Received 17 March 2015
Revised 21 August 2015
8 September 2015
Accepted 11 September 2015

Anticipatory adaptation and the role of decadal climate information in rural African livelihood systems

Lessons from the Mid-Zambezi Valley, Zimbabwe

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Abstract

Purpose – This study aims to explore the utility of anticipatory adaptation to climate variability and related livelihood sensitivities in rural African contexts using the case of Mbire district situated in the mid-Zambezi valley region of Zimbabwe. The provision of decadal climate information (up to ten years), as part of an anticipatory adaptation package, is at the centre of analysis.

Design/methodology/approach – The study used semi-structured and key informant interviews, with a total of 45 semi-structured interviews being conducted with randomly selected long-term communal farmers in the case study area. Whilst data from semi-structured interviews was arranged in Microsoft Excel, thematic analysis was used in analyzing all data.

Findings – Anticipatory adaptation and decadal climate projections are shown to potentially enhance flexibility in adaptation planning *vis- à-vis* responding to climate variability and other challenges, as well as reduce chances of maladaptation in responding to climate challenges in the context of multiple and reinforcing stresses and shocks.

Originality/value – Anticipatory adaptation, with its three main pillars of future analysis, flexibility of strategies and proactive action, is emerging as key in assisting adaptation planning, the harnessing of opportunities and decision-making *vis- à-vis* responding to climate uncertainties and related livelihood sensitivities. Yet there have not been much empirically grounded analyses in understanding the role of anticipatory adaptation in rural Africa. This study therefore adds to evidence-based analyses towards understanding the role and utility of anticipatory adaptation in local communities in Africa.

Keywords Anticipatory adaptation, Decadal climate information, Livelihoods, Rural farming systems

Paper type Research paper

Research for this article was part of work on the project "Emerging Climate Risks, Agriculture and Food Security" funded by the CGIAR programme on Climate Change, Agriculture and Food Security (CCAFS). The authors would like to thank the funders, and all team members of this CCAFS project at the African Climate and Development Initiative, University of Cape Town, who helped with suggestions on refining research tools and conducting the fieldwork as well as commenting on results.

International Journal of Climate Change Strategies and Management
Vol. 8 No. 2, 2016
pp. 236-252

1756-8692
DOI 10.1108/IJCCSM-03-2015-0029

1. Introduction

The climate adaptation discourse has predominantly focused on the reactive aspects and less on the proactive anticipatory aspects of responding to change and uncertainty. Anticipatory adaptation is adaptation which takes place before the impacts of climate change are observed (IPCC, 2007). It involves exploring probable futures and how these futures can be rendered actionable through planned, methodical and strategic approaches *vis-à-vis* responding to multiple stresses at a defined scale. Whilst there is an expanding body of work around anticipatory logics with respect to climate adaptation in recent years (Anderson, 2010; Tschakert and Dietrich, 2010; Boyle and Dowlatabadi, 2011; Serrao-Neumann *et al.*, 2013; Kuruppu and Willie, 2014), much of this work remains theoretical and has not been adequately supported by empirical research, particularly in the case of Africa. There has been an apparent lack of explicitly practical engagement with questions on how the future particularly relates to the past and the present in different contexts. The danger with respect to this position is that it triggers continued assumption about linear temporality – "specifically that the future is a blank (slate) separate from the present, or that the future is a telos towards which the present is heading" (Anderson, 2010, p. 2). Most importantly, this has had implications on understanding and demonstrating how adaptation functions as a process and the wider implications of that process to vulnerability and resilience (Tschakert and Dietrich, 2010).

There is, therefore, need to place adaptation at the interface of the past, the present and the future for improved responses to and engagement with climate variability and related risks. Drawing on results from a fieldwork study undertaken in the mid-Zambezi Valley area of Mbire district in northern Zimbabwe, this paper explores the utility of an anticipatory focus to adaptation planning in a rural context characterised by multiple and reinforcing vulnerability factors. In essence, the provision of decadal climate information (which alludes to medium-term climate projections – longer than seasonal but shorter than climate change) – is at the centre of analysis. Anticipatory adaptation is envisaged as residing and flourishing at the intersection of two main factors:

(1) the envisioning of plausible future challenges and opportunities (in light of past and present vulnerabilities and adaptive capacities); and

(2) the presence and use of effective climate information channels assisting in people's awareness of present and future climate and related livelihood fluctuations and, ultimately, timely decision-making for the future.

