CLIMATE CHANGE IN AFRICA:
ADAPTATION, MITIGATION AND GOVERNANCE CHALLENGES

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Foreword

This African Initiative Special Report presents the fruits of early research in a major collaborative project involving Canadian and African researchers. The Centre for International Governance Innovation (CIGI) based in Waterloo, Ontario, Canada; the Salama SHIELD Foundation (SSF), which is also Waterloo Region based; and Makerere University in Kampala, Uganda, have created a major research program on the subject of the impact of climate change in Africa. This initiative brings together leading African academics, a Canadian think tank, and a non-governmental organization with extensive African experience. The papers in this book reflect the diversity and ambition of the project.

In organizing the project, we have selected particular areas of focus: conflict prevention and resolution; migration; energy; health; and food security. These topics are reflected very well in the briefing papers in this report. One particularly interesting aspect of the African Initiative is the creation of an "African Portal," a joint project of Makerere, CIGI and the South African Institute of International Affairs. Other partners throughout Africa are contributing content which will make the portal an important research and public policy instrument. As the paper "Greening the Gap" demonstrates, the rapid growth of mobile phone technology throughout Africa offers opportunities for the dissemination of information that is critical for the mitigation of and adaptation to climate change in Africa.

Our project has a strong research component, which is reflected well in the papers. The multidisciplinary approach is obvious and, I believe, enhances significantly the contribution of the papers to public debate and policymaking. Climate change will affect Africa profoundly, but the continent lacks the resources of the developed world to cope with its effects. Through research, public education and policy analysis, the African Initiative hopes to contribute to a successful African response to the enormous challenge which climate change represents.

John English

Executive Director, CIGI

Chair, The Africa Initiative

About the African Initiative

- The African Initiative was launched on July 8, 2008.

- It is a partnership between CIGI and the Salama SHIELD Foundation in collaboration with Makerere University in Uganda.

- The five-year program explores the impacts of climate change on Africa's socioeconomic status and security development within five areas: health, migration, energy, food security, and conflict resolution and mediation.

- The program combines field-based research, practical experience, and teaching and education initiatives.

- The program's goals are to devise strategies to increase Africa's resilience to climate change and to develop sustainable practices.

- A student/faculty exchange program will bring Africans to study at academic institutions in Ontario, Canada, and enable Canadians to study at academic institutions in Africa.

- The African Initiative Congress on Climate Change (AICCC) will be held November 1-4, 2009, in Uganda.

OVERVIEW: THE CURRENT CLIMATE CHANGE SITUATION IN AFRICA

FRANKLYN LISK

BACKGROUND: AFRICA AND THE GLOBAL RESPONSE TO CLIMATE CHANGE

About a quarter of the 192 parties to the United Nations Framework Convention on Climate Change (UNFCCC) that will gather at Copenhagen in December 2009 to try to reach agreement on global action to combat climate change for the period after 2012 — successor to the Kyoto Protocol — will come from Africa. What is Africa's interest in this global effort to meet key climate change objectives? How will Africa perform in Copenhagen? Will Africa make a difference to the outcomes of the negotiations and the Copenhagen Agreement, given its passive role in Kyoto?

Most analyses of the impacts of climate change that have influenced UNFCCC agreements focus on medium- to long-term projections of carbon emissions and forecasting models of global warming, and cover mainly countries and regions for which relevant data are readily available. This leaves out most developing countries and regions, particularly Africa, due to unavailable data and trajectories. From an African perspective, this omission is serious and costly. As the poorest continent, Africa is considered most susceptible to climate change due to its vulnerability and in-

ability to cope with the physical, human and socio-economic consequences of climate extremes.

Moreover, existing adaptation mechanisms and resources under the Kyoto agreement designed to mitigate climate change's effects on Africa (and other developing regions) have been directed at limiting future carbon emissions, rather than addressing the region's vulnerability and lack of resilience to the impacts of climate change on its economies and populations. As late as April 2007, a report by the Intergovernmental Panel on Climate Change (IPCC) warned that Africa was not acting quickly enough to stem the dire economic and environmental consequences of greenhouse gas emissions (IPCC, 2007). What this report seemed to have missed or overlooked is that Africa's concern about climate change is not mainly in terms projections of carbon emission and future environmental damages. It is more about the links between climate change and droughts, desertification, floods, coastal storms, soil erosion — contemporary disaster events that threaten lives and livelihoods, and hinder the continent's economic growth and social progress.

Due to the limited relevance of past and current global climate change agreements to Africa's climate and environmental problems, the hardest hit region has benefited least from the international climate change regime, which relates almost exclusively to funding and investments for green, low carbon growth. For example, Africa's participation to date in the Clean Development Mechanism (CDM) and carbon trading arrangements under the Kyoto Protocol has been minimal.[1] Africa's negligible role in previous interna-

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[1] Under the Kyoto Protocol, the CDM allows countries to gain green-

tional climate change negotiations can be remedied by concerted action on the part of African leaders in the Copenhagen round of negotiations.

Africa has much at stake. The key question is: *how can Africa make a Copenhagen deal relevant to the impact of climate change on its economies and populations?* To address this question, we need to explore the link between climate change and socioeconomic conditions that intensify underdevelopment and poverty in Africa, and examine the different pathways through which climate change affects Africa's development. We also need to highlight the opportunity that Copenhagen can create for Africa to adapt to new, more efficient patterns of development that reduce its vulnerability and improve its resilience.

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house gas emission reduction credits by investing in projects to protect the environment. The idea is that developing countries, which are minor environmental polluters, could benefit from such projects through foreign investment and technology transfer from developed countries, which are the biggest polluters. The CDM, which has developed into a US$6.5 billion market, has, unfortunately, not fulfilled its potential for mobilizing development finance and technology transfer for Africa: only 4 percent of global CDM projects are in Africa, and of 40 CDM projects involving forests only four are in Africa and none have passed the registration stage. See APP et al. (2009) for details on CDM rules and other existing carbon trading arrangements as they affect Africa and proposals for modifications.

IMPACT OF CLIMATE CHANGE ON AFRICA'S DEVELOPMENT

Climate change is already a reality in Africa. There are prolonged and intensified droughts in eastern Africa; unprecedented floods in western Africa; depletion of rain forests in equatorial Africa; and an increase in ocean acidity around Africa's southern coast. Vastly altered weather patterns and climate extremes threaten agricultural production and food security, health, water and energy security, which in turn undermine Africa's ability to grow and develop. Climate and environmentally related disasters which threaten human security can induce forced migration and produce competition among communities and nations for water and basic needs resources, with potential negative consequences for political stability and conflict resolution.

(i) Pathways through which Climate Change and Development Interact

Agriculture and food security: Agriculture, which provides a livelihood for about three-quarters of Africa's population, is mainly rain-fed. Severe and prolonged droughts, flooding and loss of arable land due to desertification and soil erosion are reducing agricultural yields and causing crop failure and loss of livestock, which endangers rural and pastoralist populations. The Horn of Africa's pastoralist areas (Ethiopia-Kenya-Somalia border) have been severely hit by recurrent droughts; livestock losses have plunged approximately 11 million people dependent on livestock for their livelihoods into a crisis and triggered mass migration of pastoralists out of drought-affected areas. Climate change is also contributing to oceanic acidification and an increase in surface water temperatures around the African continent,

negatively affecting fish stocks and threatening the livelihood of coastal and small-scale fishing communities.[2] The impacts of climate change on agriculture and other key economic sectors in the food production and supply chain, such as forestry and energy, threaten food security across sub-Saharan Africa.

Health: Increases in temperature, climate change-induced natural disasters and scarcity of safe drinking water due to droughts are major contributors to the spread of infectious and water-borne communicable diseases in Africa. Many more millions are being exposed to malaria — already a leading cause of death in Africa — due to temperature increases and intensifying rains which affect previously malaria-free areas such as the Kenyan and Ethiopian highlands. A recent joint UNEP-UNAIDS study has established complex links between climate change and the HIV/AIDS epidemic in Africa (UNEP and UNAIDS, 2008). Climate change also has indirect effects on health in the region through ecosystems degradation and unsafe water and poor sanitation, which contribute to malnutrition, cholera and diarrheal diseases and increase in child mortality. Poor water and sanitation is linked to climate-induced droughts and floods, and, according to WHO and UNICEF (Joint News Release, March 2008), accounts for more than 20 percent of the burden of disease in Africa. Diarrhoea is the second leading cause of death for African children.

Forced migration: Weather extremes, shifts in climate and the degradation of ecosystems threaten livelihoods

and erode human security, causing forced migration and population displacement. Already, droughts and the drying of river basins in southern and eastern Africa as well as floods and rising sea levels in western Africa have induced migration of individuals and communities in search of alternative livelihoods. Examples of climate change-related migration in Africa include: the continuous movement of pastoralist communities of northern Kenya ravaged by both droughts and floods; rural-urban migration in Ethiopia due to adverse environmental changes in its highlands; and internal displacement of population in the low-lying and flood-prone plains of the river Niger in Nigeria. These migrants and refugees represent a major policy challenge for African governments in terms of humanitarian assistance and sustainable long-term solutions, in addition to national security concerns linked to competition for scarce resources between migrants and local populations.

Conflict: Climate change may seriously threaten political and economic stability, as, for example, when communities and nations struggle to access scarce water resources or when forced migration puts previously separate groups into conflict over the same resources. Given the history of ethnic, resource and political conflicts in Africa, climate change could aggravate territorial and border disputes and complicate conflict resolution and mediation processes. Conflict zones and potential flashpoints in Africa, such as Darfur, the Sahel, the Horn of Africa, the DRC and northern Kenya, all have populations living in fragile and unstable conditions making them vulnerable to climate change's effects and the risk of violent conflict. Declining water resources and diminishing arable land are already intensifying competition for those resources, and creating tensions for displaced

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[2] Inter Press Service News Agency (IPS) report on "climate change and diminishing fish stocks" [http.www.ipsnews.net/]. Accessed September 23, 2009

populations or those moving in search of improved live-lihoods. Armed conflict and intensified national security concerns minimize capacity to cope with climate change.

