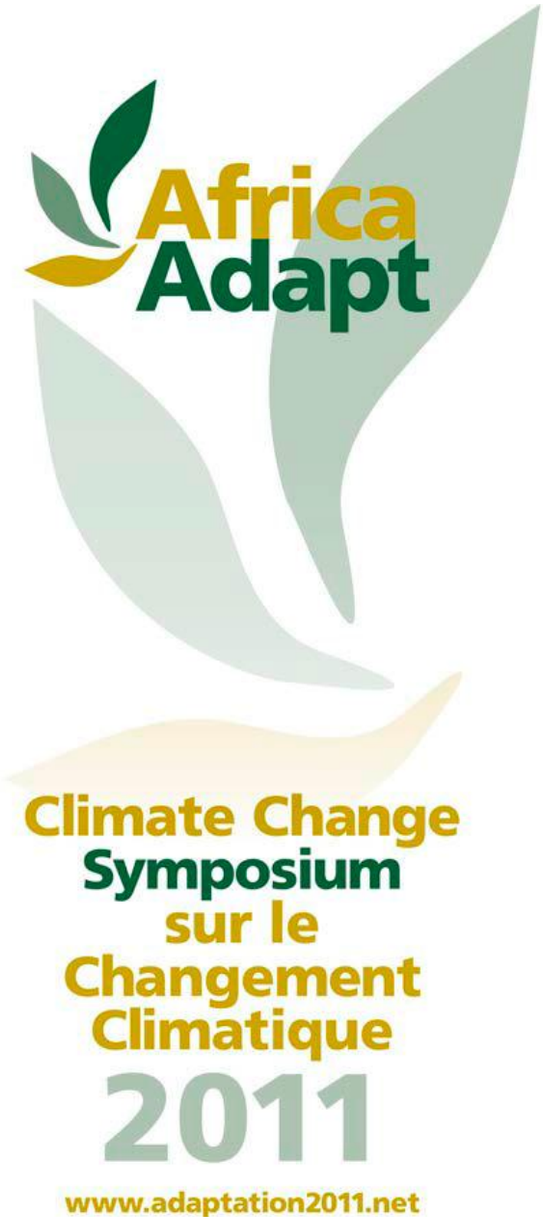

Panel 17: Special Panel: Lessons from the African Climate Change Fellowship Programme

Chair: Clark Seipt (START)

Chipo Plaxedes Mubaya: Climate variability and change or multiple stressors? Farmer perceptions regarding threats to livelihoods in Zimbabwe and Zambia

Sale Abou: The role of different information resources in the adaptation of agro-pastoralists to climate change, and identification of public policies: A case study in the arid region of Kibwezi, Kenya (French)

Felix Olorunfemi: Flood Risk Management in diverse contexts: examples from Nigeria and South Africa

Cyriaque-Rufin Nguimalet: Comparison of communities' adaptation strategies in Kenya and Central African Republic catchments to droughts and floods

Chipo Plaxedes Mubaya

Climate variability and change or multiple stressors? Farmer perceptions regarding threats to livelihoods in Zimbabwe and Zambia

Chipo Plaxedes Mubaya[*1], Jemimah Njuki[+b], Eness Paidamoyo Mutsvangwa[c], Francis Temba Mugabe[⊥a], Durton Nanja[d], Cyril Murewi[a], John Dimes[c], Veronica Makuvaro[a], Adelaide Munodawafa[a]

Abstract

Climate variability is set to increase, characterised by extreme conditions in Africa. Southern Africa will likely get drier and experience more extreme weather conditions, particularly droughts and floods. However, while climate risks are acknowledged to be a serious threat to smallholder farmers' livelihoods, these risks have been considered to be a risk multiplier. It was important for this study to understand farmer perceptions regarding the role of climate risks within a complex and multifarious set of risks to farmers' livelihoods. This study used both qualitative and quantitative methods to investigate farmers' perceptions regarding threats to livelihoods in southern Zambia and south-western Zimbabwe. The study finds that farmers' perceptions relate more to climate variability than to climate change. While farmers report changes in local climatic conditions consistent with climate variability, there is a problem in that these farmers may be assigning observed negative impacts on the agricultural and socio-economic system solely to climate variability. Furthermore, while there is a multiplicity of stressors that confront farmers, climate variability and change remain the most critical and exacerbate livelihood insecurity for those farmers with higher levels of vulnerability to these stressors. Essentially, there is need to make a transition *from* designing policies that target climate change issues as a distinct entity *to* policies that address climate change issues as an integral component of multiple stressors that confront farmers.

Key words: farmers, perceptions, climate variability, climate change, multiple stressors

---

[*] Corresponding author and present address-Institute of Resource Assessment (IRA), University of Dar es Salaam (UDSM), P. O. Box 35097, Dar es Salaam, Tanzania -mubayacp@yahoo.com

[1] Midlands State University (MSU), Faculty of Natural Resources Management and Agriculture, Department of Land and Water Resources, Private Bag 9055, Gweru, Zimbabwe

[+] Present address-International Livestock Research Institute, Nairobi, Kenya

[b] International Centre for Tropical Agriculture (CIAT), 12,5 km peg Mazowe Road, P. O. Box MP 228, Mt. Pleasant Harare, Zimbabwe

[c] International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Matopos, Bulawayo, Zimbabwe

[⊥] Present Address-Chinhoyi University of Technology, Chinhoyi, Zimbabwe

[d] Zambia Meteorology, Southern Province, Zambia

1.0 Introduction

There are predictions that due to accelerated anthropogenic activities, climate variability will continue to increase, characterised by heightened frequency and intensity of extreme weather conditions in Africa (Clay *et al.* 2003; Nhemachena & Hassan 2008). Southern Africa is generally expected to get drier and experience more extreme weather conditions, particularly droughts and floods. However, there would be variations within the region with some countries experiencing wetter than average climate (Tyston 1991). The climate of Southern Africa is highly variable and unpredictable and the region is prone to extreme weather conditions, including droughts and floods (Department for International Development (DFID) 1999; Kinuthia 1997). In the predominantly semi-arid Southern African region, there is significant rain variation from year to year and these trends may continue with the wet season increasing and at the same time offsetting decreases in the drier months (Clay *et al.* 2003).

Vulnerability Assessment Committees (VACs) (Southern Africa Development Cooperation [SADC] in 1999 established the Regional Vulnerability Assessment Committee [RVAC], a multi-agency committee to address the need to broaden and improve early warning information and vulnerability assessments at national [VAC] and sub national levels [RVAC] through spearheading critical improvements in food security and vulnerability analysis at country and regional levels respectively) have highlighted how SADC member states were subjected to climate variations including droughts in the 2001/2002 and 2002/2003 seasons (Waiswa 2003). Although drought has been commonly seen as the main climate issue in the region, there have been recent floods in Mozambique and extremely high rainfall in Malawi in the 2000 season (Clay *et al.* 2003), floods in Southern Zambia (de Wit 2006) and some parts of Zimbabwe (Cooper *et al.* 2006). These excessive rains in Malawi are considered to have played a leading role in the food crisis of 2002. Furthermore, links have been drawn between reduced production of annual cereal and maize, and the South Eastern African rainfall index for Zimbabwe alone and for both Zimbabwe and Malawi, specifically for the country specific rainfall index (Clay *et al.* 2003). In Southern Africa, among the countries worst affected by droughts are Zambia and Zimbabwe. Drought relief is a common feature (Mudimu n.d), almost every year, in the drier areas of both countries, as there appears to be an increasing trend towards a late start to the rain season, prolonged mid-season droughts, and shorter growing seasons (Cooper *et al*. 2007; Love *et al*. 2006).

It is important to note though, that climate change amplifies already existing risks for farmers. This is the case as there are non-climatic risk factors such as economic instability, trade liberalisation, conflicts and poor governance that may also be faced by farmers (Nyong & Niang-Diop 2006). Other factors are impacts of diseases such as malaria and HIV and AIDS and lack of and limited access to climate and agricultural information (Gandure 2005; Gandure & Marongwe 2006). Africa is also characterised by institutional and legal frameworks that are, in some cases, insufficient to deal with environmental degradation and disaster risks (Beg *et al*., 2002; Sokona & Denton 2001). It is important to understand that vulnerability levels are heightened when there are droughts and floods, among other climate risk factors (Gandure & Marongwe 2006). Non-climate risk factors may compound the situation for farmers already faced with climate variability and change. In this regard, this paper highlights farmer perceptions regarding climate change and variability as a threat to livelihoods. This paper also highlights how climate change and variability is viewed in relation to other non-climatic stressors in the sampled districts in Zimbabwe and Zambia. In this paper, the distinction

between ‘climate variability’ and ‘climate change’ relates to differences in time-scale. On the one hand, ‘climate variability’ is conceptualised as variations in the climate system over short time scales such as months, years or decades and on the other hand ‘climate change’ is conceptualised as longer term trends in mean climate variables of periods of decades or longer. This is the suggested distinction in definitions of the concepts in question by the IPCC.

Farmer perceptions of climate change

While there is literature to demonstrate that at the centre of the adaptive process there is the individual farmer who is free to make a specific choice such as what to plant, how much land to cultivate and the resources to be employed (Crosson 1986, 1993), there is an alternative approach which underscores how individuals perceive their environment and make decisions, with mal-adaptations attributed to problems in perception, cognition or the lack of available information (Diggs 1991; Saarinen 1966; Taylor *et al.* 1988). The main point is that from whatever level these adaptation measures are taken, the adaptation and coping measures depend on households’ perceptions of extreme events and the problems associated with them (Davies 1993). While adaptation to climate change and variability falls outside the scope of this paper, this literature points towards the central role that farmer perceptions play in adaptation, making it essential for this study to understand farmer perceptions on climate change and other non-climatic factors.

