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**ADAPTING TO
CLIMATE CHANGE
IN EAST AFRICA:
A STRATEGIC
APPROACH**

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EXECUTIVE SUMMARY

This paper provides an overview of the likely impacts of climate change in three least developed countries in East Africa: Sudan, Tanzania, and Uganda. In the coming decades, climate change is likely to alter temperatures and distribution of rainfall, contribute to sea-level rise and increase the frequency and intensity of extreme weather events in East Africa. In fact, many widespread climatic changes have already been observed in the region. Climate change will have both a *direct* impact on development of climate-dependent activities (such as infrastructure and agriculture) and *indirect* consequences for social systems (such as issues of poverty, conflict, health and education). As a result, climate change has the potential to undermine, and even undo, socio-economic development in East Africa and it is imperative that governments and institutions come together to formulate long-term adaptation strategies.

Despite the inherent link between climate change and development, climate change continues to be unrecognised in many African countries. And yet, the impacts of climate change are not just of environmental concern, but will impede efforts to tackle poverty and promote national development. Moreover, the problems impeding socio-economic development in African countries are often the same as those that increase vulnerability to climate change.

This paper hopes to demonstrate the need for African countries to formulate comprehensive climate change adaptation strategies that focus on the needs of the poor and are integrated into the wider development agenda. Specific recommendations include:

- Understanding, documenting and strengthening existing livelihood coping strategies rather than imposing new, high-tech solutions.
- Co-ordinating efforts between governments, private sector and civil society in promoting adaptation to climate change and sustainable development through sharing of ideas. This will encourage innovation and maximise the efficiency with which limited resources are used.
- Integrating climate change adaptation into the development agenda, across all sectors and all levels of government.

ADAPTING TO CLIMATE CHANGE IN EAST AFRICA: A STRATEGIC APPROACH

Victor A. Orindi¹ and Laurel A. Murray

INTRODUCTION

Climate change is one of the most significant challenges facing human society in the 21st century. Industrialisation has led to the release of greenhouse gases (GHGs) into the atmosphere, with subsequent changes in the Earth's temperature and weather systems. Mean global temperatures are predicted to increase by between 1.4-5.8°C over the coming century (IPCC, 2001) which will cause changes in temperature, distribution of rainfall, the frequency and intensity of extreme weather events, and sea-level rise. Many human systems will be affected by these changes, particularly agriculture, water resources, industry and human health. However, the impacts of climate change will not be uniform across the globe and considerable differences are expected among different regions (McCarthy *et al.*, 2001). In an unfortunate twist of fate, the poorest countries, which have contributed least to global GHG emissions, are amongst the most vulnerable to climate change. Poor communities are not only located in high-risk areas, but their lack of economic and social resources mean they are ill-equipped to adjust to the long-term changes in climate. Indeed, industrialised countries are already dedicating significant resources to protect themselves against the impacts of climate change. The risks of climate change for least developed countries (LDCs) are hard to exaggerate, and communities, governments and other institutions in these countries must prepare in order to reduce and minimise the adverse effects.

In this paper, we focus on three East African LDCs: Sudan, Tanzania and Uganda, to highlight the anticipated impacts of climate change in the East Africa region, discuss existing coping strategies in these countries, and recommend ways in which climate change may be mainstreamed into the region's wider development agenda.

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Box 1: Anticipated impacts of climate change in East Africa

- Decreased rainfall, increased temperature and evaporation in dry areas
- Frequent drought spells leading to severe water shortage
- Change in planting dates of annual crops
- Increased fungal outbreaks and insect infestations due to changes in temperature and humidity
- Decrease in forest area and area under cultivation
- Decline in crop and gum yield
- Increased risk of food shortage and famine
- Reduction in ecosystem integrity and resilience, and decline in biodiversity
- Increased potential of malaria transmission and burden on the country's health care system
- Sea level rise

Sources: MLWE, 2002; RoS, 2003; URT, 2003

ANTICIPATED IMPACTS OF CLIMATE CHANGE IN EAST AFRICA

Biophysical impacts

A wealth of research has been undertaken on the impacts of climate change in East Africa, and here we attempt to summarise the dominant findings. Some of the expected repercussions of climate change for the region include rising sea waters along the coastlines, increased rainfall and incidence of disease in wetter areas, extinction of species, worsening droughts and crop failures (Box 1). Generally, humid areas are likely to become wetter while the dry regions are expected to become even drier under climate change conditions.