Energy: Deforestation caused by illegal logging, the fell-ing of trees for firewood and charcoal for cooking, and "slash and burn" farming practices has reduced biodi-versity in Africa, and weakened the ability to adapt to climate change. Yet this situation reflects the reality of energy insecurity in Africa in terms of increasing de-mand due to population growth and dwindling supply of traditional fossil fuels. Heavy reliance on non-renew-able fuel sources for domestic energy supply in most of sub-Saharan Africa contributes to ecosystem degrada-tion, which is threatening wildlife and endangered spe-cies, and destroys natural forests. Unfortunately, loss of biodiversity is considered a marginal issue on climate change agendas in Africa, even though it could have negative economic consequences due, for example, to declines in eco-tourism. Conserving nature and restor-ing ecosystems should be an important policy consider-ation that links climate change adaptation with critical energy infrastructure and renewable energy supply such as solar, wind, hydro and geothermal power.

(ii) Climate Change and Development Link: An African Priority

The negative impact of climate change on economic growth and sustainable development in Africa, which is also limiting the ability of African countries to cope with climate change, makes a *focus on development* an African priority at Copenhagen. For Africa, the immedi-ate need is not essentially that of reducing greenhouse gas emission, which is relatively low in the global con-text. According to the World Bank's *World Development Report 2010,* high-income industrialized countries, with one-sixth of the world's population, are responsible for nearly two-thirds of greenhouse gases. *The need is for Africa to ensure that the current development impacts of climate change on its economies and populations are recognized and that a development agenda is integrated into the Copenhagen Agreement.*

Africa is extraordinarily diverse: its 53 countries have varied topology, resources, population sizes and cul-tures, and differences in development experience and performance. Yet, all African countries face the global climate change challenge, which threatens their devel-opment gains and prospects. In preparation for Copen-hagen, recent decisions taken by African leaders at the African Union (AU) Summit and the Africa Partnership Forum/UN Economic Commission for Africa Special Session on Climate Change, and the statement by the AU spokesperson at the Summit on Climate Change during the present session of the UN General Assem-bly in New York show that the continent's political leadership is sufficiently aware of the threats of climate change. African leaders are united about the need for adaptation and mitigation strategies to cope with cli-mate change on Africa's development. Africans will speak with one voice on climate change and present a common position at Copenhagen.

(iii) Climate Change and Poverty: An African Challenge

The poor are hardest hit because of their vulnerability to the effects of climate change. Most of the poor in Af-rica depend on natural resources and rain-fed agricul-ture for their livelihoods, and they are least able to cope with the shocks of climate change-induced droughts, floods, soil erosion and other natural disasters. Cli-mate change impedes poverty reduction. People will

find it hard to escape poverty if vulnerability to climate change persists, and those who have emerged from poverty can easily slip back again. Higher frequencies of climate extremes have made it difficult for households that have recovered from one climate shock to cope with another. For example, in East Africa, pastoralists who have taken the decision on the movement of their herds from drought-stricken areas have found themselves facing livestock disease, conflict over access to land, and other such conditions that could plunge them back into poverty. Hence, climate change is a limiting factor on poverty-reduction strategies such as the UN's Millennium Development Goals (MDGs). A poverty-reduction agenda must be incorporated into the Copenhagen agreement, and poverty concerns must be mainstreamed in climate change adaptation mechanisms and mitigation policies and programmes.

(iv) Climate Change and the North-South Divide: A Moral Imperative from an African perspective

As we have seen, climate change issues in the global North differ from the prevailing climate change concerns of sub-Saharan Africa. For the world's richest, industrialized countries whose energy systems and affluent lifestyles have contributed most to global warming, the priority is to avert a global climate change crisis through managed reduction of greenhouse gas emissions coupled with measurable influence and control over the process. Africa and other developing regions in the global South that have relatively low carbon emissions due to their lack of development need support and assistance to ensure survival in the face of current and future climate change challenges. Africa bears the brunt of a global problem to which it, as the least de-

veloped region in the world, has contributed the least. Poorer nations and regions have neither the wealth nor strategic capacity to impose their will on the global climate change negotiations. Any global response to climate change should first and foremost focus on securing global equity between those most responsible for climate change and those bearing most of the cost.

POLICY IMPLICATIONS AND RECOMMENDATIONS

Africa needs to have an effective voice at Copenhagen and influence on the global agreement that will emerge to ensure that a development and poverty reduction agendas are included in the outcome and follow-up action. To this end, the following recommendations are made.

NATIONAL ACTION

Increased awareness of development implications of climate change and action

African leaders and policy makers should address climate change as a development issue and recognize its major impacts on human development and sustainable economic growth, and the crucial link with poverty. African leaders should also realize the opportunities and challenges created by climate change adaptation funds/resources to alter existing development patterns and practices. Climate change creates opportunities to devise adaptation strategies to ensure food security, protect human health, prevent forced

migration and conserve nature. These may provide pathways out of underdevelopment and poverty.

Building climate change knowledge and capacity

Africa should develop capacity for research and data collection, including meteorological infrastructure, to monitor climate change impacts, and formulate and implement policies to protect natural resources, including forests, and conserve energy based on clean low carbon technologies. At the same time, African countries should realize that climate change does not just require state-of-the-art information and new technologies, but also the need for people to respond, change their behaviour and find new livelihoods. Involve people at community and grassroots levels in the planning and execution of programs and projects to minimize how climate change affects human and socioeconomic development.

REGIONAL ACTION

Coordinated and common African position

African political leadership has recognized the importance and timeliness for Africa to actively engage in global climate change negotiations via a coordinated common position to ensure the continent's interests are protected and its needs are met. This implies a key role for major continental and sub-regional organizations and institutions — the African Union (AU), United Nations Economic Commission for Africa (UNECA), African Development Bank (AfDB), Southern African Development Communi-

ty (SADC), Economic Community for West African States (ECOWAS), among others — in promoting Africa's active participation in global efforts to meet climate change adaptation objectives relevant to the continent's interests.

GLOBAL ACTION

Integrating climate change into development assistance

Link climate change adaptation with external assistance and put poverty reduction and sustainable development agendas in climate change negotiations. Climate change adaptation funds should respond to the objectives of the MDGs and the Paris Declaration on Aid Effectiveness. There is a need to connect development assistance flows for climate change adaptation with key principles of the Paris Declaration, that relate to poverty-reduction goals and the achievement of sustainable development. This calls for effective climate change adaptation governance, where the international response to climate change will be based on a shared understanding between developed and developing countries on the need for action on both current development impacts and long-term environmental goals and agreements. Developing countries should also not be obliged to transfer billions in debt repayments to rich countries most responsible for global warming, as this practice constitutes a huge drain on resources that could otherwise be spent on mitigating the impact of climate change.

Global governance innovations

Innovations in global governance should secure equity between those most responsible for climate change and those who have contributed the least, but bear the brunt of the problem. Existing and new adaptation initiatives should be governed by criteria and improvements that make them responsive to Africa's and the developing world's interests and needs.

Increased international cooperation

Provide technical assistance and capacity-building support to Africa through existing institutional and partnership arrangements, such as the Africa Partnership Forum (APF)[3], the African, Caribbean and Pacific Group of States (ACP)-EU Cooperation[4], and such programs as the as UN Environment Programme (UNEP), the World Bank and the UN International Strategy for Disaster Reduction (ISDR)[5], which aim to help African countries build their resistance to climate change vulnerability.

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[3] The APF was established in November 2003 as a partnership between the G8 and the AU/NEPAD with the aim of broadening international cooperation between the two groups, and meets regularly [www.africapartnershipforum.org]. The APF organized a special session on climate change in the run-up to Copenhagen at the UN-ECA in Addis Ababa on September 3, 2009. It issued a joint statement focusing on Africa's key concerns and expectations and announcing the decision that Africa will speak with one voice at Copenhagen (APF, 2009).

[4] The European Union has been involved in brokering a climate change deal with the ACP group of EU-associated countries in the run-up to Copenhagen. This involves developing countries, including India, China and South Africa, agreeing to rein in their emissions growth in return for greater financial aid and technical assistance for adaptation. The proposed EU-ACP agreement also includes contribution to an international fund to help the poorest developing countries deal with the current impacts of climate change.

[5] The United Nations International Strategy for Disaster Reduction (ISDR) is a Geneva-based agency that, among other things, analyzes and provides information on the nature and significance of climate change for disaster risk, as well as the main perspectives of disaster risk reduction and how they can support climate change adaptation strategies (www.unisdr.org/climate change).

POSTSCRIPT

Depending on the outcome, the world's response to climate change at Copenhagen can either be a development disaster or a development success story – this is what is at stake for Africa.

REFERENCES

Africa Partnership Forum (APF) (2009). *Special Session on Climate Change: Joint Statement.* September 3. Addis Ababa.

Africa Progress Panel (APP), Africa Development Bank, United Nations Economic Commission for Africa and United Nations Environment Programme (2009). *Climate Change: A Call to Action for African Leaders.* Geneva: APP.

Commission on Climate Change and Development and the UN International Strategy for Disaster Reduction (ISDR) Secretariat (2008). *Links between Disaster Risk Reduction and Climate Change.* Geneva.

Intergovernmental Panel on Climate Change (IPCC) (2007). *Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* Geneva. Available at: http://www.ipcc.ch.

Overseas Development Institute (ODI) (2008). *Climate Change, Forests and Environment Programmes.* Available at: http://www.odi.org.uk/ccef/index.html.

Schipper E.L.F. (2007). *Climate Change Adaptation and Development: Exploring the Linkages.* Tyndall Centre Working paper No.107.

Stern, N. (2008). *The Stern Review on the Economics of Climate Change.* London.

UNEP and UNAIDS (2008). *Climate Change and HIV/AIDS: A Joint Position Paper.* Nairobi.

World Bank (2008). *Making Development Climate Change Resilient: A World Bank Strategy for Sub-Saharan Africa.* Washington DC.