As already alluded to, this is because anticipatory adaptation requires a degree of foreknowledge of future climate dynamics and how they are likely to manifest, whilst also recognising that there are challenges and uncertainties associated with predicting impacts and adaptations through time (Boyle and Dowlatabadi, 2011). The two stated factors, therefore, form the main link in understanding the role and importance of anticipatory logics *vis-à-vis* adaptation and adaptation planning in the case study area and, subsequently, in similar rural African contexts. In the following sections, we, first, briefly discuss what decadal climate information consists of, making the case for its use in rural African livelihood systems – as it is at the centre of the utility of anticipatory adaptation in this paper. This is followed by an outline of the specific aim and research questions around which the paper is developed and a discussion of the methodology used as well as contextual information on the case study area. Results from the

fieldwork exercise are then presented followed by a discussion and analysis of the results and finally the conclusion.

2. Decadal climate information

Decadal climate prediction is a relatively new endeavour in climate science, focusing on time-evolving regional climate conditions running ten years into the future (IPCC, 2014). It includes both rainfall and temperature information and lies between seasonal/interannual forecasting and longer-term climate change projections (Meehl *et al.*, 2009). In predicting climatic dynamics on this time-scale, decadal climate information takes into account both natural variability and human influences, and this is achieved by initialising climate models with observation of the current climate state, in addition to specifying changes in radiative forcing because of greenhouse gases, aerosols (both volcanic and man-made) and solar variability (UK Met Office, 2015). Decadal climate predictions are currently highly experimental (Goddard *et al.*, 2012; Mehta *et al.*, 2011) and, therefore, have not been effectively introduced and used in particular African agricultural and livelihood systems. This paper is, in fact, a product of a (2012-2015) Climate Change, Agriculture and Food Security project exploring the potential of decadal climate information in selected African agricultural and livelihood systems (see Acknowledgements). Climate predictions at annual-to-decadal time horizons are projected to potentially advance progress in narrowing the uncertainty in, for example hydrological predictions for water resources management, natural hazard mitigation and related decision-making and policy guidance (Vera *et al.*, 2010).

Decadal climate information potentially leads to a better understanding and quantification of the role of longer-term variability in year-to-year impacts, and such understanding can be valuable to resource management in the face of longer-term expectations and planning, particularly in instances where the decadal scale variations of the background climate modify the risk of exceeding certain climate thresholds or the frequency of extremes (Goddard *et al.*, 2012). Decadal climate information inherently deals with climate variability at multiple time scales (e.g. at one-, five- and ten-year time scales). Therefore, to the degree that climate uncertainty adversely impacts livelihoods as well as agricultural planning and decision-making processes that farmers are involved in across temporal scales, decadal climate information has the potential to improve livelihoods. This through enabling farmers to adopt improved technology, intensify production, replenish soil nutrients and invest in more profitable enterprises in years when conditions are (or are projected to be) favourable or near average, and to more effectively protect their families and farms against the long-term consequences of adverse extremes (Hansen *et al.*, 2007).

3. Aim and research questions

As noted in the introduction, the study specifically aimed at understanding the utility of anticipatory adaptation in African farming and livelihood systems using the case of Mbire district in northern Zimbabwe, with a particular focus on the role of decadal climate information in people's strategic decision-making. Pursuant to this main aim, the following three research questions were addressed:

RQ1. What is the current role of an anticipatory focus in responding to climate variability and other challenges in the study area?

RQ2. What are the main sources of climate information in the area and how effective are they?

RQ3. How important would be decadal climate information as part of anticipatory adaptation planning in building resilient local farming and livelihood systems?

4. Methodology and study site

4.1 Methods

Fieldwork for this study was undertaken in the period October-November 2013. The study used semi-structured and key informant interviews in collecting data. A total of 45 semi-structured interviews were conducted with randomly selected communal farmers in the area. Key informant interviews were carried out with local agricultural extension (Agritex) officers, local (cotton) input providers and the district council's chief executive officer. Both the semi-structured interview guide (for community members) and key informant interviews included questions around: (the combination of) stresses and shocks that people in the area are most susceptible to; the predictability of weather over the years; how people have responded to climate risks and other challenges; tentative future plans and envisaged opportunities given worst and best climate scenarios; networks and communication of climate information in the area; and people's perceptions on the relevance and utility of medium-term (five to ten year) climate projections in as far as their livelihoods are concerned. Whilst data from semi-structured interviews was arranged in Microsoft Excel, thematic analysis was used in analysing all data.