Regions with increased precipitation may also experience increased runoff while the reverse will be observed in regions with decreased precipitation. In Tanzania, for example, reduced runoff into two out of three major rivers will have far-reaching socio-economic impacts. Due to increased temperature and decreased rainfall in their catchments, River Pangani's annual flow could decrease by between 6-9% and that of River Ruvu by 10% (URT, 2003). In Sudan, where more than half the country is desert or semi-desert and another quarter arid savannah, a decrease in precipitation is likely to lead to desertification or other forms of land degradation (RoS, 2003). Increased temperatures and reduced rainfall could also lead to water scarcity in such places as north-eastern Uganda (MLWE, 2002), western Sudan and large parts of Tanzania.

In contrast, low temperatures and increased rainfall in currently humid areas may increase river flow by between 5-11%, as in parts of Tanzania, and 10-20% in

Box 2: Impacts of increased temperature and reduced rainfall on agriculture

- Drop in food crop yields (maize yields by 33% in Tanzania; sorghum 13-82% and millet (20-76%) in Sudan (URT, 2003).
- Gum Arabic production may decline by 25-35% in Sudan (RoS, 2003).
- Optimal area for high yielding dairy cattle may reduce in Uganda (MLWE, 2002).

Uganda (URT, 2003; MLWE, 2002). The potential for heavy flood damage will increase during the long rainy seasons, affecting major hydropower stations, communication infrastructure, farms and human settlement. In addition, increased rainfall could lead to nutrient leaching, loss of topsoil and waterlogging, all of which will seriously affect agricultural production (Box 2). In Uganda, for example, the El Niño of 1997/98 resulted in the death of over 1000 people and disrupted communication and service provision (MLWE, 2002; Ropelewski, 1999). Increased incidence of pests and diseases is also expected due to higher temperatures and rainfall. This is likely to lead to farmers using more agrochemicals and disease resistant varieties, thus increasing production costs.

In terms of human health, diseases such as malaria, dengue fever, cholera, dysentery and respiratory diseases are expected to increase as a result of climate change. For example, malaria is already a serious health problem for East Africa; climate change is likely to only worsen this situation. A global mean annual temperature increase of between 1 and 3°C would enable mosquitoes to extend their range, while increased rainfall would attract vectors and increase their survival rate (Githeko *et al.*, 2000).

Tanzania has a coastline of about 800 km. There are also numerous islands along the coastal belt. The coastline supports a high human population and vigorous economic activities, including tourism, industry, subsistence agriculture, mining and fisheries. Important infrastructure like beach hotels, training institutions, roads, offices and fish landing sites along the coast could be affected by sea-level rise. Among Tanzania's important and productive coastal ecosystems, mangroves are the most vulnerable to inundation, followed by sand and mud flats. Sea-level rise would also cause salt water intrusion in Tanzania's aquifers and deltas, affecting fresh water availability, especially in coastal areas.

Wildlife also contributes a significant proportion of the region's GDP in the form of tourism and meat. Prolonged droughts, floods and rapid changes in climate may

adversely affect biodiversity if habitat conditions change drastically. Furthermore, the occurrence of new parasites and diseases could kill large numbers of animals as witnessed in the outbreak of rinderpest in Tanzania in 1989 (URT, 2003). A decline in biodiversity would harm tourism, which is a major foreign exchange earner for the region. Lastly, drier conditions may lead to a decline in forests, reducing timber and fuelwood availability.