World Bank (2009). *World Development Report 2010: Development and Climate Change.* Washington DC.

CLIMATE CHANGE AND HEALTH: AN ISSUE WITH GREAT POTENTIAL FOR EXACERBATING HEALTH INEQUITIES IN AFRICA.

NELSON K. SEWANKAMBO

There is a growing consensus that the global climate is changing due to international development policies that have created an environmental hazard on a global scale, exposing societies involuntarily to the effects of greenhouse gases. These changes have substantial negative impacts that threaten to exacerbate health inequities and reverse advances recently made to improve population health, including the efforts to achieve the United Nations Millennium Development Goals (Costello, Abbas and Allen et al., 2009; WHO, 2008).

The distribution of climate-related health burdens is described as almost inverse to the global distribution of greenhouse gas emissions (Patz et al., 2007). Africa is likely to be affected the most and is the region where the observed adverse consequences of climate change are most apparent (Collier et al., 2008; Campbell-Lendrum et al., 2003; McMichael et al., 2008). Predictions are that the loss of healthy life years due to global environmental change (including climate change) is 500 times greater in Africa than in Europe, and yet health is widely recognized globally as a fundamental human right (McMichael et al., 2008). A vital step towards achieving health for all even in Africa requires

nations to ensure the provision of access to universal health coverage (Garrett et al., 2009).

In addition, the World Health Organization's (WHO) Commission on Social Determinants of Health has emphasized that actions to promote health must go well beyond health care and must focus on people's daily living conditions, that is, the conditions in which they are born, grow, live, work and age, and on the structural drivers of those conditions, such as inequities in access to power, money and other resources (WHO, 2008). Climate change per se has significant negative impacts on the social determinants of health. These conditions are intertwined and play a major, albeit indirect, role in creating and perpetuating health inequities within and between nations. In sub-Saharan Africa, rain-fed agriculture provides food for roughly 90 percent of the population and provides livelihoods for 74 percent of the poorest people. Therefore, major reductions in the amount of rainfall or changes in its patterns would lead to population ill health. The threats to health by climate change operate through direct consequences from extreme weather and through indirect pathways such as changing patterns of disease and morbidity, water and sanitation, food security, global economic crisis, population pressure, migration and urbanization (Costello, Abbas and Allen et al., 2007). The spread or resurgence of malaria to the highlands of east Africa is widely cited as an example of a vector-borne disease spreading to new geographical areas as a consequence of climate change (Wanding, Opondo and Olago et al., 2008). However, some unresolved questions remain.

Climate change is a global problem facing all nations — African countries included. To realize cross-border and

local solutions, all countries need to join in managing the effects of climate change on health. This daunting challenge requires a multidisciplinary approach that involves all sectors of government, non-governmental organizations, civil society, the private sector, media, various academic disciplines and innovative forms of international cooperation. African nations, their communities and all partners cannot afford to be passive participants in the struggle against climate change; they should be creatively and meaningfully engaged with full participation over the long haul. Partners should play an active role in monitoring, discussing, advocating and assisting with the process of adaptation and mitigation. Each country should show leadership by putting in place appropriate public health systems to deal with adverse health outcomes; developing its own capacity to monitor emerging health and health-related problems; improving the evidence base for policy makers, planners and practitioners; implementing programs and undertaking regular evaluations to assess and guide interventions.

The UCL Lancet Commission on Managing the Health Effects on Climate Change[1] argued that climate change is the biggest global health threat of the twenty-first century (Costello et al., 2009). Since it results from involuntary exposure of societies to the effects of greenhouse gases, climate change represents possibly the largest health inequity of our time, with Africa being the most vulnerable

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[1] A collaboration between The Lancet and University College London, UK. The first UCL Lancet Commission report outlines how climate change over the coming decades could have a disastrous effect on health across the globe. The report examines practical measures that can be taken now and in the short and medium term to control its effects (Costello et al., 2009).

to negative consequences (Collier et al., 2008; McMichael et al., 2008). Addressing issues of inequity requires a recognition that equity extends beyond health and disease to include processes like priority setting, developing agendas for research, and implementing interventions. The current African generation is morally obligated to do all in its power to make use of every opportunity nationally and internationally to advocate for policies and actions that will protect present and future generations against the adverse health effects of global warming.

A WHO resolution in May 2008 prioritized climate change and health, placing it firmly on WHO's health sector agenda and requiring member states to implement actions to protect the public's health from climate change (Horton, 2009; WHO, 2008). In another highly anticipated event, Copenhagen will host the Conference of Parties to the United Nations Framework Convention on Climate Change (COP 15) in December 2009. World leaders will negotiate the global successor regime to the Kyoto Protocol to accelerate efforts to mitigate and adapt to inevitable global climate changes. If COP 15 is to adequately address Africa's specific needs, African heads of state must be proactive by earnestly championing and carefully articulating a well-argued, evidence-based common negotiating position. Given the relatively limited data from the continent, linking climate change to health remains a challenge. Without a doubt, however, the health effects of climate change will be among the important considerations as negotiations for adaptation and mitigation are forcefully discussed.

On January 1, 2010, Canada will assume the G8 presidency amid expectations from the world population that climate change will become a subject of greater priority

in the G8 (WHO, 2008). The health fraternity, particularly the Canadian health community, should seize this opportunity to enhance its advocacy to influence the decisions of the G8 in favour of the world's poorest countries. There is reason to be optimistic insofar as the four priorities identified thus far by Canadian Prime Minister Stephen Harper are climate change, development, the global economy and democratic governance (Horton, 2009). It is our hope that Africa will not be sidelined during the two major events noted above and the many others to come, but rather that its special needs will be recognized and acted upon. African governments have a right to expect that meaningful strategies will be devised to facilitate access to adequate global financing and technical capacity to more seriously and concertedly address the ethical dilemma created by climate change and its effects on health in the coming decades. Africa also stands to gain if health and climate change become priority issues for African electorates when they prepare to change their leaders and hold them accountable in office.

Patz and others have argued that there is an ethical dilemma regarding climate change and health because those most vulnerable to the health risks stemming from global warming —those living in Africa — have contributed the least to global warming (Patz et al., 2007). African nations tend to be the most resource-dependent with the least resources and capacities to adapt to growth in disease and other sector impacts of climate change. African governments should work together with international agencies to put in place mitigation and adaptation policies and measures that aim to slow global warming and minimize the negative impacts of climate change on health and health inequity.

Consideration needs to be given to the probability that poorly designed policies could easily undermine both climate and health equity goals. Addressing climate change can worsen health equity, and improving health equity can worsen climate change (Walpole et al., 2009). The use of a carbon tax in Denmark was regressive in terms of income inequality. In Uganda, higher prices for hydropower appears to have driven more homes to using charcoal wood fuel, which is contributing to deforestation.

Equally important is the fact that some policies applied at the individual and industrial level to address climate change may disproportionately hurt the poor (Patz et al., 2007). In Africa, for example, poor people who often live in disadvantaged communities are extremely vulnerable since they have very limited resources to adapt to climate change-induced health threats. Poverty is rampant in Africa, a continent which is home to a population that is heavily dependent on natural resources. In addition to dependency on rain-fed agriculture, 45 percent of Africa's population sustains its livelihood by the surface water sources of the continent's major river basins of the Nile, the Congo, the Zambezi, Niger and the Chad. It is predicted that these will be adversely affected by changes in rainfall.

The continent has the most rapid levels of population growth and urbanization in the world (ISS, 2009). By 2030 Africa's population will be equal to that of China or India. East Africa is the least urbanized region in the world, but it is urbanizing quickly, having the world's shortest urban population doubling time, less than nine years; it will grow 50.6 million in 2007 to a projected 106.7 million by 2017 (ISS, 2009). These trends pose se-

rious challenges for population health especially in the context of global warming (Michael, 2008).

POLICY RECOMMENDATIONS:

- African governments need to show commitment and take the lead in organizing their own domestic responses to address the health impacts of climate change.

- Population stabilization is critical to achieving real reductions in global CO2 emissions and to coping with the health effects and equity challenges of climate change.

- African countries should draw from lessons learned in the struggle against another silent killer, HIV/AIDS, and all associated challenges and strategies such as alliances with communities, health equity, social justice and the importance of food security.

- African efforts for climate change adaptations and health should be linked to innovative strategies to improve (restructure) global health governance.

- In view of the many knowledge gaps that exist, there is a need to increase Africa's capacity to research the impacts of climate change and health, and to define effective, affordable and accessible interventions.

REFERENCES

Campbell-Lendrum D. H., Corvalan C. F. and Ustun A. Pruss (2003). "How much disease could climate change cause?" in McMichael A. J., Campbell-Lendrum D. H. and Corvalan C. F. et al. (eds) *Climate change and human health: risk and responses*. Geneva: WHO.

World Health Organization. Protecting health from climate change: report for World Health Da

Collier P., Conway G. and T. Venables (2008). "Climate change in Africa," *Oxford Review of Economic Policy*. Vol. 24, No. 2: 337-353.

Costello A, Abbas M and A. Allen et all. "Managing the health effects of climate change," *The Lancet*. Vol. 373: 1693-733.

Garrett L., Chowdhury M. R. and A. Pabloz-Mendez (2009). "All for universal health coverage," *The Lancet*. Vol. 374: 1294-99.

Horton R. (2009). "Canada 2010: what should global health expect," *The Lancet*. Vol. 746: 1677-9.

ISS (2009) *Climate change, population pressure and conflict in Africa*. ISS paper 178, January.

McMichael A. J., Friel S., Nyong A. and C. Corvalan (2008). "Global environmental change and health: impacts, inequalities and health sector," *BMJ*. Vol. 336: 191-94.

Michael A. J., Neira M. and D. L. Heymann (2008). "World Health Assembly 2008: Climate Change and Health. *The Lancet*. Vol. 371: 1895-96.

Patz, J., Gibbs, H., Foley, J., Roger J. and K. Smith (2007). "Climate change and global health: quantifying a growing ethical crisis," *Eco-Health*. Vol. 4: 397-405.