Preliminary evidence from a number of African countries reveals that large numbers of farmers already perceive that the climate has become hotter and the rains less predictable and shorter in duration (Gbetibuo 2009; International Crops Research Institute for the Semi-Arid Tropics [ICRISAT] 2009; Maddison 2006; Mapfumo *et al*. 2008; Nhemachena & Hassan 2007). However, it has been documented that farmers perceive risk associated with variable rainfall to be greater than it is. Near Katumani in Kenya, farmers attribute declining maize yields to climate change and reduced rainfall but long-term rainfall records do not support this perception (ICRISAT 2009). Declining soil fertility and greater land use intensity by reducing the frequency of fallow periods are primarily responsible. Similar stories have emerged from Zimbabwe and Zambia. Similarly, at Machakos in Kenya, farmers rated nearly 47% of the seasons as poor, while historical climate data indicated that in only 27% of the seasons would maize crop failure have occurred (ICRISAT 2009). It is therefore important for this study to bear in mind that farmers will often ascribe changes in farm productivity to changes in rainfall patterns yet there could be other reasons, making it imperative to also understand perceptions on non-climate risks. Notwithstanding this, there are other studies that show that farmers’ perceptions do tally with historical climate data: Vedwan & Rhoades (2001) in a study done in the Western Himalayas of India, Hageback *et al*. 2005 cited in Maddison 2006 in the Danagou watershed in China and Madison (2006) on a number of countries in Africa.

2.0 Methodology

2.1 Study areas

This study was carried out in Southern Zambia and in South-western Zimbabwe (Figure 1). Two districts were selected for this study in each country, Monze and Sinazongwe in the former and Lupane and Lower Gweru in the latter. Land use in the districts is typical of communal lands with dry-land crop production in the rain season and animal rearing. The major crops grown in Zimbabwe are maize, groundnuts, cowpeas and *Bambara*

nuts while the major crops grown in Zambia are maize, groundnuts, cotton and sorghum. Average land owned and cultivated across countries and districts is between 1.6 and 3.9 ha. The smallholder farmers also produce vegetables for sale and consumption from gardens they irrigate using water from shallow wells or small dams. While all the districts are in the semi-arid areas and receive less than 850 mm per annum, Monze district in Zambia and Lower Gweru District in Zimbabwe are wetter than Sinazongwe and Lupane respectively. The rains are erratic and ill-distributed in time and space, resulting in frequent crop failures. While annual rainfall for Lower Gweru ranges from 650-800mm, average annual rainfall in Lupane district ranges from 450-650 mm with periodic dry spells during the rainy season. Farmers in Lupane frequently experience periods of dry spells, and drought conditions are not uncommon. Similarly, Sinazongwe is characterised by hot, dry spells, a short rainy season of 60 to 90 days and an average annual rainfall of 600 to 700 mm while Monze has an average annual rainfall of between 800 and 840 mm and a moderate temperature environment.

Figure 1: A map showing the study sites in Zambia and Zimbabwe

2.2 Data collection and sampling

To understand farmers' perceptions of climate and non-climate risks, this study employed both qualitative and quantitative methodologies. The qualitative methods of data collection used include Participatory Rural Appraisal (PRA) techniques such as historical trend analysis and matrix scoring and ranking and Focus Group Discussions (FGDs). The quantitative method used is the household questionnaire survey. A sample of 720 households across countries was selected for the survey, 180 households per district. Specifically, systematic random sampling was employed to come up with six villages per district and 30 households per each of these villages, making a total of 380 households per country. This survey collected data on changes in crops grown over a period of five years and reasons for these changes, indicators for good and bad crop production seasons and years considered to be good or bad over a ten year period. Questions in the survey also related to changes in weather patterns over a ten year period in relation to agriculture and what might have caused these changes. General household characteristics were also captured in this survey. For FGDs and PRA workshops, a group of eight to fifteen participants was selected to represent the three villages per district, with approximately five representatives from each of the three villages per district. In coming up with this group, factors such as age and gender were used. In terms of gender, separate PRA workshops were held for men and women in

order not to compromise the amount and quality of information that can be generated from the less confident if they were to be combined. Specifically, old men and women were incorporated into the sample for the group discussions in order to capture information related to historical trends in climate. It was envisaged that they would be able to recall as far back as they could and provide rich information on these trends. In the same context, youths were incorporated into the sample in order to validate some of the recent trends on climate suggested by the elderly.

FGDs were used to first of all establish the general perceptions regarding climate change and variability and their causes and various stressors that confront farmers' livelihoods. Following this, it was considered important for this study to factor in how farmers regard climate change and variability as an obstacle to their livelihoods among the multiple stressors that they had identified. Among these stressors are climate variability in different forms, issues of financial capital, issues related to cattle pests and diseases, inadequate draught power, marketing issues and HIV and AIDS. A matrix scoring and ranking exercise was then facilitated for farmers. Farmers were asked as a group to select from the long list of stressors the ones they considered critical for the purposes of scoring and ranking. The second step involved participants defining criteria that they would use to evaluate these stressors. These criteria include food security, income generation, crop production and livelihood security. Through group consensus, farmers then decided how much to allocate each shock out of a total of 20 points, based on the group defined criteria. Historical trend lines were used to elicit information on specific historical trends in farmers' perceptions regarding changes in climate over a period of 20 years and as far back as they could recall. Specifically, participants were asked to recall major occurrences that had a bearing on climate and weather, community resources, and even the political situation. They were then asked to indicate what occurrences had the greatest impact on their livelihoods among the cited events.

2.3 Data analysis

Qualitative data were categorised into four distinct themes. These themes are

- Perceptions regarding changes in weather patterns,
- Perceptions regarding causes of changes and variability in climate,
- Perceptions regarding other stressors among farmers and
- Perceptions regarding climate change in relation to other stressors

These perceptions were established in historical trend lines, FGDs and matrix scoring and ranking. The questionnaire survey was used to validate data generated trough the qualitative methods. Data from the questionnaire survey were entered into the Statistical Package for the Social Sciences (SPSS) and analysed by running descriptive frequencies in relation to the distinct themes highlighted in this section.

3.0 Results and discussion

3.1 Perceptions regarding changes in weather patterns

Data from the questionnaire survey indicate that above 70% of the farmers in all the four districts have been aware of significant changes in weather patterns over the past five years (see Figure 2). It is interesting to note that when compared by district within each country, independent of the other country, there are more farmers in Monze and Lower Gweru indicating that they have been aware of these changes than there are in Sinazongwe and Lupane. The implication in this finding is that farmers who are accustomed to dry conditions are less conscious of changes in climate than farmers in

wetter areas who may experience a significant reduction in crop yield due to these changes. Therefore, it appears that by country, farmers closely associate changes in weather conditions with crop productivity. In addition, reductions in rainfall amount in dry areas could be less noticeable than in wetter areas.

Significant proportions of farmers in both countries indicated that they have observed changes in climate for all the parameters highlighted (see Figure 3). The highest percentage of farmers who have experienced increased floods/excessive rains is from Monze (85%) and Sinazongwe (72%), with much lower percentages for this climate parameter for farmers in both districts in Zimbabwe. This is the case because Lupane and Lower Gweru farmers indicated that what they have witnessed are rather excessive rains and not floods per se. Above 58% of farmers in all districts have experienced droughts and a greater proportion of farmers in Monze and Sinazongwe reported to have observed dry spells than in Lupane and Lower Gweru. The percentage of farmers who have observed early rains is much lower in all the districts than for the other climate parameters. What is emerging from these findings is that climate variability is on the increase in both countries.

For precipitation, as reported in historical trend lines, farmers in Monze indicated that the drought occurrences that they could recall which had a major impact on their livelihoods were those of the 1992/93 and the 1995/96 seasons. While they highlighted that they have experienced major floods in the 2007/08 season, they also indicated that there were other years when they received excessive rains which they could not quite classify under floods but which were destructive in the 2002/03 season. While farmers in Sinazongwe highlighted the same periods as drought periods, they also added that 2001/02 was a drought year for them and that they experienced floods in the same seasons as those highlighted by Monze farmers. This says more about variations than deviations from some long-term trend, implying that farmers have witnessed climate variability rather than climate change. This finding is consistent with an analysis of climate data for the Southern Province done by Nanja (2004) in ICRISAT (2009).