Livelihood impacts

The extent to which East African countries are vulnerable to climate change depends on both exposure and sensitivity to changes in climate, as well as the ability to adapt to new conditions (Kelly and Adger, 2000). Sudden shocks caused by climate change, when coupled with existing vulnerabilities and institutional weaknesses, could lead to much larger and longer term poverty traps than local livelihood systems, national governments and the international humanitarian systems seem capable of coping with (Devereux and Edward, 2004).

Nearly 80% of East Africa's population depends on agriculture for a living, and agriculture contributes 40% of the region's GDP (IFPRI, 2004). Agriculture in East Africa is highly vulnerable to climate variability and long-term climate change, which could result in higher food prices, lower domestic revenues and widening of current account deficits due to lower export earnings together with increased inflation and increased external indebtedness. Such changes will only compound the difficulties faced by a region where agricultural yields and per capita food production have been steadily declining and where population growth will double demand for food, water and livestock forage in the next 30 years (Davidson *et al.*, 2003). Countries in East Africa are already among the most food insecure in the world (Devereux and Edward, 2004), and climate change will only aggravate falling harvests. In Tanzania, for example, famine resulting from either floods or drought has become increasingly common since the mid-1990s, undermining food security (URT, 2003). In Sudan, traditional farming (including nomadic, transhumant and sedentary agriculture) is widespread throughout the northern and southern parts, with livestock being the main insurance against uncertainty (Guvele *et al.*, 2003). Approximately 90% of Sudan's cultivated areas depend exclusively on rainfall and the traditional rainfed sector supports 1.7 million households (RoS, 2003). Recent droughts (1983-85 and 1990-93) have resulted in severe food shortages and famine among dependent populations (*ibid.*).

In Uganda, cattle rustling, intertribal fighting and overall environmental insecurity have been blamed on increased frequency of drought, forcing cattle keepers to move beyond their lands (Magezi, S., quoted in Jones and Mearns, 2005, p. 136).

Added to the other considerable stresses facing the region, such as HIV/AIDS, civil war and security, climate change can only worsen the situation. Indeed, violent conflict in East Africa has increased the region's vulnerability to climate change and worsened the prospects for future adaptation.

Local level coping strategies

Over time, households and communities have developed a number of coping strategies in response to extreme climate events. Some of these coping measures can only assist families in the short-term and cannot deal with increased and more severe shocks. However, many traditional coping strategies do provide an important lesson for how East Africa can better prepare and adapt to climate change in the long-term.² There is a need to strengthen these coping strategies to enable households to live with current climate variability as well help them to adapt to long-term climate change. And this is only possible if we first understand local people's vulnerabilities, capacities and risks (DFID, 2004).

Local level coping strategies to shocks such as drought and floods differ among households and communities depending on the resources available and social capacity. They may include remittances from migrant household members, collecting wild fruits, switching to non-farming activities or, in extreme cases, selling assets. Eriksen *et al.* (2005) found in Saweni Village, Same District, Tanzania that households' coping mechanisms during drought included casual labour, brick making, handicraft, collecting honey and charcoal burning. Indigenous fruits were also highly regarded because they could be harvested by any household member and did well in drought conditions. These activities provide an important source of cash to allow households to purchase food and cater for other necessities at such times.

Remittances from migrant family members and relatives play an important role in household well-being during difficult periods. People who receive remittances tend to be less affected by shocks in terms of access to food, health services and school attendance (Eriksen *et al.*, 2002).

² Coping strategies should not be confused with adaptation, as they refer to actions taking place within existing structures. Adaptation frequently involves changing the framework within which coping takes place (Adger, 1996).

The sale of household goods is another strategy, albeit only for the short-term. Household goods and assets such as land and livestock can be sold to pay off debts incurred during extreme events. This erodes the asset base and, ultimately, a household's chances of long-term survival. Such short-term coping strategies need to be managed to ensure that households do not descend into a state of helplessness.