Walpole S. C., Rasanathan K. and D. Campbell-Lendrum (2009). Natural and unnatural synergies: climate change policy and health equity. *Bull World Health Organ*. Vol. 87: 799-801.

Wanding S. O., Opondo M. and D. Olago et al. (2008). "Vulnerability to climate change induced highland malaria in East Africa," in *Climate Change Vulnerability.* Edited by Nearly N., Conde C., Kulkan J., Nyong A. and J Pulhin. London: Earthscan.

World Health Organization (2008). "Protecting health from climate change: report for World Health Day." Geneva.

World Health Organization Commission on Social Determinants of Health (2008). *Closing the gap in a generation: health equity through action on the social determinants of health.* Geneva: WHO.

CLIMATE CHANGE AND FOOD SECURITY IN AFRICA

JOHN DAVID KABASA AND IRENE SAGE

FOOD SECURITY CHALLENGE IN AFRICA

Globally, about 923 million people are chronically hungry (FAO, 2008). The Millennium Development Goal of halving the number of undernourished people by 2015 is becoming more difficult to reach. Africa's food security situation is particularly worrisome. Of the 36 countries worldwide currently facing food insecurity, 21 are African (UN, 2009). More than 300 million Africans are chronically hungry — nearly a third of the continent's population (UN, 2009). Of this number, at least 235 million are in sub-Saharan Africa (FAO, 2008), making it the region on the planet with the highest proportion of chronically hungry people. The poorest families, the landless and female-headed households are among the hardest hit. Most urban and rural households in Africa rely on food purchases and stand to lose from high food prices. High food prices reduce real income and increase the prevalence of food insecurity and malnutrition among the poor.

The 2008 food crisis in Africa was overshadowed by the global financial crisis. Nevertheless, food insecurity remains rampant. Prices of basic foodstuffs remain high, and the structural factors that underpinned the crisis have not been resolved. The 2008 crisis, however, was a wake-up call for Africa. Africa and her development partners must heed and acknowledge the urgency of addressing food insecurity on the continent.

The drivers behind 2008's soaring food prices included:

1. Lower stock levels and market volatility due to changes in agricultural policies of the world's major cereal producers (China, the European Union, India and the United States) (FAO, 2008);

2. Production shortfalls due to extreme weather events;

3. Petroleum demand — steep increases in petroleum prices;

4. Biofuel demand — the emerging biofuel markets' demand for some agricultural commodities, such as sugar, maize, cassava, oilseeds and palm oil;

5. Changes in consumption patterns created by rapid and sustained economic growth and increased urbanization in some developing countries, especially China and India, which have at least 40 percent of the world's population; increased purchasing power and rising overall food demand and consumption of meat and dairy products. The latter are heavily dependent on cereal inputs;

6. Trade policies — the adoption of export restrictions and export bans by some countries reduced supply, aggravated shortages and eroded trust among trading partners. Such actions reduce farmers' incentives to respond to higher international prices. Speculative re-stocking or pre-stocking by large importers with relatively strong cash positions also contributes to higher prices; and

7. Financial markets — the 2008 turmoil in traditional asset markets impacted food prices as new types of investors became involved in derivatives markets based on agricultural commodities in the hope of achieving better returns than those available on traditional assets.

CLIMATE CHANGE AND POLITICAL ECONOMY OF FOOD SECURITY

Underlying the key drivers of high food prices is yet the bigger and growing problem of climate change and its impacts. The unimpeded growth of greenhouse gas emissions is raising the Earth's temperature leading to more and more extreme weather events, more precipitation, shifting seasons and melting glaciers. The accelerating pace of climate change, combined with population and income growth, threatens Africa's rain-fed agricultural economy and food security. Although there will be some gains, the overall impacts of climate change on agriculture are expected to be negative. Climate change-induced yield declines will result in price increases for the most important agricultural crops — rice, wheat, maize and soybeans — with consequent higher feed and meat prices. The subsequent decline in calorie consumption is predicted to increase child malnutrition.

To unpack the impact of climate change upon Africa's food security, an understanding of the political economy of food is essential. While the volatility of food prices has been disturbing and damaging, the effect will likely pale in comparison to the impact of climate change on international trade, development assistance and food security regimes. Climate change has introduced a new uncertainty that requires a re-evaluation of traditional assumptions and practices. The task for Africa's policy makers and for international organizations is to reassess trade, aid and food policies in light of the impact of climate change. The 1992 United Nations Framework Convention on Climate Change (UNFCCC) recognized Africa as the continent where the contribution to climate change has been least and yet the impact

has been greatest. Limited research, small holdings, poor infrastructure, susceptibility to drought and extreme weather events represent the principal causes of the threat of climate change to food security in Africa. A recent work summarizing international research on climate change bluntly concludes that "all the models show that Africa is the most vulnerable continent in the world to climate change." (Dinar, 2008: 4). The impact on Africa will be most significant because of the dependence of much of the continent on rain-fed agriculture and, in several cases, on production of single crops, such as coffee in Uganda, which could be profoundly affected by climate change.

The impact on food security in Africa is two-fold: first, the failure of export crops such as cocoa, flowers or coffee causes trade imbalances which greatly restrict African access to international agricultural markets; second, subsistence agriculture becomes less capable of responding to local needs, particularly as populations rise. Moreover, advanced agricultural producers can adapt quickly to the impact of climate change, producing new crops which may crowd out African exports to developed nations. In short, African agriculture is not able to adapt nimbly to changes in international commodity trade. These effects will exacerbate rural poverty, particularly since approximately two-thirds of Africans are dependent upon agriculture (FAO, 2009). Africa appears likely to contribute less to global agricultural production and to be unable to assure food security for its own population.

Regional differences in the impact of climate change upon African agriculture appear to be highly significant, with the more developed African countries such

as South Africa being less vulnerable. However, other factors, notably water and economic and social policies, also possess considerable significance. The differences could be the source of conflict within and between states, a possibility that has been recognized by several international organizations in their recent statements urging a new commitment to global food security.

One final aspect specific to Africa is the investment in African land by international investors. Since 2004, foreign countries have been purchasing or leasing vast tracks of land across Africa. For example, the United Arab Emirates (UAE) has acquired 30,000 hectares of land in the Sudan and is looking to add a further 378,000 hectares. The UAE intends to grow wheat, corn, potatoes and beans for its domestic population. China has acquired almost three million hectares of land in the Democratic Republic of Congo for food production. India, South Korea and Malaysia are also active in land acquisition across Africa. These are just some examples of where African lands have been secured by foreign investors. While such investment could potentially transfer technology and resources to enhance African production, this investment appears to reflect food security concerns in investor countries and not in Africa. It appears that there may be opportunities for enhanced food security through improved infrastructure and techniques, but there are also dangers that this production will benefit non-Africans (Cotula, 2009: 7-9).

ADAPTIVE STRATEGIES

Many African countries, often with the assistance of international organizations or development agencies, have responded to the impacts of climate change. What is apparent immediately is the variety of responses, the lack of coordination and the highly experimental nature of some approaches. There is no coherent approach to the development of a food security policy for Africa. Notable responses are often isolated and specific; for example, the efforts of Lake Olbollosat area residents in the heart of Kenya, who slowed down deforestation on the mountain slopes — which had been exacerbated by erratic rainfall caused by climate change — through reforestation. Namibia has battled desertification by using rain-fed pearl millet fields to produce a ground cover that holds the soil between rains. Similarly, the Konso of Ethiopia, living in one of Africa's harshest climates, have created inter-connected terracing systems that preserve fertile lands (Ground Up, 2007).

Clearly, such individual responses are essential to assure food production in threatened areas. In a broader sense, the African response must be local but must also reflect cooperation among African states to produce a common voice to press upon the relevant international organizations the need for a broader response to the challenge of food security. Both the G8 and the G20 have recently emphasized the need for an integrated and effective approach to food security, and Africa must play a major part in shaping that effort.

To contain the negative effects of high food prices, governments have introduced various measures, such as price controls and export restrictions. While understandable from an immediate social welfare perspective, many of these actions have been ad hoc and are likely to be ineffective and unsustainable. In the long run, high food prices represent an opportunity for Africa's agriculture, but this will have to be accompanied

by the provision of essential public goods. Smallholder gains could fuel broader economic and rural development. Farming households can see immediate gains; other rural households may benefit in the long run if higher prices turn into opportunities for increasing output and creating employment.

Africa and her partners must combine efforts in a strategic, twin-track approach to address the impact of high food prices on hunger. This should include: 1) measures to enable the agriculture sector to respond to the high prices; and 2) carefully targeted social protection programs for the most food-insecure and vulnerable.

Policy Recommendations

- Create task forces on food security in each major country and regional bodies to coordinate policy and adaptive strategies.

- Build upon the G8 and G20 food security initiatives to re-examine existing international financial agreements and conditionalities. A "food first" approach should be a condition of future agreements.

- Establish national and regional resource management boards, with the backing of African governments and regional bodies, to assess foreign investment in African land with a view to establishing that such investments bring "net benefit" to Africans.

- Hold a high-level summit on urbanization and its management in Africa, with particular reference to the impact of the process on food security in Africa.

- Encourage the twin-track approach to hunger reduction; that is, address both the threats to food security caused by high food prices, and the opportunities that arise.

- Encourage targeted social protection programs to ensure that everyone is able to access the food they need for a healthy life. Help producers, especially small-scale farmers, to boost food production.

- Strengthen Africa's agricultural sectors to enable them to respond to growth in demand. The expansion of food production must constitute the cornerstone of policies, strategies and programs.

- Empower both small-scale farmers and the youths who constitute the next generation of farmers. Past investments overemphasized small-scale farmers.

- Develop efficient early warning systems: food crises can emerge anytime, anywhere. Africa needs to have a long-term focus on agricultural development in the context of economic diversification.

REFERENCES

Cotula, Lorenzo, Sonja Vermeulen, Rebeca Leonard, and James Keeley (2009). *Land grab or development opportunity?* Rome: FAO, IIED, and IFAD.