4.2 Study site

The mid-Zambezi Valley is part of the Zimbabwean lowveld and it particularly refers to lands lying north of the Zambezi escarpment bordered by Mozambique to the north and east, and Zambia to the north-west (Mupangwa *et al.*, 2006). It consists of an extensive undulating plain averaging 450-m above sea level, descending to 350-m above sea level to the north towards the Zambezi River (Pwiti, 1996). Mbire district forms the major part of the low-lying mid-Zambezi Valley in Zimbabwe's Mashonaland Central Province, and it is a semi-arid remote area listed in the country's agro-ecological zones IV and V specifically located 30° 25" E and 16 ° 30"S, and encompassing an area of 2,700 square kilometres (Osborne and Parker, 2002). It is bordered by Mozambique to the north, Zambia to the north-west, Mashonaland West district to the west, Guruve district to the south and Muzarabani district to the east and has 17 wards/local administrative geographical boundaries (Figure 1). It is characterised by temperatures of up to 40°C in summer and low, increasingly irregular rainfalls averaging 450-650-mm annually. There are two clearly defined seasons in the area – a rainy season from December to March and a long dry season from April to November (Baudron *et al.*, 2011).

4.2.1 Sources of livelihoods. The main sources of livelihoods in Mbire revolve around agricultural activities, particularly crop production and livestock production. There are two crop production systems in the area – upland crop production and riverbank crop production. Upland fields are held by all households in the area and they average 7 to 12 acres per household. The riverbank crop production system consists of fields along the banks of major rivers, where the majority of villagers hold plots averaging 1 to 5 acres per household (either personal or borrowed). Upland fields consist mainly of shallow

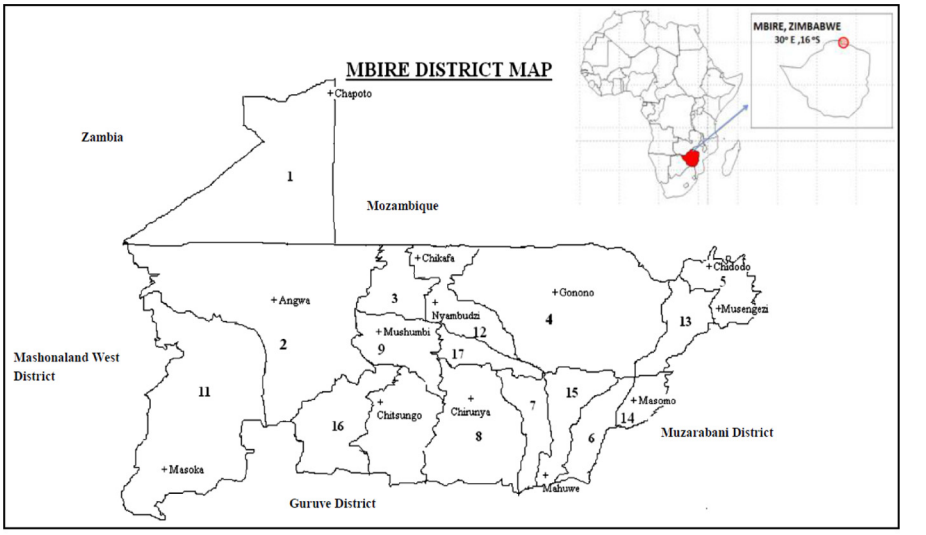

Figure 1.
Mbire district, Zimbabwe

Source: Created by author available at: www.humanitarianresponse.info/sites/www.humanitarianresponse.info/files/A3_districts_Mbire.pdf

sandy clay soils, and are used for dryland crop production involving mainly cotton, the major cash crop in the area, sorghum and groundnut farming. A variety of other crops particularly cowpea, sunflower and millet are also cultivated in upland fields in small portions. All farmers involved in the study held both upland and riverbank fields. The main crop in riverbank fields is maize, alongside green vegetables, tomatoes and onions in smaller portions. Autochthonous residents (defined in the context of this work in the mould of Weiner (1983) as non-immigrant residents) make up the majority owners of riverbank fields, with non-autochthonous residents (referring here to immigrant residents) accessing these plots through borrowing from close neighbours, friends and kin who own them. This is because riverbank fields are inherited and treated as private property passed on from generation to generation. Kinship and lineage are therefore key factors in the ownership of these fields.