Pastoral groups have dealt with recurrent drought and other extreme climate events in a number of ways, including depending on social networks and trusts, switching between capital assets, and migrating to other areas to look for work until droughts have passed (DFID, 2004). For instance, households distribute their livestock among relatives and friends in other areas to ensure they are not all wiped out in a disaster. In addition, pastoralists normally graze in certain areas but move to reserved sites during dry seasons (i.e. valley bottoms and hilltops). This kind of management allows land to recover from grazing, similar to shifting cultivation within agricultural communities. Migration in search of pasture and water in neighbouring areas has been an important livelihood strategy and depends on negotiated rights of access to such resources, which are in most cases collectively owned and managed. Such systems rely on customary laws and institutions that are respected by community members.

Other strategies for coping with seasonal food shortages include petty business, changes in diet, fewer meals and loans from traders. In recent years, migration to urban areas in search of paid employment has become increasingly popular even though urban unemployment is high. However, this reduces the labour available in rural areas, as those who migrate are mostly the young and energetic. Typically, it is the men who move in search of off-farm employment, overburdening the women left behind. New initiatives for creating employment or income opportunities should therefore consider the fact that certain groups are already burdened with household chores and are unlikely to have the energy and time for additional activities.

MAINSTREAMING ADAPTATION TO CLIMATE CHANGE IN THE DEVELOPMENT PROCESS

The inherent link between climate change and development continues to be ignored in many African countries. However, as seen above, the problems impeding development in these poor countries are the same problems that increase climate change vulnerability. Mainstreaming climate change adaptation into the

Box 3: Some of the adaptation measures suggested in the National Communications for Tanzania, Uganda and Sudan

- Increase irrigation to boost crop production
- Introduction of low water use crops & adoption of sustainable water resource management policies (seasonal rainfall harvest; water quality control)
- Increase capital investment in reservoirs and infrastructure
- Reduction of water loss through water conserving technologies
- Make water resource management an attractive career and field of investment
- Institute policy mechanisms to control unsustainable forest clearing and forest consumption (plans for reforestation and afforestation projects with a primary concentration on Hashab trees)
- Promote techniques for tackling emergency food shortage
- Adjust farming areas and reduce animal population
- Promote use of LPG for cooking and solar cookers instead of inefficient woodstoves and charcoal stoves
- Comprehensive study of malaria

Sources: MLWE, 2002; RoS, 2003; and URT, 2003

development process means including climate change and vulnerability considerations in all development policies. Such an approach will have additional benefits within other sectors such as water, health, agriculture and poverty.

An important step has been taken in countries such as Tanzania, Uganda and Sudan to address the various sectors most vulnerable to climate change in their National Communications (NCs) to the UN Framework Convention on Climate Change (UNFCCC) – see Box 3. These countries, along with other LDCs, are also now preparing their National Adaptation Plans of Action (NAPA) which will identify and prioritise their adaptation needs. Despite this, research has shown that climate change continues to be treated separately from the wider development agenda. Indeed, Poverty Reduction Strategy Papers (PRSPs) in the three countries do not explicitly mention climate change but only make reference to impacts of floods and drought on economic development.

The National Communications include a number of activities based on the scenarios projected by global models that may be carried out as part of the adaptation process. However, some of the proposals are technological and will require large capital investments not readily available in poorer countries (for example, construction of sea walls). In contrast, adaptation proposals which are neither technological nor capital intensive will prove more feasible for LDCs. Moreover, adaptation to climate change should not focus simply on new activities, but strengthen exist-

Box 4: Adapting to decreased water availability

Access to water for both domestic and productive uses could be severely limited by the increased temperature and reduced rainfall in certain areas. Adapting to decreasing rainfall may include adjusting water management to increase sources of water supply and conserve available water. Small-scale, low-tech technologies, such as the use of rooftops and tanks to harvest and store rainwater are cheap, easy to construct and are already used in many places. A number of domestic chores like washing, bathing, watering gardens and livestock can use water from 'unimproved' sources with immense health benefit; the problem of waterborne disease among poor households has more to do with water quantity rather than quality (Thompson *et al.*, 2001). The other side of the coin, demand management, will entail investing in new water-saving technologies, recycling and reusing water, both at home and in industries, and changing user practices. In the agricultural sector, there is a need to reduce water losses in the irrigation system by making water supply efficient. Construction of water reservoirs and water transfer across basins could form part of the government's adaptation activities.