Dinar, Ariel, Rashid Hassan, Robert Mendelsohn, James Benhin et al. (2008). *Climate Change and Agriculture in Africa: Impact Assessment and Adaptation Strategies.* London: Earthscan.London. FAO

(2007). Ground Up: A PELUM/PSAf publication promoting sustainable community development. Vol. 3, No. 19. November.

(2005). "Africa: Whatever you thought, think again," in *National Geographic.* Special Issue. September.

Pak Sum Low (ed.) (2005) *Climate Change and Africa.* Cambridge: Cambridge University Press.

Republic of Uganda (2007). Climate Change: Ugandan National Adaptation Programmes of Action. Kampala.

United Nations (UN) (2009). *Food security in Africa: learning lessons from the food crisis.* United Nations Conference on Trade and Development

CLIMATE CHANGE AND CONFLICT IN AFRICA

DENNIS G. WILLMS AND KAROLINA WERNER

BACKGROUND

Africa will be one of the continents hardest hit by the effects of climate change. Increased drought, desertification, variability in rainfall and other consequences resulting from environmental changes undermine the continent's ability to adapt. Many African countries are marked by grinding poverty, and possess unsupportable infrastructures and weak governance mechanisms that contribute to political instability. These fragile states have an increased risk of conflict (Francois and Sud, 2006). Moreover, if the underlying causes of conflict are not fully addressed during post-conflict reconstruction, conflict is likely to recur. For all stakeholders, reflective, participatory and indigenous policy processes are required to translate these concerns into effective, defensible and practically implementable processes for adaptive change.

ASSUMPTIONS

Emerging situations of conflict, juxtaposed with necessary adaptive responses to the consequences of climate change, negatively reinforce each other. As already impoverished groups seek to adapt to pervasive droughts or continual flooding, the power struggles that erupt between ethnic, religious and political camps and indigenous leaders often decrease the necessary adap-

tive capacity of these groups. Culturally, the adaptive responses rely on the essentials of mutual trust — a moral ingredient required to generate solutions that will resolve present problems, thereby ensuring they do not escalate into violent tensions. Yet how is this trust and moral courage harnessed between conflicting groups?

CASE STUDY

There are many examples of conflict intertwined with the effects of climate change, including the widely discussed rainfall variability in Sudan that has been identified as an important factor in the Darfur conflict (Ki Moon, 2007). The variability in rainfall and the accompanying droughts have forced pastoral communities to change routes and watering holes, leading them to new and potentially unfriendly areas. Peoples' fight for survival has resulted in new conflicts. A closer look at pastoralism, characterized by nomadic migration and the tradition of raiding, may be warranted. It is a common thread in many cases of conflict driven or exacerbated by climate change.

Kenya, for example, experienced a period of prolonged drought between 2004 and 2006. The Turkana district, a part of the larger Karamoja cluster, located in the north-western part of Kenya on the border with Uganda, is one of the driest areas in Africa where pastoralists roam. It also has some of the highest levels of poverty in the country (Eriksen and Lind, 2009). A history of periodic cross-border conflicts between tribes during British colonial rule weakened the adaptive strategies used by the Turkana population. Raiding and increased violence by bandits has further undermined trust in the usual pastoralist culture. Once considered a legitimate

practice and part of pastoralist culture, raiding has become increasingly violent, due to necessary claims to existing resources, and is now classified as theft. This situation has developed into a rivalry among warlords, particularly in areas such as Turkana (Meier et al., 2007). As a coping strategy, many inhabitants have settled down, deeming pastoralism no longer safe. Yet this threatens cultural institutions once deemed sacrosanct, and the resentment this incurs breeds collective anger, again leading to intra- and inter-group conflict.

Due to the prevalence of violence, access to livestock and other resources — which were instrumental in the maintenance of social ties across borders — has been restricted. People are wary of outsiders and refuse to trade livestock with strangers, as it may have been stolen (Eriksen and Lind, 2009). Entire social networks are affected, with many people abandoning their previous way of life for fear of losing even more animals. The lack of such reciprocal exchanges and joint peace initiatives makes organized raids more likely (Meier et al., 2007). These conflicts have influenced the population's adaptive capacity.

One report (Christian Aid, 2006) posits that pastoralists in the Horn of Africa may be the first people unable to sustain their way of life due to climate change. As their grazing and watering paths are changed, and political pressures over ever-dwindling resources are heightened, pastoralist peoples will either abandon their nomadic way of life or turn to violence to protect what they believe is theirs. These two stressors (environment and conflict) are continuously working against groups such as the Turkana, weakening their already diminished adaptive capacity and leaving them with limited avenues for recourse. Climate

change has influenced resource availability, including livestock, and has therefore led to increased violence and conflicts among the Turkana people.

DISCUSSION

The link between climate change and conflict is complex. We argue that the two reinforce each other in a vicious cycle. Addressing this combination of forces requires innovative processes for adaptation.

This raises several important questions. How, in the context where climate change is linked to conflict, do we prevail and overcome the odds? How do we resolve this challenging concern? What are the culturally compelling methods for resolution?

EMPLOYING INDIGENOUS PROCESSES

We argue that it is important to respect indigenous conflict-resolution processes and build on these cultural traditions in addressing the problem of climate change as it impacts conflict concerns.

Why should this be the case?

In the absence of the present concern for climate change, indigenous practices have been employed to resolve conflict situations. Some of these are institutionalized in family councils organized by tribal elders and chiefs. The authority wielded by these councils fostered renewable trust among ethnic groups. Adaptive responses to conflict resulted in the exchange of livestock, agreement on pastoral routes and migration patterns, and collaborative councils that allowed all groups to continue with life during the shocks of prolonged droughts. Many of these negotiating proc-

esses are still used today, but they are slowly being undermined by overarching political and nationalist controls. Clan chiefs no longer wield the same power. The formation of larger allied groups that have the potential to influence local policy makers has become pivotal to ensuring that the local population's needs are taken into account (Eriksen and Lind, 2009).

The cultural adaptive processes used in the past, as well as traditional conflict-resolution mechanisms, may be the entrée into implementable policy solutions. Attempts by international aid agencies to implement change have not always been successful. Acknowledgement and strengthening of the existing processes may be key to how Africa can deal with climate change and conflict.

POLICY RECOMMENDATIONS

Core Recommendation

That acknowledgement and respect should be afforded to indigenous institutions and processes for problem solving in the context of climate change and conflict. Any advancements should build on these institutional premises, and seek to merge present scientific evidence with traditional, cultural evidence as to how to name the problem, represent its reality and collectively resolve it.

There is widespread agreement in the literature that existing conflict-resolution mechanisms may be pivotal in preventing resource conflicts from escalating (Salehyan, 2008; Nyong and Fiki, 2005; Eriksen and Lind, 2009). Examples range from *indaba*, a Zulu tradition of gathering for purposeful discussion, to *mato-oput*, a Ugandan traditional mediation and sharing of a bitter drink (Wasonga, 2009) or the well-known village assemblies of the *gacaca* process in Rwanda (Graybill, 2004).

Similarly, conceptual events have been used by organizations such as the Salama SHIELD Foundation as a process mechanism for resolving conflict and disputed arguments in the context of HIV/AIDS and the convergence of differing cultural agendas – science, religion and traditional culture. Conceptual events are "facilitated, creative, problem-based forums that intentionally nudge individuals with different truth perspectives toward constructing a shared, ethically compelling framework for understanding a problem and devising behavioural and social solutions" (Willms, Arratia, & Makondesa, 2004).

Additional Recommendations

In addition to the above core recommendation, the following are relevant:

Construct a conflict-sensitive mechanism — that is, a trigger thermometer, much like an early warning system, which easily identifies emerging events that are the consequence of climate change linked to conflict.

As part of advancing policies that deal with vulnerability to climate change, the potential for conflict in certain regions should be kept in mind. Attempts should be made to create institutions — and early warning signals — that address conflict in its early stages. Furthermore, any policies that deal directly with adaption and climate change

should be sensitive to potential conflict concerns, including tribal traditions and nomadic patterns. *Processes need to be created for collaborative discussion (mediation, resolution) across stakeholder constituencies — that is, between cultures, regions, government and non-government organizations (NGOs).*

Participatory, process methods need to be implemented to engage all stakeholders in a morally equivalent manner — where all are treated as equals at the table in determining the nature of the problem, how it should be communicated and represented and what solutions and interventions are required to address the problem. Usually, it is the scientific and government authorities that have a voice. In this instance, respect must be shown to traditional elders, chiefs and leaders whose wisdom needs to be appropriated in mitigating conflict and climate change concerns.

Produce plans for climate-induced migration.

As climate change becomes more pronounced, various communities may be forced to migrate to sustain themselves. Water scarcity, continual flooding or mudslides may make life in their area impossible. Because migration is a common trigger for conflict, it is important that provisions be made for these types of movement, which limit the likelihood of conflict as much as possible. Clear and transparent regulations for newly arrived migrants, awareness raising within cities, towns and villages, as well as focused programs to integrate new arrivals should be considered.

Build and construct socially-, culturally-, and institutionally-compelling capacities for adaptive response.

As capacity for adaptation to climate change increases, so too does the capacity to deal with conflict. Strong local and national institutions will provide the communication vehicle for the sharing of knowledge and lessons learned on how to deal with the consequences of environmental change. This will then mobilize the community for action, encourage collaborative activities and ultimately lessen the likelihood of conflict.

Policy Recommendations

• Acknowledgement and respect should be afforded to indigenous institutions and processes for problem solving in the context of climate change and conflict. Any advancements should build on these institutional premises, and seek to merge present scientific evidence with traditional, cultural evidence as to how to name the problem, represent its reality and collectively resolve it.

• Construct a conflict-sensitive mechanism — that is, a trigger thermometer, much like an early warning system, which easily identifies emerging events that are the consequence of climate change linked to conflict.

• Processes need to be created for collaborative discussion (mediation, resolution) across stakeholder constituencies — that is, between cultures, regions, government and non-government organizations (NGOs).

• Produce plans for climate-induced migration.