Significant changes in weather patterns over a five year period by district

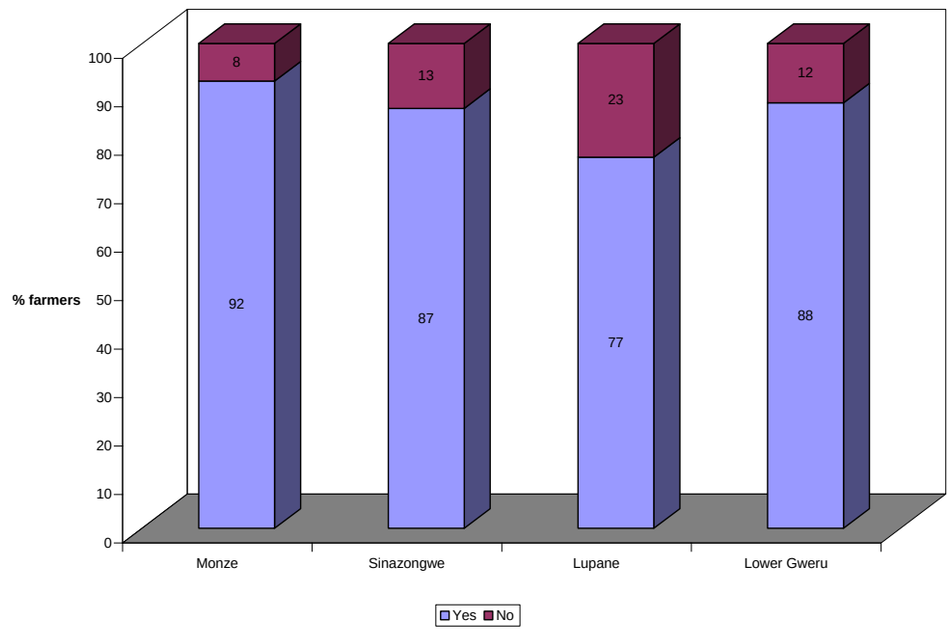

Figure 2: Farmers' awareness of climate parameters in the sampled districts

Also through historical trend lines, farmers in Lower Gweru and Lupane concurred that they experienced droughts in the 1992/93, 1994/95, and 2001/03 seasons. They also highlighted that though they have not experienced floods, they have experienced excessive rains which have impacted negatively on them in many ways (crop damage, human and livestock diseases and damage to infrastructure, among others). These farmers remembered the 1978/79, 1999/2000 and 2007/08 as the seasons in which they received excessive rains. This matches with available rainfall data, which show that the 1999/2000 season was a La Nina season (Stern 2007). However, the percentage of farmers who witnessed excessive rains is significantly and understandably higher in Lower Gweru (43%) than Lupane (28%) (Figure 3). It is understandable because of the fact that Lower Gweru is significantly wetter than Lupane.

Farmers in Zimbabwe districts generally concurred that in the 1980s it was easy to predict the coming season and the seasons were distinct but now the rains have become more and more unpredictable beginning around 1995. Moreover, they also highlighted that now they are experiencing shorter rain seasons than before. Rains would start from October and stretch up to April but now rains are coming late around November and in most cases ending around February. Farmers in FGDs indicated that in the past, rain seasons started around 15 October but now it only starts raining around the first or second week of November. When the rains come early, like in the 2007/08 season, they normally fall heavily and cause damage to crops and people. The same sentiments were given by farmers in Monze and Sinazongwe, that the rains have become more and more unpredictable than before. These farmers also said that they used to expect the first rains in October but now they have to wait for mid-November and sometimes December for the first rains to come. Farmers indicated that now there is a higher incidence of dry spells, which have also increased in intensity. However, in Monze and Sinazongwe, farmers cited the unpredictability of the rains as having started in the late 1980s. These farmers also indicated that they have started experiencing

heavy rains and floods for the past two seasons. This is congruent with the finding that only small percentages of farmers in the household interviews attested to witnessing early rains (Figure 3).

The foregoing picture of increasing climate variability in the four sampled districts is consistent with the somber picture detailed in literature on climate variability and change in Africa in general and Southern Africa in particular. There appears to be an increasing trend towards a late start to the rain season, prolonged mid-season droughts, and shorter growing seasons in Southern Africa (Cooper *et al*., 2007; Love *et al*., 2006; Twomlow *et al.,* 2008 and Waiswa 2003). Moreover, variability in the annual rainfall total in the Southern Province in Zambia is more pronounced from the 1990s to date, where rainfall totals have frequently been seen below the 20 percentile and 80 percentile. The two lowest rainfall totals were also experienced from 1991 (Nanja 2004 in ICRISAT 2009). This is congruent with the observation that was made based on climate data for the Southern Province that all along, the major problem in the South is that there is often not enough rain and so the risks have been concerned mainly with drought. Floods are a recent phenomenon in Southern Africa (Stern 2007).

With regards to temperature, farmers in Lupane and Lower Gweru highlighted that temperatures have become hotter than before. Specifically, they reported that for the past five years, while the duration of the summer season has remained consistent, that is between September and April/May, the highest temperatures have been witnessed for an extended period from October to December and sometimes January. This is unlike the situation before this period when they would experience the highest temperatures in September and October. In addition, farmers had also started experiencing warmer winters than before. These winters have in recent years been extended to mid-September, a factor which they associated with the unpredictability and the late onset of the rains.
Similarly, in a study done across ten African countries, which include Zimbabwe and Zambia, farmers generally considered temperatures to have risen and precipitation to have decreased (Maddison 2006). Farmers in Monze and Sinazongwe similarly reported that temperatures have become warmer than before.

What is of interest is that there are more farmers in Monze and Sinazongwe than there are in Lupane and Lower Gweru indicating that they have witnessed changes in all the climate parameters highlighted in Figure 3. This could be linked to the fact that there are significantly more farmers in Zambia districts than there are in Zimbabwe districts who have access to weather information (Figure 4). This is based on the assumption that while farmers may already have a certain way of perceiving climate variability, access to weather forecasts enhances awareness of climate changes. Previous research has highlighted the critical role that access to weather information plays in shaping farmers' perceptions of climate variability and change (Deressa *et al.,* 2009; Mano & Nhemachena 2006). Those farmers with access to weather information could possibly be more inclined to notice changes in climate than those who have less access. For instance, at the time field work was conducted, farmers in Monze had weekly access to 'Radio Chikuni', which presents weather forecasts. Maddison (2006) shows that farmers with access to weather information and with more years of farming experience are more likely to be aware of changes in climate.

In the household survey, farmers in Lupane and Lower Gweru stressed that three consecutive seasons since 2004 were largely all bad seasons for them, while Monze

and Sinazongwe farmers indicated that in the same period, these seasons were both good and bad (Figure 5). It appears that farmers who have a lot of challenges to contend with may have their attention divided so much that they would less likely be able to notice changes in climate. In the same context, these multiple challenges may present a farmer with an option to prioritise concerns and cloud their perceptions of climate variability and change. This finding is buttressed by the fact that perceptions of danger and risk have been considered to be shaped by psychological, social, cultural and institutional processes (Lowe & Lorenzoni 2006). There is an indication that perceptions of farmers were clouded by a higher incidence of multiple stressors that Zimbabwe was facing at the time (a detailed presentation of these stressors is presented in section 3.3). A series of interlocking problems including hyper-inflation, perennial and acute food shortages, shortages of other basic commodities in the formal market and a critical shortage of farming inputs resulted in the ballooning of the proportion of the national population trapped in cycles of poverty and vulnerability in Zimbabwe (Gandure & Marongwe, 2006).

Awareness of specific climate parametres by district

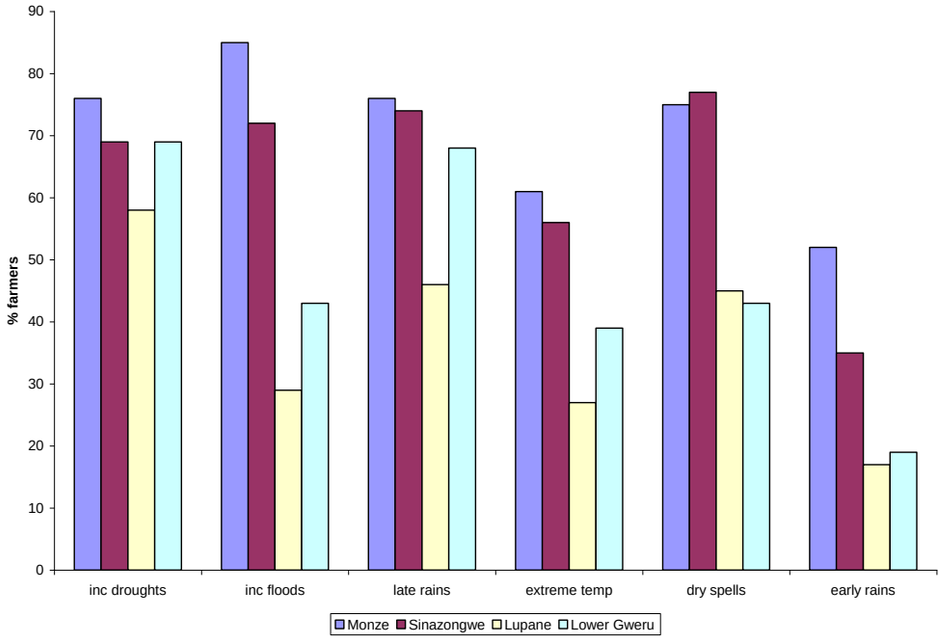

Figure 3: Farmers' access to weather information in the study districts in Zimbabwe and Zambia

Access to weather information by district

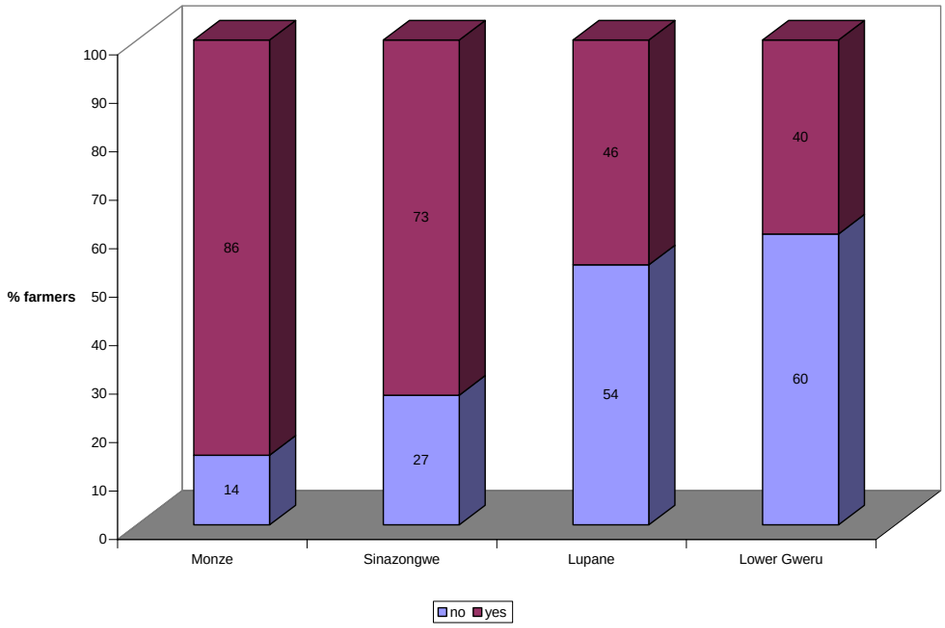

Figure 4: Perceptions of changes in weather for specific seasons between 2004 and 2007