Livestock raised in the area include cattle, goats, sheep, pigs and poultry – with cattle, goats and poultry forming the larger numbers of animals. Livestock in the area is important as a source of draught power, meat, milk, manure and essential in other important social processes (e.g. paying bride-price, settling serious societal conflicts and payment of fines in traditional courts). As in many other rural African communities, cattle are the most highly ranked form of livestock and the more cattle a household owns, the wealthier and/or financially stable they are (perceived to be) (Nyamwanza, 2012). The number of cattle one has also determines the area that can be planted in upland fields and how fast this can be done, which is important given the fact that timely planting is a major factor in crop success in these marginal areas (Nyamudeza, 1999). It is also a local source of money-making business (e.g. ploughing other villagers' fields for cash and transporting other people's commodities to the market), as well as spreading

social networks because owning more cattle in the area generally means more social recognition and being "culturally anchored" (Nyamwanza, 2012).

People also obtain earnings from local casual agricultural work (*maricho*) in other villagers' fields, (with most of this casual work revolving around the pre-harvest activities of land preparation, planting and weeding, the actual harvesting and post-harvest activities of threshing, winnowing and packing). Other livelihood activities in the area are non-agricultural, and these include fishing (for both commercial purposes and household consumption), trading in goods and services as well as regular employment and remittances for a very few number of households.

4.2.2 Vulnerability factors. Vulnerability factors in the area include low and erratic rainfalls, high temperatures, increasing drought cycles, poor (input, output and labour) markets and infrastructure, quelea birds and locusts on crops, labour challenges because of the HIV/AIDS problem and (seasonal) malaria for most households as well as wildlife (Figure 2). From the sampled farmers, two groups of farmers emerged, with the majority (60 per cent) of the farmers interviewed practising mixed crop-livestock farming and the remaining 40 per cent engaged only in crop production. It was interesting to note that vulnerability factors in the area were ranked almost similarly by farmers in the two groups, with the exception that wildlife was ranked among the top five vulnerability factors by farmers practicing mixed crop-livestock farming and not as high by those with no livestock (Figure 2). Despite not ranking wildlife as high among vulnerability factors in the area, the latter group, however, still indicated increasing crop destruction especially by elephants over the years and particularly in upland fields. Those practising mixed crop-livestock farming indicated that apart from crop destruction by elephants, they also had to put up with livestock attacks particularly from lions, hyenas and crocodiles as well as the recurring tsetse-fly problem affecting cattle.

It is important to note, at this point, that this study was undertaken immediately after the end of the tenure of Zimbabwe's coalition government (which ended in July 2013 and had been composed of the country's main political protagonists). This 2009-2013 coalition government had managed to stabilise the country politically and economically and had engineered some partial rehabilitation of public services such that the economic

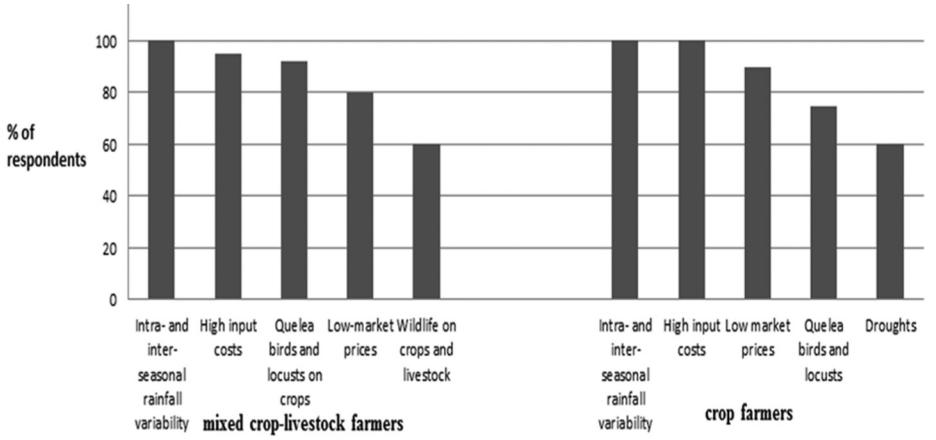

Figure 2. Top five vulnerability factors as ranked by different farmer respondents

and public service collapse as well as political violence that had characterised the country in much of the noughties and exerted pressure on people's livelihoods had eased. Therefore, although at the time of the research, the country was back under the control of a sole (pre-coalition) Zimbabwe African National Union – Patriotic Front Government, the general vulnerability context in the country, at this time, was no longer as complex as, for example, that which had been witnessed and experienced between 2000 and 2009. It is within this general national context that this study was carried out.

