Situation analysis of climate change aspects in Kenya

S.O. Nyamwaro, D.K. Wamae, Kizito Kwena[1], A.O. Esilaba[2], W. Ndegwa[3], S.J. Matere[4], K.J. Wasswa[5], R. Ruttoh[1] and A.M. Kibue[3]

KARI-Muguga North, P.O. Box 032-00902 Kikuyu, Kenya, snyamwaro344@gmail.com
[1]KARI-Katumani, P.O. Box 340-90100 Machakos, Kenya
[2]KARI-Headquarters, P.O. Box 57811-00200 Nairobi, Kenya
[3]Kenya Meteorological Dept, P.O. Box 30259-00100 Nairobi, Kenya
[4]KARI-Muguga South, P.O. Box 30148-00100 Nairobi, Kenya
[5]Ministry of Agriculture, P.O. Box 30028-00100 Nairobi, Kenya

Abstract

Given that climate change and variability have become one of the greatest threats to food security and livelihoods, a baseline study was conducted to understand the current situation of climate change scenarios in Kenya. The study sought to determine the current status of climate change projects that have been undertaken in Kenya in the past five years between 2007 and 2012. Major climate change themes including adaptation, mitigation and capacity building and sensitive productive sectors such as agriculture, livestock, water and environment to climate change were conceptualised in which the study was based. The baseline survey targeted key informants in academic, research and policy arenas. It was observed that adaptation, mitigation and capacity building accounted for 60, 17 and 23% of the projects sampled. Agricultural sector (crops) accounted for most of climate change projects, accounting for 36% as well as 40% of all projects on adaptation. Agriculture, livestock and environment sectors accounted for 30% each of the mitigation projects. It is established that most projects undertaken in Kenya on climate change arena have been on adaptation, capacity building and mitigation. Climate change projects undertaken in Kenya were in agriculture and livestock sectors. Although considerable efforts appear to have been put in adaptation to climate change, more needs to be done, especially in agriculture and water sectors, which are important in Kenya's economy.

Key words: climate change adaptations, mitigation, capacity building, situation analysis.

Introduction

Climate change (CC) is a serious threat to agricultural productivity in regions that are already food insecure. Evidence of crop yield impact in Africa and South Asia resulting from CC is clearly witnessed in wheat, maize, sorghum and millet, and is unclear, absent or contradictory in rice, cassava and sugarcane (Knox *et al.,* 2012). It is projected that by 2050 the world will have to increase agricultural production to feed a projected nine billion people against changing consumption patterns, impacts of CC and growing scarcity of water and land (Beddington, 2010). Sub-Saharan Africa (SSA) is reported as the most vulnerable region to CC and variability (Slingo *et al.,* 2005). This is partly because SSA maintains the highest proportion of malnourished populations with substantial portion of its national economies dependent on agriculture (Schlenker and Lobell, 2010; Kpadonou *et al.,* 2012); and most of its available water resources (85%) used for agriculture (Downing *et al.,* 1997). Farming techniques in SSA have also not kept abreast with modern technology, with a majority of its land arid and semi-arid, and smallholder farming systems that have limited capacity to adapt dominating agricultural landscape (Müller *et al.,* 2011). Hence development externalities associated with CC will be most felt in Africa. Some CC extremes such as seasonal droughts and floods are already undermining economies and prosperity of the SSA and its people.

In Kenya, the effects of climate change and variability (CCV) are becoming more conspicuous and real given that their impacts are already affecting ecosystems, biodiversity and people. Climate change extremes such as unpredictably more frequently occurring droughts and flooding are already undermining the economies and prosperity of Kenya and the Greater Horn of Africa. Agriculture and water resources are among key sectors that are getting affected most by the impacts of CC scenarios.

Climate change has the potential to slow down economic development of Kenya and many other countries.

Currently there is growing evidence of increased CCV in Kenya, leading to more than one drought every five years. This is causing substantial and irreversible decreases in productive sectors, particularly in livestock numbers in the arid and semi-arid lands (ASALs) of Kenya (MacMillan, 2011). The droughts and floods expose the livestock industry to serious vulnerability and myriads of problems including livestock deaths, high malnutrition rates and diseases incidences. During the 2009 drought, Kenyan pastoralists lost more than 50% of their herds; 81% and 64% of their cattle, and sheep and goats respectively (African Conservation Centre, 2012; Mutimba *et al.,* 2010).

Global circulation models predict that by year 2100, CC will increase temperatures by 40C leading to serious crop failures, reduced water and forage availability, and increased livestock mortalities and loss of livelihoods (Nanyingi *et al.,* 2012). Similarly, Knox *et al*. (2012) projected impacts of climate change on the yield of eight major crops in Africa and South Asia showing that projected mean change in yield of all crops is –8% by the 2050s in both regions. Across Africa, mean yield changes of –17% (wheat), –5% (maize), –15% (sorghum) and –10% (millet) were estimated. It is also predicted that potential cost to Africa due to CC dynamics will reach about US$10billion per year by 2030 (Pan African Climate Justice Alliance, 2009).