3.2 Perceptions regarding causes of changes and variability in climate

In the survey, the greater proportion of farmers in both countries perceived climate change as purely a natural phenomenon, without any human intervention being responsible for climate change. This perception is more dominant in Sinazongwe and Monze than in Lupane and Lower Gweru (Table 1). These natural causes were cited as natural changes in winters, low/high temperatures and changes in wind movement, among others. In addition, there is an indication that farmers in both countries seriously disregard the role played by anthropogenic activities in the increase of climate variability and change. This fact is further reinforced by significant percentages of farmers in Lupane (45%) and Lower Gweru (27%), who assert that causes of climate change have also been due to factors such as the wrath of cultural spirits and God who have meted out punishment to Zimbabwe. The punishment has been for the failure of people to continue to appease their spirits and conduct traditional rites such as the rain making ceremony *(mukwerera)* for asking for rain from God and for showing gratitude for the rains in the previous season.

Table 1: Causes of climate variability and change by district

Causes of climate variability and change	Monze %	Sinazongwe %	Lupane %	Lower Gweru %
Natural causes	34	35	24	31
Deforestation	33	17	5	14
Believe its god's will/ nature, cultural beliefs	3	7	45	27
Does not know	30	41	26	28

Human induced causes of climate change, such as deforestation were highlighted, particularly by farmers in Monze (33%) and Sinazongwe (17%). In essence, Monze and Sinazongwe farmers who indicated that they are aware of causes of climate change dwell more on the scientific and technical issues such as natural causes than Lupane and Lower Gweru farmers who dwell more on cultural and spiritual issues. Understanding of farmers' perceptions of causes of climate change is important as this understanding might be decisive in determining farmers' responses and mitigation measures to the crisis. In essence, if farmers are not aware of the extent to which anthropogenic activities may alter climate related processes, the implication for adaptation and mitigation is negative. In the same context, the fact that significant percentages of farmers in all districts indicated that they are not aware of the causes of climate change may imply that these farmers would not make efforts to address human activities that may contribute to climate change and variability.

FGDs found that farmers in Lower Gweru and Lupane linked the political crisis in Zimbabwe at the time of the research and the decline of social and cultural practices to the variability in climate. Essentially, farmers do not only associate changes in climate with natural factors, but also with social and spiritual factors. The implication is that when there are political, social and economic problems in a country, farmers tend to link them to climate change. In addition, the cultural context and spiritual world view play a critical role in shaping farmers' perceptions and attitudes, a factor which may cloud farmers' consciousness of the negative effects of human activities on the earth systems. Similarly, some farmers in Monze associated the beginning of climate variability with the descendancy of one of their presidents into power. The period of his leadership was marred with controversy and linked to economic problems in Zambia at this time. What is emerging is the idea that we cannot disassociate climate change from the political, social (including the cultural and spiritual realms) and economic context. Farmers try to make sense of what is happening in their environment based on the socio-cultural framework in which they operate.

3.3 Multiple stressors at household and community levels

This section discusses farmer perceptions of a host of other stressors that compound climate change impacts. These perceptions were gathered through FGDs. The section further displays how farmers view climate change among other disturbances through a matrix scoring and ranking exercise.

3.3.1 Perceptions regarding other stressors among farmers

There is a general similarity in the stressors that were identified by farmers in all the four districts (Table 2). These include constraints for increasing agricultural production, such as lack of capital to purchase agricultural inputs, implements and chemicals for crops and livestock. In addition, farmers in these districts indicated that inadequate draught power also inhibits their capacity to maximise on crop yields. Loss of cattle due to disease and drought has led to limited draught power, which has reduced their ability to prepare larger pieces of land and on time. Furthermore farmers in all districts are faced with a lack of appropriate seed varieties and improved seed. Shortage of water for domestic use is another challenge that farmers in all districts have had to contend with. Farmers highlighted the high incidence of HIV and AIDS in both countries, although in Monze and Sinazongwe, the problem has been alleviated by the availability of Anti-retroviral Therapy (ART) and food assistance for the chronically ill.

What is emerging from the findings is that there is weakened government capacity in both Zimbabwe and Zambia districts in terms of provision of basic services to farmers. For instance, there was mention of non-functional dip-tanks and boreholes due to lack of maintenance. This would reflect the expectation that for substantial change to occur in the agricultural sector, it would need to be at least partially subsidised by the public sector (Wehbe *et al.,* 2006). While there is a convergence in the challenges faced by farmers, there are problems that are unique to each district. For Monze and Sinazongwe, farmers are faced with low pricing for both crops and livestock, specifically for cotton and vegetables for Sinazongwe. Low livestock prices are imposed on them by buyers who take advantage of them knowing that because they are poor, farmers will undertake the transaction as they need the money desperately. In addition, the type of cattle breed in the area is too small for them to realise higher prices. Improved breeds that were introduced for them by government were unable to adapt. The weakening of government capacity in Zambia districts is further displayed by the diminishing of credit facilities from government in Monze since 1999. The little inputs accruing from the facility were unevenly distributed.

There are more challenges that are unique to Lupane and Lower Gweru than those that are unique to Monze and Sinazongwe. In addition to the common problem of lack of capital to purchase inputs in both countries, farmers in Lower Gweru and Lupane have to further contend with the unavailability of these inputs on the market and late supply of the same inputs. These inputs are now coming from government and farmers only get them on the basis of their political affiliation, meaning that in the end, some of them lack access to inputs completely. These challenges are aggravated by lack of maintenance of roads and bridges in Lupane and Lower Gweru. In this respect, farmers in Lower Gweru highlighted that when they do manage to get some of their gardening produce (the rest goes bad when they are in the process of finding transport) to the market after struggling with transport problems, the money obtained from their sales loses value fast within a period of one day due to hyper-inflation. The greater proportion of the income is also swallowed by high transport costs. As a result, these farmers have had to contend with a drastic reduction in income and food availability more than farmers in Monze and Sinazongwe (see Figure 6).

It is also emerging that stressors in the different districts directly relate to specific economies of these districts and these farmers' livelihood strategies. For instance, although there have been problems related to livestock in all districts, most of the stressors highlighted by farmers in Sinazongwe and Lupane are related to livestock issues and this underscores the importance of livestock in the economy of these districts. In addition, both Sinazongwe and Lupane farmers highlighted that they experienced shortages of veterinary chemicals that were important for their livestock. The same is somewhat true for Monze where diminished dipping facilities were identified. The economies of these districts are livestock based and Monze also falls within the Southern Province of Zambia, which has the largest livestock population in the country. Veterinary services in Lupane also diminished and this had a negative effect on the well-being of their livestock, which were affected especially during the rainy season by a plant that kills cattle (*mkhawuzane).*

Table 2: Multiple stressors by District

Monze	**Sinazongwe**	**Lower Gweru**	**Lupane**
Lack of financial capital to purchase	Imposed low livestock prices by	Late supply of inputs	Lack of chicken feed

agricultural inputs	buyers		
Erratic rainfall	Lack of improved cattle breeds	Lack of capital to buy inputs and farming implements	Lack of a bridge for the major river
Inadequate draught power due to a high frequency of livestock diseases	Low market price for vegetables	Inappropriate seed being supplied	Unavailability of inputs
Dams quickly dry up- there are no running rivers in the area	Streams and boreholes dry up early	Lack of transport to market produce	Lack of capital
Few dams for livestock watering	Pests and diseases in crops (vegetables)	Climate variability (Erratic rains, frost, drought)	Inadequate farming implements
Non- functional dip tanks	Floods and droughts	Inadequate draught power	Low soil fertility
Limited knowledge with regards to farming	Lack of money to meet charges for vet services	Unavailability of chemicals for crops	Limited knowledge on farming
Low selling prices of crops and livestock	Lack of improved seed varieties	HIV and AIDS	There are few mills and are far away
HIV and AIDS	Limited draught power and farming implements	Crops destroyed by livestock	Climate variability (low/excessive rains)
Limited access to credit facilities	Shortage of livestock drugs	Bad roads	Lack of pesticides/chemicals
Untimeliness of weather forecast information	Human diseases e.g. malaria, diarrhoea and HIV/AIDS	Lack of irrigation equipment	Inadequate draught power
Reduced access to information on weather forecasting		Unavailability of drugs in clinics	Shortage of water for domestic use
		Unavailability of water for domestic purposes (Non-functional boreholes)	Diminishing veterinary services