Equally important is ensuring rights of water access by the poor (for example small-scale irrigators) in line with the Millennium Development Goals. Access to alternative water sources during drought is a particularly important coping strategy. Certain parts of East Africa have a long history of traditional irrigation among ethnic groups which has enabled survival in dry environments. Governments have acknowledged the need to support small-scale irrigation, which will become increasingly important with changing climatic conditions. Traditional water rights of small-scale irrigators need to be recognised in the formal laws. However, current reorganisation of the water sector aimed at formalising such rights is already marginalising the poor—especially those who cannot afford to pay the fee (Maganga *et al.*, 2003; Van Koppen *et al.*, 2004). Although formalisation of water rights is supposed to bring efficiency and improve water management, it has ended up creating a large number of 'illegal' users that the authorities can do nothing about (Maganga *et al.*, 2003).

ing livelihood coping strategies and incorporate development initiatives that may create and diversify income opportunities (for example, see Box 4).

Adaptation in the agriculture sector

Crop management must be improved since climate change will lead to changes in cropping systems through shifting of agricultural zones and increased incidence of pests and diseases. Drought resistant and fast maturing crop varieties will be needed in areas of reduced rainfall. Identification of the most suitable drought resistant crops should be carried out in consultation with local communities to ensure that they are acceptable to people. Despite government efforts to promote drought resistant crops in dryland areas of Kenya and Tanzania, Eriksen *et al.* (2005) found that farmers were reluctant to use certain drought resistant species because of their low market and consumption values and high labour investment associated with their cultivation.

Other agriculture strategies could include conservation tillage practices (i.e. minimum or no tillage practices) and planting cover crops and green manure to help restore soil fertility where leaching occurs from increased rainfall. This would also reduce the need for costly fertilisers. Furthermore, many communities grow more than one crop as a form of insurance against total crop failure. Many crops can also be grown at the same time for a mixture of subsistence and cash. Increased incidence of pest and diseases in areas that might get wetter will need farmers to adhere to improved agronomic practices to avoid incurring heavy losses. Adjusting crop rotation practices to fit the new conditions, as well as making better use of climate and weather data and forecasts, could help to ensure sustainability of production systems. However, these are only possible if dissemination of such information is strengthened (see below). In addition, mechanisms need to be identified that involve communities in developing and identifying appropriate technologies.

Food and other social security programmes should be initiated or strengthened to provide insurance in case of crop failure. Examples exist of successful food-for-work programmes that have enabled many communities to get through difficult times and at the same time promote rehabilitation of their environments (eg., CARE, 2005; CRS, 2005).

Adaptation to infrastructure and planning

The poor condition of infrastructure in East Africa hinders the movement of goods and people and often leads to high commodity prices. For example, El Niño rains (1997/98) resulted in the collapse of infrastructure and agricultural production in Tanzania and Uganda. Improvement of infrastructure as part of the general development initiative will increase access to markets, especially in rural areas, and keep commodity prices low. Accessibility to markets also helps build social networks between communities where people not only exchange goods and money but also information (Morris *et al.*, 2002). Climate change must be factored into development schemes such as transport and infrastructure construction to ensure funds are spent efficiently for the long-term by locating infrastructure where it is likely to be least affected.

Building a barrier wall around vulnerable coastal areas has been suggested as one way to combat sea level rise. Such proposals are expensive and unlikely to be carried out in East Africa. In addition, such a strategy is only useful as long as the wall remains effective (i.e. it only provides a temporary solution). Proactive approaches such as restricting the development of new housing and other infra-

structure on flood plains and along the coastline would be more realistic, less costly and easier to implement in the long run. Integrated coastal management³ must be strengthened as this helps build capacities of coastal communities in participatory land use planning and resource conservation.