Hence, mainstreaming adaptation capacity in Kenya and African development policy, planning and investment processes is absolutely relevant. In spite of uncertainties surrounding CC projections, adaptation planning remains a relevant integral component of development and investments.

In order to provide practical roadmaps for future adaptation investments, programmes for adaptation actions such as the National Adaptation Programmes of Action need strengthening. One way of doing this is through conducting economic analyses of adaptation investments that are informed by credible and impartial scientific assessments of CC impacts.

Towards tackling economic analyses of adaptation options in Kenya, it became necessary to understand the current situation analysis of CC scenarios within the country. Major CC themes and sensitive productive sectors to CC were thus conceptualised in which the analysis was based. First this paper gives an introduction to climate change in general in which selected literature is described. A summary description of materials and methods is presented followed by results and discussions. Following the findings of the study, conclusions and recommendations are finally provided.

Materials and methods

A baseline survey was undertaken to determine the current status of CC projects that have been undertaken in Kenya during the past five years between 2007 and 2012. Ninety willing respondents purposively drawn from universities, government departments, national research institutions and non-governmental organizations were interviewed using a structured open-ended questionnaire. The survey targeted key informants in academic, research and policy arenas. Most respondents however came from academic institutions (universities) and a few researchers and policy planners. The collected data were coded, entered, cleaned and analysed for descriptive statics using the SPSS Version 18 software.

Results and discussion

Projects in selected CC thematic areas

Given that CC effects and impacts are being stopped and mitigated from happening and/or proceeding further, three major thematic areas/scenarios were conceptualised on what actions are being taken against CC in Kenya. The commonest actions being undertaken in Kenya were adaptation, mitigation and capacity building, which were regarded as the major CC thematic areas.

Adaptation to CC (or global warming) involves acting to adapt, cope with and/or reduce effects of global warming, an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects. Adaptation measures may include prevention, tolerance or sharing of losses, changes in land use or activities, changes of location, and restoration. In contrast, CC mitigation is action to decrease the intensity of radiative forcing in order to reduce the effects of global warming (Marland *et al.,* 2007; IPCC, 2007; GoK, 2010). Climate change mitigation scenarios involve reductions in the concentrations of greenhouse gases, either by reducing their sources or by increasing their sinks (Molina *et al.,* 2009). In the 1990s, the UN defines mitigation as a human intervention to reduce the sources or enhance the sinks of greenhouse gases. Mitigation include using fossil fuels more efficiently for industrial processes or electricity generation, switching to renewable energy (solar or wind power), improving insulation of buildings, and expanding forests and other 'sinks' to remove greater amounts of CO2 from the atmosphere (UNFCCC, 1997). It is important to note that adaptation and capacity building are more implementable at the micro level, while mitigation at the macro level.

Effective responses to CC combine both adaptation and mitigation strategies. There are clear complementarities in applying both mitigation and adaptation aspects to CC, although they differ in important respects. Benefits from mitigation are expected to be global and deferred, while those from adaptation projects are expected to be local and to some extent more immediate (World Bank, 2009). Important adaptation options in agricultural sector include: crop diversification, mixed crop-livestock farming systems, using different crop varieties, changing planting and harvesting dates, and mixing less productive, drought-resistant varieties and high-yield water sensitive crops (Bradshaw *et al.,* 2004).

The baseline survey indicate that CC projects implemented in Kenya during the past five years were mostly on adaptation (60%), followed by projects in capacity building (23%) and mitigation (17%).

These findings are fairly rational given that adaptation is a way of trying to tolerate and live with the CC, while capacity building is empowering people in raising awareness, training and education and providing other capacity requirements to deal with and accommodate CC scenarios. Some projects have emphasized in enhancing provision of climate information services, strengthening capacity of governments to facilitate adaptation to CC, building awareness and capacity among civil society; and to a lesser extent improving freshwater resources, pastoralism and human health (Kurukulasuriya and Rosenthal, 2003).

Projects in selected productive sectors

Kenya's productive sectors are the most sensitive ecosystems to CCV. Some of these sectors were identified as agriculture, livestock, water, tourism, health, infrastructure, natural resources (the environment), and fisheries (Kpadonou *et al.,* 2012; IPCC, 2007; IFPRI, 2007; World Bank, 2007).

By expert opinion and consensus, four most sensitive sectors to CC were identified for analysis of this research. The sectors are agriculture (crops), livestock, environment (natural resources), and water resources.