5. Results

5.1 Role and importance of an anticipatory focus in responses to climate variability and other challenges in the area

As noted in the introduction, one of the main indicators of anticipatory planning within an area is the willingness and ability of people to envision plausible futures *vis-à-vis* both their challenges and their opportunities. This is akin to constructing "archetypical descriptions of alternative images of the future created from mental maps or models which reflect different perspectives on past, present and (most importantly), future developments" (Rikkonen *et al.*, 2006, p. 70). However, as Tschakert and Dietrich (2010) note, a useful anticipatory focus should also encompass the ability of people to shift from simply envisioning plausible futures to developing dynamic plans of how to deal with potential uncertainties. In this study, people's willingness and extent of "planning ahead" in responding to climate variability and other livelihood challenges became a major benchmark in assessing and understanding their willingness and ability to envision possible future challenges and opportunities. Understanding people's ability to envision possible futures was also aided by scenario-based questions on tentative future plans with respect to how they would react to best and worst climate scenarios in the area.

In that regard, there appeared to be a prominent role of an anticipatory focus in adaptation planning in the area, as about 75 per cent of respondents noted that they do plan further ahead in responding to challenges in recent years than they used to in previous years. The main reason proffered was to counter the unpredictability of livelihood conditions in the area. Almost all the community members interviewed, for example, noted that there was a marked increase in climate variability (as witnessed in decreasing seasonal rainfalls, increasing air temperatures and sunshine intensity and rains beginning late and/or ending prematurely). Respondents also noted that the unpredictability of conditions in the area are limited not only to climate conditions but also market fluctuations particularly of producer prices for their main cash crop, cotton, in recent years. All these were, therefore, motivations for a particularly focused pre-season planning, and the main examples (of this planning) noted include:

- flexibly adjusting the timing of seasonal farming operations, e.g. clearing of fields in preparation for planting, the actual planting of crops and when to start the weeding cycle according to expected variations in rainfall and temperature patterns;
- careful selection of the types of crops and seeds to focus on especially in upland fields;

- holding on to land, i.e. not lending or renting out to friends and relatives until after the first rains;
- careful calculation of the amount of (cotton) inputs to borrow before the beginning of the farming season;
- careful planning on division of family labour and time in own fields well before and during the farming season, to create opportunities for engaging in local casual agricultural and other work (*maricho*) locally and in other areas so as to accumulate savings (in both cash and kind) in case of a poor harvest or poor market prices at harvesting; and
- engaging in other forms of livelihoods diversification well before and during the farming season (e.g. knitting and selling reed-mats as well as fishing for both commercial and subsistence purposes).

It was also clear in discussions on tentative future plans in relation to best and worst climate scenarios that people in the area have clearly laid out livelihood fall-back plans in case of worst climate scenarios (Table I).

5.2 Access to and communication of climate information for adaptation planning in the area

The presence of and accessibility to reliable climate information sources have long been identified as critical in adaptation planning (O'Brien *et al.*, 2000; Ziervogel *et al.*, 2008; CARE, 2011). In the context of this study, for decadal climate information to be effective in influencing strategic decision-making and anticipatory adaptation processes, it has to feed into, improve and/or positively influence the utility of existing climate information channels and flows. Access to and utilisation of accurate climate information essentially strengthens capacity not only for farmers but also for local government and non-governmental institutions involved in adaptation efforts (CARE, 2011). It was, therefore, critical to understand and assess climate information channels and flows in the area.

Sources of climate information in the area ranged from the formal (i.e. the local meteorological office, Agritex officers, the media (radio) and local cotton company extension officers) to the informal (particularly local knowledge, obtained from: fellow villagers – especially the elderly and long-term residents; local diviners and spiritualists; and personal observations and experiences over the years). Around 40 per cent of interviewed community members noted that they did not have access to any climate information from formal sources at the time of the research – relying only on local knowledge, whilst 66 per cent of respondents pointed out that they have access to between daily and annual weather information from either the formal or the informal sources or both. The question on the most effective source of climate information (as defined by accessibility and accuracy) revealed the popularity of local knowledge ahead of other sources (Figure 3).