• Build and construct socially-, culturally-, and institutionally-compelling capacities for adaptive response.

REFERENCES

Christian Aid (2006). *Life on the Edge of Climate Change: The Plight of Pastoralists in Northern Kenya*. Available at: http://www.reliefweb.int/rw/RWFiles2006.nsf/FilesByRWDocUNIDFileName/LTIO-6VHRL6-christianaid-ken-13nov.pdf/$File/christianaid-ken-13nov.pdf.

Eriksen, S., and Lind, J. (2009). "Adaptation as a Political Process: Adjusting to Drought and Conflict in Kenya's Drylands," *Environmental Management*. Vol. 43: 817-835.

Graybill, L. S. (2004). "Pardon, Punishment, and Amnesia: Three African Post-Conflict Methods," *Third World Quarterly*. Vol. 25. No. 6: 1117-1130.

Ki Moon, B. (2007). "A Climate Culprit in Darfur," *The Washington Post*. June 16.

Meier, P., Bond, D. and J. Bond (2007). "Environmental Influences on Pastoral Conflict in the Horn of Africa," *Political Geography*, Vol. 26: 716-735.

Nyong, A., and C. Fiki (2005). "Drought-Related Conflicts, Management and Resolution in the West African Sahel," Human Security and Climate Change: An International Workshop.

Salehyan, I. (2008). "From Climate Change to Conflict? No Consensus Yet," *Journal of Peace Research*. Vol. 45: 315-326.

Wasonga, J. (2009). "Rediscovering Mato Oput: the Acholi Justice System and the Conflict in Northern Uganda," *Africa Peace and Conflict Journal* .Vol. 2, No. 1: 27-38.

Willms, D., Arratia, M. and P. Makondesa (2004). "Malawi Faith Communities Responding to HIV/AIDS: Preliminary Findings of a Knowledge Translation and Participatory-Action Research (PAR) Project," *African Journal of AIDS Research*. Vol. 3, No. 1: 23-32.

Climate Change and Migration: Effects and Adaptation Mechanisms in Africa

Christopher Garimoi Orach

Introduction

Today many developing countries are under considerable threat from changes in the global climate, characterized by an increased severity and frequency of droughts and floods, which have forced people to leave their homes. Several recent reports have highlighted the potential for climate change to cause increased migration (Black, 2001). An estimated one billion people worldwide could be forced from their homes by 2050, with 250 million of them permanently displaced by the effects of climate change.

It has been estimated that by the end of the century global temperature will have increased between 1.8 and 4 degrees Celsius and sea level by 0.18 to 0.59 metres (IOM, 2008). During the twentieth century the rate of warming in Africa was put at 0.05 degrees centigrade per decade (Nkomo et al., 2006). Warming is predicted to be greatest over land, in continental interiors and at high northern latitudes. Increases in rainfall are forecast in high latitudes whilst decreases are likely in most sub-tropical land regions. It is expected that hot extremes, heat waves and heavy rainfall events will become more frequent and tropical cyclones more intense (IOM, 2008). In Africa significant climatic change has oc-

curred with long-term reduction in rainfall reported in the semi-arid regions of West Africa, while in the Sahel there has been on average a 25 percent decrease in rainfall over the past 30 years (Nkomo et al., 2006).

Environmental migrants have been defined as persons or groups of persons who, for compelling reasons of sudden or progressive changes in the environment that adversely affect their lives or living conditions, are obliged to leave their habitual homes, or choose to do so, either temporarily or permanently, and who move either within their country or abroad (IOM, 2008).

Without urgent actions global warming will exacerbate conflicts, natural disasters and development projects that drive displacement. Current international mechanisms to address displacement are feeble, disorganized and underfunded.

Effects of Climate Change

Although for the large part developed countries are culpable for climate change and have contributed most to total global emissions, it is poorer countries that will suffer catastrophic impacts in the long term. Small island developing states (SIDS) such as Cape Verde, Seychelles and Mauritius, as well as African mega deltas such as the Nile delta in Egypt, Niger Delta, the Kalahari and Okavango deltas in Botswana are particularly vulnerable (Black, 2001). Current projections of sea level rise and increased tropical cyclone intensity may make many of these small island states in Africa uninhabitable.

The effects of climate change include an increasing frequency of extreme weather events, rising sea levels, changes in precipitation patterns and droughts, increas-

ing water shortages, the spread of tropical and vector-borne diseases and increased frequency and intensity of storms. Recurrent droughts are becoming commonplace in several parts of Africa with the impacts on the population increasing exponentially. Droughts have largely occurred in the Sahel and in some parts of southern Africa. During the Sahelian drought of the early 1970s, about 300,000 people and millions of animals died. Flooding, on the other hand, has also caused havoc particularly in southern and eastern Africa. Floods in Mozambique in 2000 resulted in two million people being displaced with 350,000 jobs lost, impacting the livelihoods of up to 1.5 million people (Nkomo et al., 2006).

The effects of climate change will be felt most acutely by those segments of the population which are already vulnerable, especially those in the poorest countries (Centre for International Earth Science Information Network, 2009). The impact of climate change on livelihoods is manifested directly and indirectly, including loss of natural resources and changes in the viability of economic processes due to changes in global markets.

Future climate change is expected to have considerable impacts on natural resource systems and changes in the natural environment, sustenance and livelihoods. These in turn can lead to instability and conflict, often followed by displacements of people and changes in migration patterns. For example, the ongoing conflict in Dafur relates to scarcity induced conflicts. Therefore, as hazards and disruptions associated with climate change grow in this century, so too may the likelihood of related population displacements (Hugo, 1996).

Mass movements of people are projected to occur, especially from developing countries that lack the capacity to cope with recurrent droughts and associated food shortages and climate change-related migrations; such population movements are likely to pose serious international security challenges in coming decades (Mitchel and Tanner, 2006). In sub-Saharan Africa instances of climate-related conflicts have been noted. As most climate models predict a decline in precipitation in several dry-lands in sub-Saharan Africa with consequent declines in biodiversity, we might witness an increase in these scarcity-induced conflicts (Nkomo et al., 2006).

VULNERABILITY

Vulnerability to climate change has been characterized as a function of both exposure to climatic conditions and the adaptive capacity of the population at risk. The vulnerability of populations to the possible impacts of climate change depends upon both the nature of the changes in natural systems and the nature of the human social, political and economic systems in a given place at a given time (Mitchel and Tanner, 2006).

The degree of vulnerability varies widely within countries, communities and households. An important factor influencing adaptive capacity is people's access to and control of natural, human, social, physical, political and financial resources (Mitchel and Tanner, 2006). Africa's climate is highly variable and is prone to climate extremes such as droughts and floods, which have increased in frequency and severity over the past 30 years, largely in the Sahel and in some parts of southern Africa. Almost every country has experienced a yearly reduction in rainfall. The *harmattan* north-easterly trade wind that blows along the coast of West Africa has weakened, particularly in Benin and Côte d'Ivoire (WOEID, 2009).

ADAPTATION MEASURES

Recent studies in African countries have examined ways in which populations have attempted to cope with recurrent droughts. Because agriculture in these countries is often so heavily dependent on rainfall (as opposed to irrigation in more developed countries), rural populations there are particularly exposed to fluctuations in precipitation. The evidence is that drought occurs with sufficient frequency that some groups have adopted a range of adaptive strategies to cope with climactic risks, including particular temporary migration patterns. In western Sudan, for example, such migration strategies have included sending an older male member to Khartoum to seek wage labour when drought conditions occur. Similarly, the migration patterns of young people in northern Ethiopia appear to respond directly to patterns of drought. In dry rural areas, once drought becomes particularly severe and other adaptation options are exhausted, entire families and communities will move to places where relief is expected to be available (Mitchel and Tanner, 2006; Centre for International Earth Science Information Network, 2009).

Reduce Greenhouse Gas Emissions to Safe Levels

The international community has until December 2009, at the Conference of Parties to the United Nations Framework Convention on Climate Change (UNFCCC), to agree on a way forward to cut back on greenhouse gas emissions. If this deadline is not met, we will almost surely shoot past any safe emissions scenario and commit future generations to a much more dangerous world in which climate change-related migration and displacement on a truly massive scale is unavoidable (Centre for International Earth Science Information Network, 2009).

Invest in Community Resilience

There is need to increase people's resilience to the impacts of climate change so that fewer people are forced to migrate. The breakdown of natural-resource dependent livelihoods is likely to remain the premier driver of long-term migration during the next two to three decades. Climate change will exacerbate the situation unless vulnerable populations, especially the poorest – and particularly the poorest in Africa – are assisted in building climate-resilient livelihoods. This will require substantial investment in:

1. Adaptation measures: including water-wise irrigation systems, low/no-till agricultural practices, income diversification and disaster risk management.

2. Initiatives to help small farmers and other vulnerable groups to protect and promote agricultural production: simple, inexpensive actions such as setting up an effective system of meteorological alerts, improving agricultural extension services so as to increase yields, and the establishment of independent networks of information exchange between and among communities across the region.

3. The empowerment of women and other marginalized social groups to overcome the additional barriers they face to adaptation.

4. Inclusive, transparent and accountable adaptation planning with the effective participation of especially vulnerable populations across the continent.

The scale of current and projected environmental changes necessitates a crucial role for central governments in Africa. However, benefits can be maximized and risks minimized if vulnerable populations are meaningfully involved in planning, implementation, monitoring and evaluation and coordinated responses to environmental change.

Prioritize the Most Vulnerable Populations

While negotiations under the United Nations Framework Convention on Climate Change (UNFCCC) are currently focused on how to generate sufficient funds for adaptation in developing countries in Africa and how the funds should be managed, it is, however, equally important to determine how funds will be channeled so that they reach the people who need them most. Objective criteria for assessing vulnerability to the negative impacts of climate change — including people's risk of displacement — should be developed to guide priority assistance.