Adaptation in the livestock and wildlife sector

A considerable portion of East Africa is rangeland, supporting millions of livestock and wildlife species. Areas likely to experience increased rainfall may see a rise in productive potential. In semi arid areas, global warming may lead to a shift in vegetation to more climate tolerant species and the loss of more palatable species. Adaptation measures in the livestock sector may include adjustment in grazing systems that avoid environmental destruction, planning animal breeding during rainy seasons, better animal husbandry measures and optimisation of livestock production. All these require technical input from the authorities. Livestock extension services need to be strengthened to ensure that pastoral groups can access the services easily. Social strategies that may benefit pastoral groups include formation or strengthening of pastoral associations to ensure that their needs are incorporated in the development planning and policy formulation processes. Development of watering points should be a priority, but should also avoid concentrating animals around watering points which could lead to degradation of fragile environments. Laws and policies on land and water also need to allow pastoral groups unhindered access to these resources. Provision of title deeds, as proposed in Tanzania's National Communication, must not prevent free movement of livestock. Communal, rather than individual, titles may be preferable because pastoralists do not just need land but also need access to fodder; this may necessitate some movement beyond individual title.

Many in East Africa depend on forests for their livelihoods; adaptation measures may include afforestation programmes in degraded lands using more adaptive species, change in forest use and forest products to reduce tree felling, enhancement of forest seed banks, reduction of habitat fragmentation, and conservation of migration corridors and buffer zones. Active community involvement in forest management is necessary to allow access to forest resources in a sustainable manner and improve local livelihood options.

³. Integrated coastal management involves all stakeholders in the planning and development of coastal areas while considering all the area's physical, biological, social, economic and aesthetic values (AfDB *et al.*, 2003; Huq *et al.*, 2003).

Loss of biodiversity is expected to increase with rising temperatures and reduced rainfall. This will not only be a big blow to the tourism industry but also other sectors as well. To ameliorate the effects, appropriate development and management plans for conservation areas need to be put in place. Measures are needed for controlling forest fires, especially in those areas that are likely to become drier. Migration routes for animals should not be blocked by other developments, as animals are likely to migrate more often with changing environmental conditions. Allowing communities neighbouring conservation areas controlled access to resources (i.e. seed collection) could provide incentives for them to accommodate wildlife in their lands. Control of alien and invasive species and restoration of degraded areas are other options that may be carried out jointly with local communities.

Adaptation in the health sector

Health is another important sector to target in the adaptation process. Malaria control needs to be strengthened and a combination of environmental management, chemical and biological control has been suggested in national level strategies. Initiatives aimed at reducing or eliminating vector breeding sites, putting in place proper drainage, removing empty containers that collect water for mosquito breeding, and clearing of bushes and other vegetation around houses should be encouraged. Introducing mosquito predators like fish and changing water salinity are not practical ways of addressing the problem. They could actually worsen the situation as seen with the introduction water hyacinth and Nile perch in Lake Victoria. Other costly measures such as the use of chemicals also have health risks to humans and the environment (Roberts, 2004). Above all, it is important to examine why the many control methods currently available are not working before coming up with new ones.

Disaster preparedness and health programmes should also pay attention to local knowledge about trends in risks and vulnerabilities, focusing on the climatic changes witnessed by communities and coping mechanisms that have worked best in the past (RCRCCC, 2003).

It is also important that systems are developed that may provide early warning for malaria and other diseases whose outbreaks are associated with weather (temperature and rainfall) anomalies, for example cholera, meningitis and dengue fever (Nyong, 2005; Githeko and Ndegwa, 2001). In this way, appropriate and timely measures can be put in place to limit the extent or impacts of disease outbreaks.

Information collection and dissemination

Most people still consider climate change to be a distant problem. This does not augur well for initiatives aimed at reducing vulnerabilities of local communities. Local people need to understand the possible impacts of climate change and how they may be affected so that they can prepare themselves. Both the government and civil society have a role to play in educating the public on climate change, and can provide information that builds on traditional approaches to weather prediction.