Farmer perceptions of three seasons by district

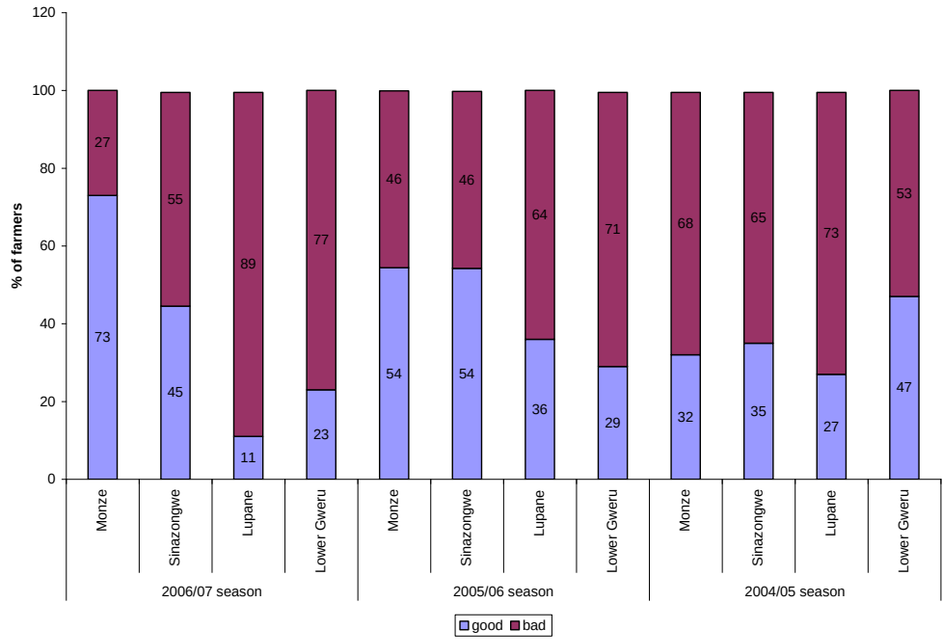

Figure 5: Perceptions of changes in weather for specific seasons between 2004 and 2007

Changes in farming systems by district over a five year period

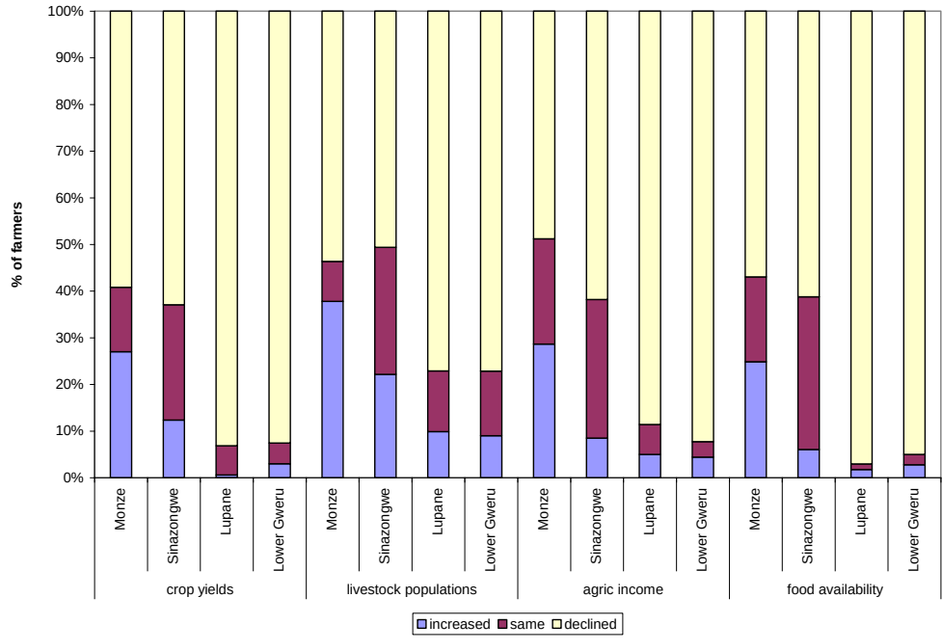

Figure 6: Farming systems changes due to climate variability and change in the study areas by district

3.3.2 Perceptions regarding climate change in relation to other stressors

The background in section 3.3.1 supports the concept of 'double exposure', which refers to the fact that regions, sectors, ecosystems and social groups will be confronted both by the impacts of climate change and other factors that are not climate-related (O'Brien &

Leichenko 2000). While there is a multiplicity of stressors that bedevil smallholder farmers in all the four districts in Zimbabwe and Zambia, climate variability and change in its different forms such as erratic rains, frost, droughts and floods are the most critical given that it was ranked first by farmers in all the sampled districts (see Tables 3-6). Data in tables 3-6 is from the matrix scoring and ranking exercise conducted during a workshop and shows points allocated by participants to each stressor under a specific criterion. There was consensus from farmers' reports to the effect that while there are a multiplicity of challenges that they have to contend with, farmers still find that most of these challenges emanate from the recent changes and variability of climate. This is consistent with findings from a study done by Thomas *et al.* (2007), that while climate does not operate in isolation from other factors, it does play a significant role in how people attempt to shape their livelihoods for the future. Farmers suggested that constraints such as lack of capital to buy food and agricultural inputs, shortage of draught power, imposed and low livestock prices and pests and diseases for crops and livestock, among others, are linked to climate variability and change. For Lupane and Lower Gweru, this finding is consistent with the assertion by the IMF (2003) that the more recent difficulties with governance, mismanagement and inflation in Zimbabwe, for example, were not anywhere near as problematic at the time of the drought in 1992/3.

Table 3: Consideration of climate change with regards to other stressors in Monze

Stressor	Food insecurity	Loss of income	Insecure livelihoods	Total	Rank
Erratic rainfall	20	10	18	48	1
Lack of capital	10	20	15	45	2
Drying up of water sources	12	14	13	39	3
Few dams	10	15	8	33	4
Shortage of draught power	15	10	7	32	5
Lack of knowledge	9	12	10	31	6
Non- functional dip tanks	6	4	10	20	7

Table 4: Consideration of climate change with regards to other stressors in 484 **Sinazongwe**

Stressor	Loss of income	Food insecurity	Total	Rank
Floods and droughts	20	20	40	1
Imposed livestock prices	15	17	32	2
Lack of improved cattle breeds	20	10	30	3
Not able to meet charges for vet services	17	8	25	4
Pests and diseases for vegetables	15	6	21	5
Streams drying up early	10	5	15	6
Low market price for vegetable	5	5	10	7

Table 5: Consideration of climate change with regards to other stressors in Lower Gweru

Stressor	Loss of crop yield	Loss of income	Insecure livelihood	Total	Rank
Climate variability (Erratic rains, frost, drought)	18	16	16	50	1

Shortage of drugs in clinics	16	16	16	48	2
Late supply of inputs	14	16	14	44	3
Lack of transport to market produce and bad roads	10	18	12	40	4
HIV and AIDS	10	10	14	34	5
Lack of draught power	12	10	6	28	6

Table 6: Consideration of climate change with regards to other stressors in Lupane

Constraints	Food security	Income generation	Total	Rank
Climate variability	20	20	40	1
Unavailability of inputs	15	10	25	2
Lack of farm implements	10	11	21	3
Lack of livestock chemicals	10	10	20	4
Low soil fertility	5	5	10	5

4.0 Conclusions

This study concludes that farmers' perceptions relate more to climate variability than to climate change. While farmers report changes in local climatic conditions consistent with climate change, there is a problem in that these farmers may be assigning observed negative impacts on the agricultural and socio-economic system solely to climate variability. While farmers are able to recognize changes in climate and to explain low agricultural performance and low well-being in terms of climate variability, when there are political, social and economic problems in a country, farmers may not be able to disentangle contribution of each factor to observed outcomes. In addition, with wider and a complexity of challenges to deal with, small-scale farmers may be less inclined to notice changes in climate parameters. Socio-cultural and spiritual factors dominate farmers' views on why climate is changing. The fact that farmers link the causes of climate change more to their socio-cultural realms than to human activities may be a cause for concern for farmers' decision making processes in climate change adaptation. This has implications for environmental management issues in that farmers may fail to realize the importance of environmental management activities. The dynamics of the differences in perceptions are therefore important to understand as this study found that local conditions determine the extent to which farmers perceive changes and variability in climate. In this regard, there is need to acknowledge the inherent capabilities of small holder farmers and to strengthen their capacity and that of institutions for identifying and assessing climate changes. This can be done through programmes to educate these farmers and other relevant stakeholders on climate change and variability and their potential impacts on farmers' livelihoods. This study further concludes that while there is a multiplicity of stressors that confront farmers, climate variability and change remain the most critical for these farmers. Against this assertion, there is need to make a transition *from* designing policies that target climate change issues as a distinct entity *to* policies that address climate change issues as an integral component of multiple stressors that confront farmers, in order to improve climate change planning.

Acknowledgements

The authors are grateful for funding from IDRC and DFID through Climate Change Adaptation in Africa (CCAA) and also for additional funding from START and

CODESRIA. The authors also thank the following who contributed as collaborators and researchers in the field work: researchers from Zambia Agricultural Research Institute (ZARI), Zambia Agro-Met and researchers and students from Midlands State University (MSU), Zimbabwe and ICRISAT, Zimbabwe.

References

Beg, N., Corfee J., Davidson, O., Afrane-Okesse, Y., Tyani, L., Denton, F., Sokona, Y. and Thomas, J.P. (2002) Linkages between climate change and sustainable development.
Climate Policy, vol. 2 pp. 129-144

Clay, E., Bohn, L., der Armas, E. B., Kabambe, S., and Tchale, H. (2003) *Malawi and Southern Africa: Climate Variability and Economic Performance.* Working Paper Series No. 7, Disaster Risk Management.

Cooper, J. P.M., Dimes, J., Rao, K. P. C., Shapiro, B., Shiferaw, B. and Twomlow, S. (2006) Coping better with current climate variability in the rain-fed farming systems of Sub-Saharan Africa: A dress rehearsal for adapting to future climate change? Global Theme on Agro ecosystems. Report no 27. Bulawayo, Zimbabwe. International Crops Research Institute for the Semi-Arid Tropics.