It was also interesting to note that only 26 per cent of respondents answered in the affirmative when asked on whether they base their farming decisions on the climate information they receive from various formal sources. The rest noted that whilst scientific climate projections and weather forecasts are critical to their farming operations, the previously incorrect forecasts especially from the media and the local

Table I.
Options and opportunities in the event of a sequence of five "good" and "bad" years (in order of importance)

	Three major livelihood options in the event of a sequence of five "bad" years	Three major livelihood opportunities in the event of a sequence of five "good" years
Mixed crop-livestock farmers	Selling livestock Temporary migration to nearby Mozambique and Zambia in search of food and jobs Intensifying riverbank farming	Increasing livestock rearing–particularly for draught power and household consumption Increasing farm land and purchasing better farming equipment Starting (non-agricultural) income generating projects
Crop farmers	Intensifying riverbank farming Temporary migration to nearby Mozambique and Zambia in search of food and jobs Foraging	Starting livestock rearing–particularly for draught power Increasing farm land and purchasing better farming equipment Starting (non-agricultural) income generating projects

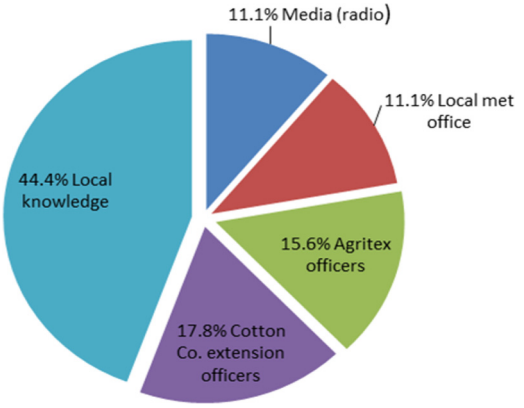

Figure 3.
Accessibility and accuracy of climate information sources in Mbire

meteorological office had lowered their confidence in forecasts and projections from formal sources.

5.3 Envisaged role and importance of decadal climate information in the area

There is currently no access to and/or communication of decadal climate information in the area. Over 90 per cent of respondents, however, pointed out that if such reliable climate information were to be made available, it would be of great value in as far as their strategic decision-making processes are concerned. Primarily, as it would lower the level of uncertainty, raise the level of information and knowledge and ultimately enhance future planning particularly in as far as crop production, their main source of livelihood is concerned.

On ways of receiving decadal climate information if availed, the majority of respondents noted that they would prefer the information to be conveyed to them through community meetings and workshops conducted, if possible, with climate scientists themselves. Other respondents, however, also noted local Agritex officers and cotton company extension officers as potentially helpful in communicating such information. Table II summarises the type of information that people in the area mentioned as important to them and which they would want to know within a one to ten-year time frame.

6. Discussion and analysis

6.1 Utility of anticipatory adaptation to farming and livelihood systems in Mbire

From presented results, it is clear that decadal climate information and anticipatory adaptation can potentially avail multiple benefits in as far as enhancing the resilience and reducing the vulnerability of farming and livelihood systems in the area is concerned. The presence of an anticipatory focus in responding to challenges and uncertainties is already one major opportunity for focused anticipatory adaptation and the use of decadal climate information in the area. Two clear benefits of anticipatory adaptation to farming and livelihood systems in the area are outlined here and these are:

(1) enhanced flexibility in adaptation planning; and

(2) reduced chances of maladaptation.

Information in the next five- to ten-years	Rainfall patterns (i.e. patchiness, intensity and amount) per year Temperature patterns per year Changes in seasons over the years (with respect to variations in rainfall and temperature patterns over the five- to ten-year period) The likely type(s) of extreme weather events to occur within that period, including their timing, frequency and intensity
Information in the next five years	Rainfall patterns (i.e. patchiness, intensity and amount) per year Temperature patterns per year Changes in seasons over the years (with respect to variations in rainfall and temperature patterns over the five-year period) The likely type(s) of extreme weather events to occur within that period, including their timing, frequency and intensity
Information in the next one year	Rainfall patterns (including start and end dates, amount, patchiness and intensity) in each month Temperature patterns in each month Likely variations from (rainfall and temperature) patterns of previous year

