risk of drought on cattle in marginalized communities. Cattle are still an important livelihood in Isiolo County, and a major drought could have a serious negative impact on cattle-dependent households. A focus for adaptation policy should include ensuring access to water and pasture for all households. This requires a larger-scale approach in landscape management and would need the cooperation of the government, livestock organizations and communities. While this is easier said than done, it is a way to integrate local perspectives of the effects of drought into larger-scale climate change adaptation policies.

And lastly, there should be a focus on critical infrastructure development such as roads, bridges and overall transportation networks. In Isiolo County, Kenya, infrastructure was perceived to be seriously affected by floods. When roads are no longer passable, all livelihoods in Isiolo County, Kenya, suffered. However, developing flood-resistant infrastructure is a local perceived effect of floods that is easier to address at larger scales of climate change adaptation policy. Indeed, infrastructure may be easier to deal with at larger scales, as road maintenance and construction often fall under the jurisdiction of a larger-scale authority, not individual households or even communities.

Conclusions

The discussion sections in this paper address the two major objectives of this paper by illustrating first the local perceptions of the effects of climate change in Isiolo County, Kenya, and then providing four recommendations that should be considered in climate change adaptation policies at a multitude of scales. This second objective helps address the problem of integrating adaptation policies at different scales.

The problem of connecting local perceptions of climate change with larger-scale policy has been called the global governance/local reality paradox. While not operating on the global scale, the PfR project undertook this livelihood survey for the purpose of planning livelihood-based adaptation interventions at the county level in Isiolo based on communities' perceptions of the effects of drought and flood. By sampling seven diverse communities across the county, PfR was able to make recommendations and plan for adaptation interventions throughout their project sites in Isiolo County. The process described here illustrates how climate change adaptation interventions and policy could be scaled-up using local perceptions. This paper provides one case study of an attempt to integrate adaptation interventions from the local perceptions to a broader county-wide context. However more research needs to be done to effectively connect macro-level adaptation policy with the context-specific needs of marginalized communities (Amaru and Chhetri, 2013).

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