Cooper, P., Singh, P., Traore, P. C. S., Dimes, J., Rao, K. P. C., Gerard, B., Alumira, J., Shiferaw, B., Twomlow, S., (2007) New Tools, Methods and Approaches in Natural Resource Management. ICRISAT, India. Patancheru 502 324, Andhra Pradesh, pp. 68

Crosson, P.R. (1986) Agricultural development: looking to the future. In Clark, W.C. and Munn, R.E. (eds.) *Sustainable Development of the Biosphere,* pp. 104-136. Cambridge University Press. Cambridge.

Crosson, P.R. (1993) Impacts of climate change on the agriculture and economy of the Missouri, Iowa, Nebraska, and Kansas (MINK) region. In Kaiser, H.M. and Drennen T.E. (eds.) *Agricultural Dimensions of Global Climate Change,* pp. 117-135. Delray Beach, FL. St. Lucie Press, Davies, S. (1993) Are Coping Strategies a cop out? *IDS Bulletin*, vol. 24(4), pp. 60-70.

Department for International Development (DFID) (1999) *Sustainable Livelihoods Guidance Sheets*. IDS. London

Deressa, T.T. (2009) Determinants of farmers' choice of adaptation methods to climate change in the Nile Basin of Ethiopia. *Global Environmental Change,* vol. 10 (2), pp. 55-62

De Wit, M. 2006. Climate Change and African Agriculture. Accessed on 23 March 2009 http://www.ceepa.co.za/docs/POLICY%20NOTE%2011.pdf

Diggs, D.M. (1991) Drought experience and perception of climatic change among Great Plains farmers. *Great Plains Research,* vol. 1, pp. 114-132.

Gandure, S., 2005. *Coping with and adapting to drought in Zimbabwe.* Unpublished thesis submitted to the Faculty of Science, University of Witwatersrand, Johannesburg, in fulfilment of the requirements of the degree of Doctor of Philosophy.

Gandure, S. and Marongwe, N. (2006) Hunger and Vulnerability in Zimbabwe, Regional Hunger and Vulnerability Programme. Unpublished, Centre for Applied Social Sciences (CASS). Harare.

Gbetibouo, G. A. Understanding Farmers' Perceptions and Adaptations to Climate Change and Variability: The Case of the Limpopo Basin, South Africa (2009**)** IFPRI Discussion Paper 00849 February

ICRISAT (2009) Managing Climate Risks and Capturing Opportunities in the Rain fed Farming Systems of the Semi-Arid Tropics; Lessons from Eastern and Southern Africa. Accessed on 25 March 2009 http://www.icrisat.org/gt-aes/Climate_Change_Poster.pdf

IMF (2003): 'Fund assistance for countries facing exogenous shocks'. Prepared by the Policy Development and Review Department (In consultation with the Area, Finance, and Fiscal Affairs Departments), Washington, DC: IMF.

Kinuthia, J.H. (1997) Global Warming and Climate Impacts in Southern Africa: How Might Things Change? *Internet Journal of African Studies* Accessed July 17, 2006. http://www.brad.ac.uk/research/ijas/ijasno2/kinuthia.html

Love, D., Twomlow, S., Mupangwa, W., van der Zaag, P., Gumbo, B. and Nyabeze, W. (2006) Implementing the millennium development food security goals – challenges of the Southern African context. *Physics and Chemistry of the Earth* vol. 31, pp. 731–737.

Lowe, T. D. and Lorenzeni, I. (2006) Danger is all around: Eliciting expert perceptions for managing climate change through a mental models approach. *Global Environmental Change*, vol. 17, pp. 131-146

Maddison, D. (2006) The perception of and Adaptation to Climate Change in Africa. Special Series on Climate Change and Agriculture in Africa. CEEPA Discussion Paper No. 10 Discussion Paper

Mano, R. and Nhemachena, C. (2006) *Assessment of the economic impacts of climate change on agriculture in Zimbabwe: a Ricardian approach.* CEEPA Discussion Paper No. 11. Centre for Environmental Economics and Policy in Africa.: University of Pretoria. Pretoria, South Africa.

Mapfumo, P. R., Chikowo, F., Mtambanengwe, S., Adjei- Nsiah, F., Baijukya, R., Maria, A., Mvula, D. and Giller, K. (2008) Farmers' perceptions lead to experiment LEISA Magazine 24.4 December

Mudimu, G. (n.d.). Zimbabwe food security issues paper. Forum for Food Security in Southern Africa.

Nhemachena, C. and Hassan, R. (2008) Determinants of African farmers' strategies for adapting to climate change: Multinomial choice analysis. *AfJARE***,** Vol. 2 (1) March.

Nyong, A. and Niang-Diop, I. (2006) Impacts of Climate Change in the Tropics: The African Experience, in Schellnhuber, H. J. (ed.) *Avoiding Dangerous Climate Change.* Cambridge University Press. Cambridge.

O'Brien, K.L. and Leichenko, R.M. (2000) Double exposure: assessing the impacts of climate change within the context of economic globalization. *Global Environmental Change*, vol. 10, pp. 221-232.

Saarinen, T.F. (1966) *Perception of the Drought Hazard on the Great Plains.* University of Chicago Press. Chicago. Sokona, Y. and Denton, F. (2001) Climate change impacts: can Africa cope with the challenges? *Climate Policy*, vol. 1, pp. 117-123.

Stern, N., 2007: *The Economics of Climate Change: The Stern Review*. Cambridge University Press, Cambridge, 692 pp.

Taylor, J. G., Stewart, T. R. and Downton, M. (1988) Perceptions of drought in the Ogallala Aquifer region. *Environment and Behavior, vol*. 20, pp. 150-175.

Thomas, D. S. G, Twyman, C., Osbahr, H. and Hewitson, B. (2007) Adaptation to climate change and variability: farmer responses to intra-seasonal precipitation trends in South Africa Climatic Change. *Climate Research,* vol. 83, 301–322

Twomlow, S., Mugabe, F. T., Mwale, M., Delve, R., Nanja, D., Carberry, P. and Howden, M. (2008) Building adaptive capacity to cope with increasing vulnerability due to climatic change in Africa – A new approach. *Elsevier-Physics and Chemistry of the Earth,* vol. 33, pp. 780-787

Tyson, P.D. (1991)' Climatic change in southern Africa: past and present conditions and possible future scenarios'. *Climatic Change*, **18**: 241-258.

Vedwan, N., and Rhoades, R. E., 2001. Climate change in the western Himalayas of India: a study of local perception and response. *Climate Research*, vol. 19:109–117.

Waiswa, M. (2003) *Strategic choices for enhancing capacity of rural communities adapt to climate variability: A case for Uganda. Insights and Tools for Adaptation Learning from Climate Variability* 18-19 November Washington DC, United States of America

Wehbe, B. (2006) Local Perspectives on Adaptation to Climate Change: Lessons from Mexico and Argentina. Working Paper No. 39.

Salé Abou

Mr Salé Abou[1]
Dr Obwoyere Obati[2]
Pr Lenah Nakhone[2]
Dr Winkar Lendzemo Venasius[1]

[1] Institut de Recherche Agricole pour le Développement (IRAD), Maroua-Cameroun
[2] Crop Management, Research and Training Centre (CMRT), University of Njoro-Kenya

Le département de Kibwézi, situé au sud-est du Kenya, fait partie des régions arides de l'Afrique où les populations sont sérieusement affectées par les effets des changements climatiques. Les Agroéleveurs particulièrement sont plus touchés à cause du caractère fragile des ressources qu'ils utilisent. Néanmoins, ces populations pour des besoins d'adaptation, ont développé diverses stratégies provenant de sources d'information variées.

Dans le but d'évaluer la contribution des diverses sources d'information à l'amélioration de l'adaptation des populations aux changements climatiques, nous avons réalisé une étude de Mai à Septembre 2009.

Comme méthodologie, nous avons sillonné comme transect toutes les principales rues liant les différents villages, et nous avons soumis un questionnaire à 186 chefs des ménages que nous rencontrons dans leurs maisons après chaque 300 m ou 500 m de parcours. Nous avons utilisé le logiciel statistique SPSS, et particulièrement les statistiques descriptives et le multivariate probit model.

Il ressort que les principales techniques d'adaptation restent les terrasses pour les cultures et les sols, la vaccination et l'utilisation des résidus de récoltes pour le bétail, et l'achat d'eau de pompe pour l'eau. Les principales sources d'informations restent les services techniques publiques et privés, la radio, les vendeurs d'intrants agropastoraux, les ONGs, les églises, les associations communautaires, les parents, les voisins, l'expérience, et l'école. De même, l'éducation, les services techniques, les vendeurs d'intrants et la radio ont une influence significative sur l'adaptation. Il serait intéressant que l'Etat Kenyan renforce octroie des crédits aux chefs de familles pour leurs d'accroître leurs revenus et de scolariser leurs progénitures. Il doit multiplier les services techniques, organiser les vendeurs d'intrants agropastoraux, installer des radios rurales. Il doit créer des barrages sur la rivière Athi et subventionner l'achat des tanks et des serres pour permettre aux populations de produire à contre-saison (cultures, fourrages).