Table II.
Expected climate information within a one- to ten-year period

6.1.1 Enhanced flexibility in adaptation planning. Adaptation planning in complex vulnerability contexts such as Mbire is, many a time, a difficult and multifaceted process that is often affected by two main interconnected challenges, namely, the uncertainties related to future change and the limited flexibility in planning systems to cater for those uncertainties (Serrao-Neumann *et al.*, 2013). The Mbire (livelihoods) environment is characterised by high uncertainty resulting not only from meteorological phenomena but also from market fluctuations, unstable macro-economic conditions and health challenges. Anticipatory adaptation in such areas brings flexibility into adaptation planning, as it provokes the exploration of various positive and negative future scenarios and response options. People are able to visualise and incorporate various scenarios and range of possibilities into their future plans thereby making it easier to confront and deal with adverse climatic and other livelihood conditions and/or take advantage of expected favourable conditions. A sustained anticipatory focus increases awareness to current and future levels of vulnerability as well as alertness to opportunities for creating and maintaining adaptive capacity and resilience. In this case, for example, decadal climate information, as part of an anticipatory adaptation package, will complement various forms of local knowledge prominently used by the majority of farmers in the area to understand, learn about and plan for the future. A forward-thinking approach supported by mid-to-long term planning horizons as instigated by anticipatory adaptation and decadal climate projections, therefore, promotes a more flexible approach in dealing with climate variability and change and related challenges (Quay, 2010).

For government and non-governmental entities involved in adaptation planning in such areas as Mbire, five to ten years would also be the typical time frame for designing and implementing many of the interventions most critical to agriculture. These would include such interventions as the introduction of new (drought resistant) crop varieties and the setting up of such projects as catchment-wide infrastructure for irrigation and water storage (Vermeulen, 2012). Effective design of these interventions significantly

depends on knowing what the climate will be like once they are running, and medium-term climate projections become key in this instance (Vermeulen, 2012).

6.1.2 Reduced chances of maladaptation. In an area such as Mbire which is characterised by multiple and reinforcing exposures, responding to the effects of one exposure may render people more vulnerable to other exposures, a situation which may also be interpreted as "risk shifting" or "risk displacement" (McDowell *et al.*, 2010). For example, interviewed farmers noted that one of their main responses to low rainfalls and droughts (which also came up as one of their major options if faced with a sequence of five bad years) is to intensify riverbank farming activity (Table I), which in the long run may, however, lead to soil erosion and siltation. Responding to the complex dynamics of multiple exposures definitely requires a cost-benefit analysis on the part of individuals, households, groups and institutions (McDowell *et al.*, 2010), and engaging in anticipatory adaptation may lead to an adequate assessment of the sustainability of different response options. Anticipatory adaptation planning gives room for the exploration of various possibilities in dealing with climate variability and other challenges well in advance thereby reducing chances of maladaptation. This was apparent during scenario-based questions whereby respondents inevitably had to assess the sustainability and drawbacks of various livelihood options and opportunities in their answers to different "what-if" future climate scenarios. In this case, an anticipatory focus emerges to enable an exploration of the relationship between "the presence of the future" and "the dynamics of a subsisting present" in climate adaptation (Anderson, 2010).

6.2 Factors to consider for successful and sustained anticipatory adaptation and use of decadal climate information in Mbire and similar contexts

6.2.1 (Re) building the credibility of scientific weather forecasts and climate projections. Successful anticipatory adaptation efforts involving the utilisation of new technologies like decadal climate information require that people develop confidence in scientific weather and climate information. Perception towards and confidence in climate information *vis-à-vis* decision-making for adaptation planning, in general, is, however, directly strengthened by apparently confirmatory feedback and weakened by apparently contradictory feedback of previously availed information (Eiser *et al.*, 2012). As evidenced by the small percentage of respondents who answered in the affirmative *vis-à-vis* the use of climate information from formal sources in Mbire, it was clear that there has been a significant dip in confidence regarding weather forecasts released in the area in recent years with the main reason given being the unreliability of previously availed forecasts.

It appears there is, therefore, a need to rebuild both the credibility of scientific climate information and people's confidence towards utilising scientific weather forecasts and climate projections in the area. This establishment of trust and changing of people's perceptions is a complex process given the inherent probabilistic nature of weather forecasts and climate projections. A first step is that those providing information to farmers at the community level should, therefore, clearly explain the probabilistic nature of forecasts and projections, as well as make sure that users are aware of the uncertainties (Patt and Gwata, 2002). In essence, more time should be invested in understanding how target decision makers perceive and communicate probabilistic information in the first place, which should then go on to inform the design of climate

forecast information products and presentation protocols (Hansen *et al.*, 2004). In the case of Mbire for example, where most farmers rank local knowledge highly *vis-à-vis* the forecasting of weather and climate patterns (Figure 3), it would be necessary for scientists to understand the relationship between the causal models of climate variability and the resulting forecasted information as explained within local knowledge discourse. This will move farmers, researchers and other players in the communication process towards a common probabilistic language, thereby overcoming the inherent difficulties in understanding and wisely applying probabilistic forecast information (Hansen *et al.*, 2004).