It was observed that the agriculture sector accounted for most (35.7%) of CC projects during the past five years in Kenya ;followed by livestock (27.4), the environment (19.8) and water resources sectors (17.1%).

This finding clearly indicates that agriculture and livestock (63.1%) accounted for the bulk of the CC projects in Kenya. One of the reasons underpinning this trend could be that agriculture and livestock sectors are more directly related to food security than any other sector. Further, the effects of CCV are easily and immediately reflected on the production of crops and livestock commodities.

Adaptation projects in selected productive sectors

Given that most CC projects in Kenya were implemented within the adaptation theme, it became apparent to reflect how the thematic projects were implemented and distributed in the selected

productive sectors. This provided reflections on priorities areas in which investments on CC projects are made.

Adaptation projects were mostly invested in agriculture sector accounting for 39.5% of all adaptation projects implemented in Kenya during the past five years followed by projects in livestock (27.4%), the environment (17.2%) and water resources (15.9%).

Again, agriculture and livestock sectors accounted for the bulk of the adaptation projects (66.9%) implemented in Kenya.

The moderately high levels of investments in adaptation projects in agriculture and livestock are encouraging given that these two sectors are critical in their contribution to the Kenyan economy. These investment levels need to be enhanced in these sectors given their vulnerability to CCV as well as their importance to food security and economic growth.

Mitigation projects in selected productive sectors

The survey analysis shows that mitigation projects have been going on in Kenya during the past five years. The agriculture accounted for about 29.6%, livestock for 29.5% and the environment for (29.5%). In spite of the increases in frequency and severity of floods in Kenya, water resources accounted for only 11.4% of the mitigation projects.

This may explain the massive destruction of property and lose of livelihoods reported every rainy season. Notwithstanding, it is generally recognised that smallholder farmers can contribute substantially to CC mitigation, but will need incentives to adapt mitigation practices. These incentives would include the selling of carbon credits, which unfortunately are limited by low returns to farmers, high transaction costs, and the need for farmers to invest in mitigation activities long before they receive payments. Designing agricultural investments and policies to provide up-front financing and longer term rewards for mitigation practices will help reach larger numbers of farmers than specialized mitigation interventions (Wollenberg *et al.,* 2012).

It is instructive noting that potential for mitigation strategies is great and what is needed is a coordinating strategy to organise the generation and sharing of greenhouse gas data, and facilitate improved understanding of the potential for greenhouse gas emissions and removals from the CC sensitive sectors such as agriculture and forestry.

In Kenya mitigation activities have been practised on crop and soil management practices including sustainable agriculture land management, nutrient management (fertilisers), tillage and residue management, and agroforestry. Mitigation has also been practised on livestock and grazing land management that included grazing intensity – intensification and reduced herd sizes (productivity), and rangeland and pastureland management (Masiga, 2012).

Capacity building projects in selected productive sectors

Capacity building projects were mostly undertaken in the agriculture sector which accounted for 30.6% of all the projects followed by livestock (25.8%), water resources (24.2%) and the environment (19.4%). Up to 81% of all the capacity building projects were undertaken in agriculture, livestock and water resources sectors.

One example of the capacity building project going on in Kenya is the 'building adaptation capacities for CC through participatory research, training and outreach', which was initiated in 2010. This project is evaluating indigenous / traditional CC mitigating and adaptation strategies currently used by diverse Kenyan farming and pastoral communities and build capacity on CC adaptation strategies among various stakeholders (Lelo, 2011).

Conclusions and recommendations

Most projects undertaken in Kenya on CC arena have been on adaptation, capacity building and mitigation areas, while majority of the CC projects undertaken were in agriculture and livestock sectors. Three sectors on agriculture, livestock and environment received an equal share of mitigation projects, while majority of the CC capacity building projects were implemented in agriculture, livestock and water resources sectors.

Given the importance of adaptation in tolerating effects / impacts of CC, it is recommended that more adaptation work be intensified in Kenya. One area to work on is to undertake policy review to provide enabling environment to conduct adaptation research for development. Capacity building should also be embraced to increase awareness, education and training, and tools and equipment for CC issues.

Acknowledgement

The authors are grateful to the International Development Research Centre (IDRC) for funding and KARI Director for logistical support. Any views expressed here are those of the authors.

References

African Conservation Centre (2012). The Impact of the 2009 Drought on Wildlife, Livestock and Tourism: Recommendations for Ecosystem Restoration. African Conservation Centre, Nairobi, Kenya.

Beddington, J. (2010). Food security: contributions from science to a new and greener revolution, Phil. Trans. R. Soc. B 365 61–71.

Bradshaw, B., Dolan, H. and Smit, B. (2004). Farm-Level Adaptation to Climatic Variability and Change: Crop Diversification in Canadian Prairies. Climatic Change, 67: 119–41.