Meteorological stations need to be strengthened to collect and disseminate timely information as part of early warning and disaster preparedness schemes. Information for public use should be translated into a simple and easily understood format and/or translated into local languages whenever possible. A combination of print, electronic and other forms of media should be used to maximise dissemination.

Capacity-building and decision-making

It is vital that farmers, livestock keepers and other livelihood groups have access to funds after extreme events so they can restart their activities by purchasing farm inputs, restocking animals, start other businesses and also buy surplus harvest from farmers.⁴ To this end, governments need to establish or strengthen existing rural credit mechanisms. Farmers' cooperatives also need to be revived to improve farmers' prospects of obtaining credit from financial institutions. Those with access to finance (i.e. remittances from family and relatives) tend to recover faster. Families sometimes sell part of their harvests at a throwaway price in order to get cash for other needs. Microcredit may help diversify households' livelihood options by spreading activities throughout the year and investing in more portable assets, which are easier to move in case of disasters or can be sold to ease immediate needs (DFID, 2004). Diversifying and ensuring the relative flexibility of assets are important as some are more readily liquidated (i.e. cattle) providing for greater livelihood flexibility (Morris *et al.*, 2002).

Insurance is becoming more important for providing essential funds in the event of natural disasters and is one of the ways through which governments may transfer risk to other agencies and spread the financial cost of recovery over time. Insurance also has the advantage that payouts after a disaster may be aimed at reducing

4. It is common to find crop harvests going to waste during bumper years in certain parts of the country due to a combination of lack of drying and storage facilities and buyers, only to face shortage a few months later.

future vulnerability by ensuring that developments are sited in less risky environments and take into consideration future climate changes (DFID, 2004).

In the past, policies related to natural resource management and rural development were formulated and implemented along sectoral lines; however, there are now promising indications that the process is becoming more consultative and participatory. This will in turn create an opportunity for natural resource management and rural development to be addressed in a more integrated way at the local level (Morris *et al.*, 2002). Devolution of rights and responsibilities to local people needs to be strengthened to ensure sustainable use of natural resources and effective adaptation measures to climate change conditions. In particular, women's participation in decision-making and planning processes should be sought. In East Africa, women are generally the ones charged with the responsibility of taking care of the household and children, and their knowledge of household resources and livelihood strategies is invaluable.

CONCLUSION

Poverty, health, education, water, land degradation and conflict are all policy areas of major concern for African governments. As outlined above, the impacts of climate change will only aggravate many of the challenges facing these sectors. Climate change is a real and current threat to households and communities in Africa who are already struggling to survive. However, most African governments do not recognise the link between development and climate change, regarding the latter as a distant, future problem. This paper has attempted to illustrate that climate change and development are two sides of the same coin, and for progress to be made in either area, each must reinforce the other (Huq, 2002). Climate change impacts will affect development projects both directly where they concern climate-dependent activities (such as agriculture, forest management, infrastructure, etc.) and indirectly with regards to social-development strategies (such as health, education, and conflict). In turn, the specific development path pursued by these countries will determine future climate change vulnerabilities and the potential to adapt.

Most of the options suggested in the National Communications are reactive, technical and expensive. Moreover, they have been treated in a sectoral manner which could make their implementation difficult. Considering the limited resources available, it is highly unlikely that all will be carried out or address the

fundamental social vulnerabilities to climate change. Real, long-term solutions can be found in existing livelihood strategies used by communities. Recognition of traditional land rights and systems of management in the formal land laws (for example in Tanzania) is therefore a significant step towards reducing vulnerability of communities. Natural resource management should build on this to allow communities to continue using resources on a sustainable basis by bringing innovative ideas from both research and development fields. We need to explore how progressive policies that support community involvement in natural resource management may be made more effective at the local level and support the institutional arrangements emerging in response to the changing policy context.

Efforts need to be coordinated between the government, private sector and civil society to encourage innovation and the sharing of ideas, as well as maximum efficiency in implementation. Integrating climate change adaptation into the development agenda, across all sectors and all levels of government, will ensure that climate change and development policies will not undermine, but reinforce one another.

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