Uptake of knowledge is also not merely a personal experience but essentially an interpersonal experience. This, therefore, may point towards a need for creating platforms for information sharing and collaborative action in such communities as Mbire towards this re-building of confidence in utilising any released climate information. Blench (1999), for example, suggested the formation of focus groups in user-communities mandated with periodically assessing the impacts of particular dissemination strategies. However, as Hansen *et al.* (2004) write, regardless of farmers' concern with the accuracy of forecasts, they seem to be consistent in their need for as clear and honest presentation of the degree of uncertainty of forecasts as possible.

6.2.2 Improving communication links and information and knowledge networks between community members, policy makers and scientists. Besides the issue of perception towards and confidence in scientific climate information as discussed, local communities should also be appropriately equipped to interpret and apply weather forecasts and climate projections for successful anticipatory adaptation, whilst, at the same time, understanding and appreciating the limitations. This calls for clear communication links and strong information and knowledge networks between community members, climate scientists and policy makers. In Mbire, the question of how ordinary community members would want decadal climate projections conveyed to them revealed that they have less trust in (the competency of) local government players involved in the dissemination of weather and climate information (i.e. the local meteorological office and local Agritex officers), as the majority of community members clearly preferred that climate scientists be directly involved in the dissemination process through community meetings and workshops. However, notwithstanding this failing trust on local formal institutional players among community members in the area, it has to be acknowledged that these local personnel have a better understanding of local dynamics, constraints and needs. Therefore, they have to be actively involved in proffering ideas on how to link new climate data with strategic decision-making for adaptation planning in local communities. In any case, they are also crucial ingredients to the success of the utility of any medium-term climate projections in anticipatory adaptation within an area because they form the key boundary institutions whose decisions must take account of climate variability and change and related risks. As Dessai and Hulme (2004) articulate, they hold the specialised practical local knowledge needed to evaluate adaptation options and they are the primary source of technological and managerial activities needed to implement these adaptation options in local communities.

As new development for farmers in the area, it was also clear that decadal climate information (as part of an anticipatory adaptation package) may inadvertently trigger legitimacy concerns. Legitimacy has to do with the questioning of the "political agenda"

of the communicators of particular climate information by the targeted users (Patt and Gwata, 2002). Farmers in the area heavily rely on credit provision for their cotton farming, which is their main (cash) crop. Though they appreciated the potentially important role of decadal climate projections in anticipatory adaptation as noted earlier, there were covert but genuine fears on, for example, this information becoming a potential means of influencing or encouraging cotton input credit providers to tighten the conditions of credit provision, particularly in the case of projections of potentially poor seasons. Community members also noted that projections of potentially good seasons may influence non-governmental organisations whom they rely on for food aid almost every year in supplementing their poor yields to cut on that aid. Clear collaborative processes that link producers of climate information, multiple interests within an area and the targeted users of climate information in the communication of availed information for anticipatory adaptation should again, therefore, be clearly laid out to allay legitimacy concerns (Kirchhoff *et al.*, 2013). Legitimacy concerns may also be allayed by presenting the new information, in this case decadal climate projections, in conjunction with local (knowledge) indicators. Hansen *et al.* (2004) argue that users of climate information will likely embrace and accept new information more fully if they can interpret it in a causal model of climate variability that they understand and with which they agree.

7. Conclusion

Anticipatory action aims at making sure that no bad surprises happen, as based on a constant readiness to pan out various possible ways in which different futures may play out (Anderson, 2010). In the same vein, the provision of decadal climate information allows people (both local community members and players in boundary organisations) to hedge the risk of climate change and other vulnerabilities by balancing the costs and benefits of waiting, against premature action (Dessai and Hulme, 2004). From this study, it is apparent that anticipatory adaptation planning is also a way of essentially stimulating thought and bringing to the fore plausible livelihood options and opportunities in a context of changing climate and other risks. Hence, highlighting the need for measured and strategic responses which allow people to capitalise on benefits and effectively reduce risks. Anticipatory adaptation is therefore at the cusp of learning and understanding future climate and other dynamics, and decision-making processes that shape resilient livelihoods. Main lessons that emerge in improving and taking this increasingly important dimension of adaptation forward include the need for (re)building confidence in local communities *vis-à-vis* utilising and relying on scientific weather forecasts and climate projections in decision-making, and improving communication links between scientists, policy-makers and community members with respect to taking information important in anticipatory adaptation planning to local communities.

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