Policy Recommendations

Institutions tasked with protecting the basic rights of migrants and displaced persons are already underfunded and overstretched in Africa. Climate change will exacerbate their strain, making the practice of protection even more difficult. The international community must therefore put in place measures to protect migrants and displaced persons under conditions of radical environmental change. Climate change will result in cases that do not fit into current distinctions between voluntary and forced migration. In order to satisfactorily address such challenges, duty bearers need to develop clear guidelines for protecting the rights of environmentally-induced migrants.

The challenges posed by climate change must be factored into international norms and legal instruments dealing with displacement and migration. These should be integrated in Africa's existing national frameworks for dealing with displacement and migration in the context of climate change.

Development agencies already advocate for cuts in greenhouse gas emissions, but they must also adopt a new role focused on helping people to adapt to climate change. The role of development agencies in climate change adaption is critical and may include raising awareness among partner organizations about adaptation in Africa.

Development agencies should:

- Make all their programs more responsive to climate change impacts.

- Plan their adaptation activities to ensure they are consistent with poverty reduction policies, plans and programs.

- Engage with international climate change debates and continue to advocate for government action on climate change and adaptation.

- Build links with researchers to help create and refine new approaches to adaptation.

Developing countries, particularly in Africa, need pro-poor climate change adaptation policies that build local resilience and adaptive capacity, thereby reducing the need for poor people to migrate away from affected areas. Policies need to support all migrants in the future, including those who have migrated partly due to climate change; for example, there is an urgent need to improve disaster preparedness and address overcrowding in

large cities in African countries such as South Africa, Nigeria, Algeria and Egypt. Climate change concerns ought to be integrated in the school curriculum, and disaster-risk-reduction strategies can be incorporated into the MDG-based national sustainable development plans.

Policy makers in Africa must also support further research to understand the specific causes and consequences of migration associated with climate change, and to improve estimates of the likely numbers involved. A good way to do this is to develop locally specific, case study research, which highlights how the existing drivers of migration might be impacted by, or sensitive to, climate change. In the agricultural sector, strategies should range from the development and deployment of early warning systems, better agricultural management systems, improved crop cultivars, better and more efficient irrigation systems and good grain storage systems.

Policy Recommendations

Development agencies should:

- Make all their programs more responsive to the impacts of climate change.

- Plan their adaptation activities to ensure they are consistent with poverty reduction policies, plans and programs.

- Engage with international climate change debates and continue to advocate for government action on climate change and adaptation.

- Build links with researchers to help create and refine new approaches to adaptation.

References

Black Richard (2001). "Environmental Refugees: Myth or Reality?" in *New Issues in Refugee Research*. Geneva: United Nation High Commissioner for Refugees. Working Paper No. 34: 1-19

Centre for International Earth Science Information Network (CIESIN) (2009). *Mapping the effects of Climate Change on Displacement and Migration*. May.

Hugo, G. (1996). "Environmental Concerns and Migration," *International Migration Review*. Vol. 30, No. 1: 105-131

International Organization for Migration (2008). *Migration and Climate Change*. Available at: http://www.iom.int/jahia/jahia/pia/1824.

Mitchell, Tom and Tanner Thomas (2006). "Adapting to Climate Change: Challenges and Opportunities for the Development Community," *Tearfund Discussion Paper*.

Nkomo JC, Nyong et al. (2006). "The impact of climate change in Africa." Available at: www.hm.treasury.gov.uk/d/chapters5.

OFEDI (Organisation des Femmes pour l'Environnement et le Développement Intégré) and GRAIN (Genetic Resources Action International) (2009). "Climate Change in West Africa – The Risk to Food Security and Biodiversity." *Seedlings*. October 2009. Available at: http://www.grain.org/seedling/?id=650

CLIMATE CHANGE AND ENERGY IN AFRICA

JAMES BAANABE ISINGOMA

BACKGROUND

Climate change will increasingly impact Africa due to many factors, including the proximity of many African countries to the equator. These impacts are already being felt and will increase in magnitude if action is not taken to reduce global carbon emissions. The impacts include higher temperatures, drought, rising sea levels, changing rainfall patterns and increased climate variability. These conditions have a bearing on energy production and consumption. The recent drought in many African countries, which has been linked to climate change, adversely affected both energy security and economic growth across the continent. With increasing population and corresponding energy demand, energy security must be addressed because energy is crucial for sustainable development.

ASSUMPTIONS

The impacts of climate change in Africa are likely to increase. Adaptive measures need to be introduced before energy shortages take a major toll on African economies.

According to the Intergovernmental Panel on Climate Change (IPCC), adaptation to climate change is defined as: "Any adjustment in natural or human systems in response to actual or expected climatic stimuli or their ef-

fect, which moderates harm or exploits beneficial opportunities" (IPCC TAR, 2001). The objective of adaptation is to "reduce vulnerability to climatic change and variability, thereby reducing their negative impacts. Adaptation should also enhance capability to capture any benefits of climate change. The gross benefit of adaptation can then be summed up as the damage avoided while the net benefit of adaptation is the damage avoided, less the cost of adaptation" (Stern Review, 2007). What policy actions will enable Africa to adapt to impacts of climate change on energy?

CASE STUDY

Climate change is one of the major causes of the recent drought experienced across the continent. The impacts of drought on the energy sector have been felt primarily through losses in hydro-power potential for electricity generation and in the effects of increased runoff, and consequent siltation, on generating capacity. Africa offers a good case study of the impacts of climate changes on electricity generation.

- In Ghana in 2007, the water level at the Akosombo dam fell below the minimum level of 240 feet. This caused a reduction in hydro generation that left the authorities with no alternative but to resort to load-shedding of electricity in the whole country (AFREPREN, 2009).

- In Uganda between 2004 and 2006, water levels at Lake Victoria dropped to 10.4 metres, far below the average of 11.5 metres; over the same period hydro-electric generation has fallen by over 100 MW (Baanabe, 2008). The loss of generation resulting from this load-shedding contributed to a fall in the GDP

growth rate to 4.9 percent from the projected 6.2 percent in 2005/2006 (MEMD, 2006). Thermal energy was introduced to mitigate the impact of load-shedding, but this is a more expensive energy source and has proven unaffordable for consumers. The electricity tariff rose by more than 100 percent in 2006. In addition, the government is subsidizing thermal energy to the tune of US$50,000 annually (Baanabe, 2008).

- Between 1997 and 2005, Tanzania experienced drought as a result of climate change and the Metera dam reached its lowest water level, resulting in a 17 percent drop in hydro generation. Tanzania announced a major power load-shedding that adversely affected industrial and commercial sectors. As in Uganda, thermal generation was introduced to meet the shortfall (Karekezi and Kithyome, 2005).

- In Kenya, drought between 1999 and 2002 drastically affected hydroelectric generation, and in 2000 capacity fell by 25 percent (Karekezi and Kithyoma, 2005). The resultant cumulative loss in generation was variously estimated at between 1.0 and 1.5 percent of total GDP (Karekezi and Kithyoma, 2005). Hydro power had to be replaced by more expensive fuel-based generation and power rationing was introduced in 1999-2001.

- In Ethiopia in 2006-2007, the country experienced more than six months of power cuts due to drought-related low water levels in hydro dams. Initially there were scheduled blackouts once a week, but as the drought continued customers lost power for 15 to 48 hours a week (Karekezi and Kithyome 2005).

DISCUSSION

Hydro is the main source of electricity generation in many African countries. For example, 70 percent of Kenya's installed capacity of 885 MW comes from hydro, 58 percent of Tanzania's 655 MW, 93 percent of Zambia's 1,786 MW, and 65 percent of Uganda's 580 MW (African Energy Commission, 2008). The recent recurrence of drought has reduced water inflows in rivers, severely affecting power production and leading to drastic effects such as massive load-shedding programs which in turn result in massive losses in the region's economies.

The impacts of climate change on hydro-power generation include: lower levels of water in catchment areas, reduced hydroelectric generation capacity, inability to meet growing demand for power and increased electricity costs in many countries.

It is important to realize that climate change has a major impact on energy production, without which African countries will suffer declining growth and declining living standards. Worse still, the alternative to hydro power is thermal power, which is seven times more expensive and requires tariff increases and government subsidies.

The money invested in thermal plants could better be spent in the development of renewable energy. For example, in the last four years Uganda has spent over US$200 million to subsidize expensive thermal power. If we estimate an investment of US$2.5 million per MW in mini hydro, the money spent on subsidizing thermal power is equivalent to investment in about 80 MW of mini hydro production.

THE ROLE RENEWABLE ENERGY CAN PLAY

Renewable energy is an ideal option to complement large-scale hydro-power generation. Geothermal, small hydro, biomass cogeneration and wind energy options are attractive since the resources are widely available across the continent. These renewable energy options are not only environmentally friendly, but are more suitable adaptation responses to the adverse impacts of climate change-related drought on the power sector.

Many African countries have made commendable strides in integrating renewable energy sources (non-large hydro) into their energy supply mix. In Morocco and Egypt, for example, electricity from wind energy is supplying the grid. In Kenya and Djibouti, electricity generation from geothermal energy is fairly well developed. Mauritius is advanced in cogeneration, which involves the generation of electricity from bagasse, a byproduct of sugar factories. Other countries, including Uganda, are also making positive developments in grid-connected bagasse cogeneration. Kenya, Mozambique and Uganda, among many others, have promoted solar photovoltaic (PV) for remote rural electrification, and several countries have developed innovative mechanisms to accelerate its dissemination in rural areas. For example, Uganda has introduced credit support mechanisms and subsidies to promote the dissemination of solar technologies. In the area of biofuels, a revival is coming for commercial production of ethanol and bio-diesel for blending with automotive petrol and diesel, respectively.

Renewable energy technologies can play the following role:

- Supplement grid power, preferably through standardized power purchase agreements and feed-in tariffs;

- Provide decentralized (off-grid) electricity in remote areas, through mini-grids (for example, small hydros, biofuels) or stand-alone solar PV systems, pico-hydros, and so forth; and

- Blend biofuels with petroleum products to reduce the effects of oil shocks, save foreign exchange and, to some extent, reduce carbon emissions.