Downing, T.E., Ringuis, L., Hulme, M. and Waughray, D. (1997). Adapting to climate change in Africa, Mitig. Adapt. Strategies Glob. Change, 2 19–44.

GoK (2010). National Climate Change Response Strategy. Ministry of Environment and Natural Resources, Government of Kenya, Nairobi, Kenya.

IFPRI (2007). Micro-Level Analysis of Farmers' Adaptation to Climate Change in Southern Africa, Discussion Paper 00714. International Food Policy Research Institute, Washington, DC, USA.

IPCC (2007). Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the 4th Assessment Report of the Intergovernmental Panel on Climate Change, Annex I., M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, pp 976.

Knox, J., Hess, T., Dacache, A. and Wheeler, T. (2012). Climate change impacts on crop productivity in Africa and South Asia, Environ. Res. Lett. 7 (2012) 034032, pp 8.

Kpadonou, R.A.B., Adégbola, P.Y. and Tovignan, S.D. (2012). Local knowledge and adaptation and climate change in Ouémé Valley, Benin, African Crop Science Journal, Vol 20, issue Supplement s2, pp 181-192.

Kurukulasuriya, P. and Rosenthal, S. (2003). Climate change and agriculture: A review of impacts and adaptations. Paper No. 91 in Climate Change Series, Agriculture and Rural Development Dept and Environment Dept, World Bank, Washington, DC.

Lelo, F.K. (2011). Building adaptation capacities for climate change in Kenya through participatory research, training and outreach, a project supported by the Rockefeller Foundation. Egerton University, Lakipia, Nyahururu, Kenya. http://www.fao.org/climatechange/micca/75369/en/ - Retrieved Nov 24 2012.

MacMillan, Susan (2011). Predicted impacts of climate change on Kenya: Definitely hotter–expect less productive cropping, more livestock herding. ILRI News. Fri 5 Aug 2011. http://www.ilri.org/ilrinews/index.php/archives/6879, November 20, 2012.

Marland, G., Boden, T.A. and Andres, R.J. (2007). Global, Regional, and National CO2 Emissions. In Trends: A Compendium of Data on Global Change. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, United States Department of Energy, Oak Ridge, Tenn., U.S.A.

Masiga, M. (2012). Economic and social evaluation of national GHG mitigation options for agricultural landscapes in East Africa, Proceedings of CCAFS/FAO Expert Workshop on NAMAs: National mitigation planning and implementation in agriculture, Rome, Italy 16-17 July 2012.

Molina, M., Zaelke, D., Sarmac, K.M., Andersen, S.O., Ramanathane, V. and Kaniaruf, D. (2009). Reducing abrupt climate change risk using the Montreal Protocol and other regulatory actions to complement cuts in CO2 emissions. Proceedings of the National Academy of Sciences 106 (49): 20616–20621.

Müller, C., Cramer, W., Hare, W. L. and Lotze-Campen, H. (2011). Climate change risks for African agriculture, Proc. Natl Acad. Sci. USA, 108 4313–5.

Mutimba, Stephen., Mayieko, Samuel., Olum, Peterson and Wanyama, Kristen (2010). Climate Change Vulnerability and Adaptation Preparedness in Kenya. Heinrich Böll Stiftung, East and Horn of Africa, Nairobi, 2010, pp30.

Nanyingi, M O., Kiama, S G., Thumbi, S and Muchemi, G M (2012). Climate Change Vulnerability, Adaptation and Mitigation of Livestock Systems in Kenya. Wangari Maathai Institute for Environmental Studies and Peace, College of Agriculture and Veterinary Science, University of Nairobi, Nairobi, Kenya.

Pan African Climate Justice Alliance (2009). PACJA statement to the 2nd meeting of the African high level expert panel on climate change, October 22, 2009, Addis Ababa, Ethiopia.

Schlenker, W. and Lobell, D.B. (2010). Robust negative impacts of climate change on African agriculture, Environ. Res. Lett. 5 014010.

Slingo, J.M., Challinor, A.J., Hoskins, B.J. and Wheeler, T.R. (2005). Introduction: food crops in a changing climate, Phil. Trans. R. Soc. B 360 1983–9.

UNFCCC (1997). Glossary of climate change acronyms. Retrieved 2012-11-22.

Wollenberg, E., Higman, S., Seeberg-Elverfeldt, C., Neely, C., Tapio-Bistrom, M.-L. and Neufeldt, H. 2012. Helping smallholder farmers mitigate climate change. CCAFS Policy Brief 5. Copenhagen, Denmark: CCAFS.

World Bank (2007). Overview on International Trade and Climate Change: Economic, Legal and Institutional Perspectives, International Bank for Reconstruction and Development / World Bank, Washington, DC, USA, pp 26.

World Bank (2009). The Economics of adaptation to climate change: A final methodology report, World Bank, Washington, DC, USA.