Felix Olorunfemi

FLOOD RISK MANAGEMENT IN DIVERSE CONTEXTS: EXAMPLES FROM NIGERIA AND SOUTH AFRICA*

Olorunfemi, F.B (PhD)[1], Battersby-Lennard, Jane (PhD)[2] and Raheem, U.A[3]**

[1]Nigerian Institute of Social and Economic Research (NISER), PMB 05, U.I P.O, Ibadan, Nigeria. E-Mail: felixba2000@yahoo.com
[2]Climate Systems Analysis Group, University of Cape Town, Rondebosch, 7701, South Africa. Email: Jane.Battersby-Lennard@gmail.com
[3]Department of Geography, University of Ilorin, Ilorin, Nigeria. Email: adebimpeusman@yahoo.com
****** Corresponding Author

Paper summary

There is a growing need to address vulnerabilities to climate change through adaptation efforts, complementing mitigation efforts aimed at reducing the rate and magnitude of climate change. At present, this development has taken place largely in parallel to the increasing shift from disaster management to disaster risk management. Disasters are associated with extreme weather events. Climate change directly interacts with the exposure to climatic extremes. The challenge in the context of adaptation is to move from the understanding that climate change is occurring to concrete measures that reduce existing vulnerabilities of human and natural systems. Furthermore, Local experiences of extreme weather events have made it obvious that climate change mitigation and adaptation are matters of multi-level governance. People living in the informal settlements in Cape Town have been identified to be among the three key groups that are most vulnerable to climate change impacts in the Western Cape Province in South Africa. On the other hand, extreme weather events especially floods and rainstorms affect households each year in the city of Ilorin affecting the poorest and most vulnerable people in the city and contributing to endemic poverty in most parts of Kwara State of Nigeria.

This study focused on impacts and responses to flood risk among these urban poor living in the highly vulnerable informal settlements in the Cape Flats in the City of Cape Town and those living along the Asa River channel in the city of Ilorin. It explores the underlying vulnerabilities of the two areas and the challenging problem of how to effectively shape human institutional responses to the risk of natural disasters with a special focus on floods. The study is driven by the underlying assumption that human vulnerability to natural disaster, particularly, those that are weather and climate related, illustrates the inter-relatedness of governance and environment related issues. Central questions are what generates vulnerabilities and what improves resilience in people's livelihoods, and how can we build on people's own responses, providing a range of institutional support, and promoting resilience and adaptive capacity among vulnerable

people in the affected areas. The study supports the emerging view that places adaptation to shocks associated with climate change as a subset of disaster risk reduction.

The social risk management (SRM) and asset-based approaches on which the study is conceptually based as developed by Helteberg et al, 2008, presents and applies the social risk management and asset-based approaches to the context of climate change. These approaches provide a conceptual framework for understanding the sequential links between risks; human exposure and sensitivity; the impacts of risky events; and risk management (or adaptation) strategies. This provides a unifying conceptual framework to examine the characteristics of the risks faced by households; how adaptation responses at multiple levels depend on livelihoods, policies, and institutions; and household vulnerability outcomes. It highlights the importance of a multidimensional and equitable approach to adaptation policy and the need to include higher level (national and international) risk management interventions.

Approaches to managing flood risk in the two cities are also examined within the context of disaster risk governance. It posits that the governance frameworks required for disaster risk reduction give governments a key role through coordination and participation mechanisms. This requires the definition of policy, establishment of robust institutions, local authority capacity-building, and partnerships between numerous stakeholders, including civil society, NGOs and private sector. In short it requires participatory management of disaster risk reduction (Diagne and Ndiaye, 2009). Where forms of governance preclude effective community participation and discourage co-management practices, local resilience tends to be low and adaptive capacity limited (Finan and Nelson, 2009). On the other hand, a more resilient socio-ecological system operates in a multi-nodal, well articulated decision-making context where knowledge production and learning are dynamic and stocks of social capital generate bonds of trust (Gaventa, 2002). Given this key relationship between governance and successful adaptive management, it appears logical that the support of appropriate governance institutions would constitute a priority element in an overall adaptation strategy.

This study relied on the use of primary and secondary data. In Cape Town, primary data were obtained mainly from the result of interviews with key informants at the community level as well as visual observations to determine the physical vulnerability of the selected communities. Interview on the management flood disasters and related risks were conducted with the officials of the Informal Settlements Unit in the Department of Housing of the City of Cape Town office. Interview was also conducted with some members of the Disaster Mitigation for Sustainable Livelihood Programme (DiMP) of the University of Cape Town (UCT). Secondary data were sourced relevant bodies, including City of Cape Town's Department of Housing, DiMP and African Centre for Cities (ACC), both of the University of Cape Town. Socio-economic and demographic profiles of the informal settlements were obtained from studies conducted by the City of Cape Town. In Ilorin, the secondary data were collected mainly from the National Emergency Management Agency, Kwara State office. The data collected include the details of various disaster incidents in the State between 2002 and 2007. Aside this, data were collected form households that occupied the properties destroyed by rainstorms and

floods during the period under study. Primary data wee captured from the questionnaires administered to flood victims and residents along Asa river channel.

The outcome of the study shows marked differences in the vulnerability factors and the management of flood related disasters in the two study areas. Furthermore, it was revealed that the indigenous coping mechanisms employed by the poor may become less effective as increasingly fragile livelihood systems struggle to withstand disaster shocks. Given the fact that many risks in informal settlements and vulnerable communities in the two cities are strongly rooted in social and economic vulnerability, along with unstable sources of livelihood, closer cooperation and confidence between settlement residents and local authority representatives as well as other stakeholders can improve municipal service delivery, infrastructure development as well as strengthen local responsibility for recurrent risks. This would serve as a good entry point between coping with flood disasters to adaptation in the medium and long run. Cape Town has moved progressively in this direction while the same cannot be said of Ilorin. Strategies to reduce vulnerability should be rooted in vulnerability analysis and greater understanding of both household-level and macro response options that are available to decrease the poor's exposure to climate risk. Increasing the response-capability in the two cities will require information on seasonal forecast to enable the preparedness to climate variability as well as longer term climate prediction data to ensure that strategies to reduce vulnerability also reflect the underlying longer-term climate trends.

It seems increasingly accepted (although not consistently implemented) that disasters shouldn't be dealt with through humanitarian relief interventions alone as currently obtained in the city of Ilorin, just like many other cities in Nigeria. Rather, focus should be on addressing the causes of vulnerability in order to mitigate the effects of disaster. However, the approach tends to address only the visible signs of vulnerability, such as poor access to services, and generally fails to make a deeper analysis based on the maintenance of sustainable livelihoods by vulnerable people. Vulnerability is seen as a physical problem which can be addressed mainly through technical solutions such as infrastructure development which may not even be provided at the appropriate time. Again, this approach generally fails to take into account the views, capacities, knowledge and priorities of local people and is thus limited in effectiveness in truly reducing vulnerability. For all practical purposes, there are many lapses in the management of flooding in the city.

On the other hand, a major achievement of the City of Cape Town administration in the management of flood risk is that the percentage of flooded settlements has remained fairly stable in the past few years. As part of the City strategy to combat flood risk and other hazards in the informal settlements, there is now a decentralised management system whereby different departments are now charged with different aspects of managing flood risks in the informal settlements. Some of the departments in charge of flood risk management in the informal settlements include department of housing, sanitation, stormwater, basic services department etc. A summary account of flood risk management and governance issues in the two cities is presented in Table 1.

Table 1: Managing flood risk in the Cities of Ilorin and Cape Town: A comparison

	Cape Town	**Ilorin**
Weather Information	Cape Town weather data, CSAG	None at the city level
Response timing	Before and after vents response,	After event response
Response type	Preparedness, early warning, relief	Post disaster relief
Management structure	Disaster management Unit of the Department of Housing (informal settlements)	Kwara State Emergency Management Agency
Long term plan	Upgrading/relocation	None
Governance of disaster Risk (flooding)	Multiple sectors of administration at various levels, horizontal and vertical, stakeholders involvement	No evidence on ground
Long term climate risk governance	Multiple sectors of administration at various levels, horizontal and vertical, stakeholders involvement	No evidence on ground

Given the fact that many risks in the physically vulnerable settlements are strongly rooted in social and economic vulnerability, along with unstable sources of livelihood, closer cooperation and confidence between settlement residents and local authority representatives as well as other stakeholders can improve municipal service delivery, infrastructure development as well as strengthen local responsibility for recurrent risks. The City of Cape Town is currently addressing many of these issues within the context of governance of disaster risk and long term climate risk posed by climate change.

Keywords: Climate change adaptation, Vulnerability, Disasters, Flood risk, Informal settlements, Cape Town, Ilorin

***** This paper is based on a two-part study. The first study was conducted in the first part of 2009 in the city of Ilorin. The second study was conducted in the City of Cape Town between August and December 2009. It was a research project implemented in the University of Cape Town under a Policy Fellowship awarded by the Global Change SysTems for Analysis, Research and Training (START), Washington DC under the African Climate Change Fellowship programme (ACCFP). ACCFP is a programme of the Climate Change Adaptation in Africa (CCAA), funded by International Development Research Council (IDRC) and the Department for International Development (DFID). The funding and support provided by these bodies to the lead author are hereby acknowledged.

Cyriaque-Rufin Nguimalet

Comparison of Communities' adaptation strategies in Kenya and CAR catchments to droughts and floods

Cyriaque-Rufin Nguimalet
Département de Géographie, Faculté des Lettres et Sciences Humaines (Université de Bangui), B.P.: 1037 – Bangui, République Centrafricaine - E-mail: cyriaquerufinnguimalet@ymail.com,

Summary: Droughts and floods are climate variability's' indicators (Odingo, 1962; Akong'a et al., 1988; Paturel et al., 1998; Conway, 2002; Kane, 2002; Davoka, 2004; Daniell, 2009; Nguimalet, 2010a and b). These ones require a necessary research of relief to the populations or strategies/solutions which the skills allow them to minimize the aforementioned phenomena effects, which can be related to their sociocultural and socioeconomics capacities. These phenomena imply water management and local strategies elaborated by communities as well as included in national policy framework or not. Policy dimension would justify the support and orientations legal framework to give facing the similar «crises» for reinforcing communitarian or traditional initiatives for the development of interconnected structures. Because the extreme events' manifestations, impacts and responses can be transboundary (Goulden et al., 2009), that shows the stake of the local strategies appropriateness or improving for transposition in the similar conditions. In general, the degree of communities' affectation by these phenomena generates the interventions as well from humanitarian NGOs or others as Governments, that according to the disaster/catastrophe intensity.

Droughts and floods are hydro-climatic extremes which traditionally agitate the local communities' life in Africa, particularly in Lake Naivasha (Kenya) and Central African (Tomi, Gribingui and Fafa) catchments. In this direction, they pose a major concern for water management in terms of 'harmful' abundance of water destroying harvests, housings or generating human life losses, such as floodings; or of water scarcity resulting to severe drought, hypothecating husbandries (water stress, low productivity), pastoralist or extra-agricultural activities, generating access conflicts to resource etc. Beyond the extreme events manifestations which are droughts and floods cover a characteristic today because not only they express the paroxysms of climatic degradation, but also challenges or threats due to climate change effects. Then, the mastery of these phenomena deserves to be re-thought/reconsidered throughout the means and skills used until to date by communities i.e. their adaptation strategies. According to Smit and Pilifosova (2001, quoted by Goulden et al., 2009), *adaptation* describes "changes in processes, practices and structures to moderate potential damages or to benefit from opportunities associated with climate change" and *adaptive capacity* refers to "the potential, or ability of a system to adapt to climate change stimuli or their effects or impacts".
This paper presents and analyzes the adaptation strategies to these phenomena taking into account socio-economic capacity in the studied basin-slopes. Adaptation strategies data were collected by questionnaire and interview, directed mainly to people having 40-50 years and above and having resided a long time in the locality (20 to 30 years); a pre-testing was initially carried out (Nguimalet, 2010b). The concern was to identify the extreme events most current affecting communities and their activities in both sites and to encircle the respective adaptation mechanisms. Survey information's treatment was statistical in the aim to characterize gotten trends for establishing climate variability/degradation effect through the hydrological extremes' violence and alternatives described locally en terms of adaptation.

Most of surveyed perceived droughts like the major extreme event in Lake Naivasha basin and floods and droughts in Central African basins alternatively. The strategies against floods are the removal, dams and search for relief in Lake Naivasha basin, while to also move, to use water of drilling for drinking, to dig gutters for evacuating/absorbing water and to request the NGOs support were proposed in Central African basins. Against droughts, a change of activity, traditional sinking near the rivers, water purchase, use of water of drilling or going elsewhere are the collected strategies in Central African basins. On the other hand, boreholes construction, food purchase, and search of relief or water from traditional wells are the suggested strategies of communities in Lake Naivasha basin.

Water scarcity which is drought resultant has more affected local communities and their activities these last years in twice study sites, being justified by shortening of rainy season or dry period insertion in rainy season and low-water levels severity. What is spectacular of these results is that extreme events and their corollaries were distinguished this last decade, especially since 1999-2000s so much in Central African basins than Kenyan, even if water scarcity started to be felt very early in Central African basins placed in Soudano-Guinean zone of wet tropical climate, and the recent data absence did not allow to couple the investigation results and measurement. These phenomena traces or marks were observed by the houses ruins, river deposits, removed roofs or the multitude around water points in Central African basins, and by drying-up of rivers, crop plants failure and death of cattle in Lake Naivasha basin (Nguimalet, 2010a). Thus, drought effect occurred on water resources availability and accessibility of local communities in various basins.

It is true that sociocultural environment of local communities determined the suggested strategies for these extreme events, but it is important to believe or admit that a deprivation in material, logistic and financial resources reduces their rooms for maneuver in this combat against climate change impacts in Africa. Especially in this direction, the awaited results of this study on the part of local communities appear elaborate and ambitious that requires actions of scale in order to help them to adapt and to improve their strategies of water management or relating to its problems according to suggestions from local communities per basin or site of study (Nguimalet, 2010b). In Lake Naivasha basin, local communities plan to initiate irrigation for reducing water shortages, afforestation, the information campaigns on climate change and its impacts, environmental protection and water purification. As for Central African basins, the main part of suggestions from communities is articulated around the multiplication of water drillings, sensitizing and training on climate change, financial support and material with peasants/farmers, sources and traditional wells installation, water and forests protection against bushfires or revision of the agricultural calendar. These populations perceptions revealed gaps of all kinds which insert local communities or mislay them in their fight against `climate change' in question to lean there in order to contribute assisting them to adapt, considering water resources degradation per basin or study site is a problem for all or global.

All these strategies, close relations from/to each other, establish almost a renewal of the traditional strategies and correspond to the sociocultural and socio-economic level of local communities, but their average annual incomes varying from USD66 to USD222 are weak to raise their adaptation capacities. Adaptation is individual and institutional beyond the social and economics considerations; but in both sites, the institutional side is poor and the Government interventions are random, depending to the disasters' intensity degree. The strategies efficiency can be described by the improving degrees leading to face more severe, catastrophic phenomena. From that, would result the strategies sustainability, even their trans-boundary aspects/roles. An improvement will be necessary to harden communities facing the rare phenomena per basin, and would guide a national or transnational adaptation policy. So, Conway (2005) thinks "adaptive actions can be implemented across all levels of society at local, national and international scales; but in all cases actions related to climate variability or climatic change occur within a decision-making framework that encompasses wider socio-economic and political considerations". In

addition according to Kabat *et al.* (2002, quoted by Golden et al., 2009), examples of adaptations to climate change in the water sector in developing countries are less documented, perhaps because developing countries have many other pressing issues to tackle, but fewest investments are directed solutions research over water issues or management. To be effective, adaptation should fit with existing management systems and objectives.

Goulden et al. (2009) shown that the impacts of climate change and other stresses on water resources and changes to flooding risks in the future will require adaptation on the part of water resource management institutions and water users. That means policy makers in twice study sites should allow all means by which local adaptation strategies for communities would be supported and improved for their wellbeing and the kindness of their respective areas throughout promising future if communities will be able to come up some droughts and floods challenges themselves.

Key words: Comparative communities' adaptation strategies, Kenya, CAR, catchments, droughts, floods.

References

Akong'a, J., T.E. Downing, N.T. Konijn, D.N. Mungai, H.R. Muturi and H.L. Potter, 1988. The effects of climatic variations on agriculture in central and eastern Kenya. Dans: The Impact of Climatic Variations on Agriculture, Assessments in Semi-Arid Regions [Parry, M.L., T.R. Carter et N.T. Konijn (éd.)]. Kluwer Academic Press, Dordrecht, Pays-Bas, p. 123–270.

Conway D. (2002). Extreme rainfall events and lake level changes in East Africa: recent events and historical precedents. In *The East African great lakes: limnology, palaeolimnology and biodiversity* (ed. E. O. Odada & D. O. Olago) Advances in Global Change Research vol. 12, pp. 63–92. Dordrecht: Kluwer.

Conway, D., 2005: From headwater tributaries to international river: Observing and adapting to climate variability and change in the Nile basin. *Global Environ. Change*, 15A, 99–114.

Dakova Sn., 2004. Low Flow and Drought Spatial Analisys. In: *Droughts and Floods*, Balwois, Ohrid, FY Republic of Macedonia, 25-29 May 2004, 11 p.

Daniell T. M., 2009. The implications of a decade of drought in Australia (1996-2007). *Sécheresse*, **20 (1)**, janvier-février-mars, 2009, 171-180.

Goulden M., Conway D. & Persechino A., 2009. Adaptation to climate change in international river basins in Africa: a review. *Hydrological Sciences–Journal–des Sciences Hydrologiques*, **54**(5) October 2009, 805-828.

Kabat, P., Schulze, R. E., Hellmuth, M. E. & Veraart, J. A. (eds) (2002) *Coping with the Impacts of Climate Variability and Climate Change in Water Management: A Scoping Paper.* DWC report DWCSSO-01 (2002) International Secretariat of the Dialogue on Water and Climate, Wageningen, The Netherlands.

Kane A. (2002). Crues et inondations dans la basse vallée du fleuve Sénégal. In : Orange D., Arfi R., Kuper M., Morand P. et Poncet Y. (eds). *Gestion intégrée des ressources naturelles en zones inondables tropicales. IRD éditions, Coll. Colloques et Séminaires*, Paris, 197-208.

Nguimalet C.-R., 2010a, Drought perceptions, effects on water scarcity and improving local coping strategies on River Malewa catchment, Lake Naivasha basin, Kenya. Poster Presentation, *International Disaster and Risk Conference (IDRC) 2010*, Davos, Switzerland, May 30 – June 3, 2010.

Nguimalet C.-R., 2010b. Climate change perceptions and local coping strategies of water management: compared cases of Tomi, Gribingui and Fafa basin-slopes (Central African Republic) and Lake Naivasha basin (Kenya). *Final Report*, Egerton University, 63 p.

Odingo, R. S. (1962). The abnormal and unseasonal rains in East Africa. *The Geographical Review* **52**, 440-442.

Paturel J. E., Servat E., Delattre M. O., Lubès-Niel H., 1998. Analyse de séries pluviométriques de longue durée en Afrique de l'Ouest et Centrale non sahélienne dans un contexte de variabilité climatique. *Hydrological Sciences-Journal-des Sciences Hydrologiques*, **43 (6),** 937-946.

Smit, B. & Pilifosova, O. (2001) Adaptation to climate change in the context of sustainable development and equity. In: *Climate Change 2001: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Third Assessment report of the Intergovernmental Panel on Climate Change*, 877–912. WMO/UNEP.