What are the options for policy reform in order to strengthen the investment climate? How relevant is the involvement of the private sector for this?

Most African countries have yet to make the policy and legislative changes to enable renewables to achieve mainstream interest so that they can be included in strategies for regulated liberalized energy suppliers. Renewable energy technologies have not been popular because of their high initial costs. Moreover, electricity generation from these new sources must still compete with conventional sources such as large hydro and fossil fuel production facilities.

Policy directions for change as articulated in Uganda's Renewable Energy Policy (March, 2007) could serve as a model for wider applicability:

- Ensure the legal and regulatory framework is responsive to the development of renewable energy sources and facilitate their promotion.

- Establish an appropriate financing and fiscal policy framework for renewable energy technology investments, including targeted subsidies, tax rebates/exemptions, favorable feed-in tariffs, risk mitigation and credit enhancement mechanisms.

- Mainstream poverty eradication, equitable distribution, social services and gender issues in renewable energy strategies.

- Promote research and development, international cooperation, technology transfer and adoption and standards in renewable energy technologies.

- Promote and enhance the sustainable production and utilization of biofuels, including developing the necessary legislation.

- Promote and encourage the conversion of municipal waste biomass to energy, in particular, municipal and industrial waste.

POLICY RECOMMENDATIONS

Priorities for governmental intervention to ensure improved energy supply

The challenges in the energy sector require that the utilities are efficient and address bottlenecks along the energy supply chain. African governments need to take appropriate action to attract investment in energy production. To improve the situation, African governments could:

- Introduce reforms to liberalize energy supply and attract private sector investment. Such reforms could include breaking the monopoly of vertically integrated utilities to allow more players in the sector, and introducing an independent regulation.

- Encourage small-scale renewable energy generation (up to 20 MW) by creating incentives for private sector investment. An example might be a published feed-in tariff: a minimum amount that anyone exporting electricity to the grid will be paid for each unit exported, a scheme specifically designed to make these investments financially viable.

- Set efficiency improvement targets for utilities, such as loss reduction in the system, to be achieved in each business centre, that is, in generation, transmission and distribution, respectively.

- Establish standard legal documents for entities entering into contractual arrangements in bulk energy in order to reduce transaction time.

- Establish a regulator with powers to prevent market abuse and ensure good service and transparency.

Strengthen regional and national institutional frameworks to tap into opportunities presented by the international community to mitigate the impacts of climate change

In terms of carbon emission reduction, Africa has the least per capita carbon emission, averaging 0.1 tonnes of carbon per year (TC/Y) compared to the world's average of 1.0 TC/Y, Europe at 2.5 TC/Y and USA at 5.5 TC/Y (Migereko, 2007). This means that Africa's obligation to combat climate change is much less than the other continents, especially that of Europe and North America. Nonetheless, Africa has an opportunity to earn carbon emission credits by moving to exploit non-polluting renewable energy sources and adopting energy-efficiency practices.

African countries can tap into the various international and regional initiatives that can provide funding for renewable investments. These initiatives include: the Global Environment Facility and the Kyoto Protocol's Clean Development Mechanism1 (CDM)[1]. One drawback of the CDM, however, is its high transaction costs and specialized skill requirements that have tended to limit the participation of African countries and experts to date.

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[1] The Clean Development Mechanism proposes that industrialized countries or their companies can earn emission credits by investing in projects to protect the environment, while developing countries acquire technology and capital and earn emissions credits that could be banked or sold.

REFERENCES

AFREPREN (2009). Large Scale Hydropower, Renewable Energy and Adaptation to Climate Change: Climate Change in East Africa and the Horn of Africa. Available at: http://www.hbfha.com/downloads/RenewableEnergyandAdaptationtoClimateChangePublication.pdf

African Energy Commission (2008). The AFREC Programme and Plan of Action on Large Hydropower Development in Africa.

Baanabe James (2005). Large Scale Hydropower Renewable Energy Adaptation and Climate Change for Energy Security in East and Horn of Africa. A paper presented at HBF regional workshop on November 21, 2008, Nairobi, Kenya.

Daudi Migereko (2008). Climate Change and Clean Energy – Challenges and Opportunities in Addressing Africa's Growing Energy Needs. A paper presented at a conference on October 20, 2007 in Washington, DC.

International Energy Agency (2009). World Energy Outlook 2009. Vienna. Forthcoming.

Intergovernmental Panel on Climate Change (2001). "Climate Change 2001 Impacts, Adaptation, and Vulnerability," IPCC Third Assessment Report. Cambridge: Cambridge University Press.

Karekezi and Kityoma (eds.) (2005). Sustainable Energy in Africa: Cogeneration and Geothermal in the East and Horn of Africa – Status and prospects. Nairobi, Kenya.

Ministry of Energy and Mineral Development Uganda (MEMD) (2006). Plan for Meeting Uganda's Electricity Supply in the Short, Medium to Long Term. Kampala, Uganda.

Ministry of Energy and Mineral Development Uganda (MEMD) (2007). Renewable Energy Policy for Uganda. Kampala, Uganda

Stern Review (2007). Stern Review: The Economics of Climate Change. Cambridge: Cambridge University Press.

Greening the Gap: How Investing in Technology Access and Education Can Help Africa Cope with Climate Change

Erica Dybenko

Technology can help Africa cope with climate change. Above all other concerns, climate change is fast becoming the defining challenge of this generation, especially in Africa. Predictions suggest that African nations, which are least responsible for climate change, are those most vulnerable to its effects. Moving beyond images of the disappearing snows of Kilimanjaro and the shifting migratory patterns in the Serengeti, it is predicted that the biggest impacts of climate change in Africa over the next few decades will be evident in extreme weather patterns, shifting food supplies and the spread of disease.

Given the grave, predicted impacts of climate change on the most defenceless victims, it seems particularly relevant to explore how technology can help them to adapt to its future effects. Africa is on the underside of the technology gap between those with the ability to access, adapt and develop technology and those without. But great strides are being made to close and even green the gap. A steady stream of new technologies and new applications of old technologies are helping Africans to uncover innovative, sustainable ways of coping with the burgeoning effects of climate change. For the most part, this innovation is occurring within information communications technologies (ICTs) and their ability to predict weather patterns, collect data, communicate coping strategies and initiate quick and effective responses. Leading the way is the mobile phone.

Mobile Technology

Roughly one in three Africans own a mobile phone (Moyo, 2009). Even when compared with Asia — the mobile industry's global leader — Africa has the fastest growing mobile phone subscriber rate in the world (Arnquist, 2009). As a result of the upsurge in mobile communication across much of the continent, great strides are being made on the knowledge and information sharing front. More than just a device for calls and texts, mobile phones are breaking down barriers by offering solutions beyond their original conception. North America is seeing these developments revolve around music downloads and mobile gaming. Africa is seeing much more practical uses, like mobile phone-based agricultural advice, weather forecasting and telemedicine.

A handful of software companies are developing tools that give African farmers a chance to increase food security and maximize their incomes by connecting them with real-time market information. The most recent of these tools, called AppLap, was launched in 2009 by search engine giant Google, in partnership with the non-profit Grameen Foundation and service provider MTN Uganda. The suite of five mobile applications aims to revolutionize the lives of millions of farmers and small entrepreneurs in Uganda by equipping their mobile phones with tools like Farmer's Friend, a searchable database with targeted agricultural advice, and Google

Trader, an application that matches buyers and sellers of agricultural produce and commodities (Adero, 2009). As climate change threatens vital crops with rising sea levels, droughts and floods, these tools will become increasingly relevant to African farmers and Africa's food security more generally.

Mobile weather forecasting is another novel application that gives African users access to crucial information for predicting and managing climate shocks. A project underway on a small scale in East Africa's Lake Victoria region has wireless equipment maker LM Ericsson and mobile company Zain operating 19 automatic weather stations on cellular phone towers that transmit to national weather services. Lake Victoria's armada of nearly 200,000 fishermen and 35 million people living along its shores will all have access to alerts on suddenly changing weather conditions via this new mobile application (Reuters, 2009). Former UN Secretary-General Kofi Annan is calling for an expansion of the project to a much larger pan-African system that would see African countries across the continent linked by installing 5,000 automatic weather stations on existing towers (Higgins, 2009). Whether delivered by mobile phone or some other means, the early warning system using satellite imaging is expected to be the single most influential technology in helping Africa measure the extent of climate change.

Telemedicine is also taking advantage of the ubiquitous mobile phone to connect African health workers with patients. Satellite communication has been used in Africa's health industry for more than 20 years, but mobile phones are opening up the communication playing field by increasing access and use. When in the hands of health workers, mobile phones are allowing for the most basic collection and transmission of health data through SMS and email to more complex sample analysis and even surgical operations by remote control in rural African regions (Armstrong Moore, 2009).

An increase in vector-borne diseases on the continent is being linked to climate change: scientists are seeing spikes in the transmission of malaria and dengue fever in certain sub-Saharan African regions also suffering from climate change's rising temperatures, droughts and floods. Regions previously considered malaria free, like Kenya's Western Highlands[1] and Uganda's Kabale district,[2] are experiencing epidemics from changing weather patterns that are extending the habitats of mosquitoes carrying the disease. Health practitioners are left scrambling to keep up with diagnosis and treatment of the epidemics.

A group of scientists at the University of California, Berkeley, is developing and testing the CellScope, a small microscope designed for situations where laboratory facilities are scarce, but mobile infrastructure is far-reaching. It attaches to a mobile phone and is powerful enough to detect malaria, tuberculosis and sickle red blood cells using the mobile device's light and camera (Armstrong Moore, 2009). Just as important as pioneering new technologies are examples like this of the convergence of old ones. When the Berkeley group combined mobile technology with a compact microscope,

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[1] The 1970 Kenya national atlas declared the Western Highlands region "malaria-free" due to cool weather uninhabitable to the mosquito strains that carry malaria.

[2] The World Health Organization declared the Kabale district in Uganda malaria-free in the 1950s.

they created a new way of analyzing biological samples, detecting disease and communicating that information faster than was previously possible — not to mention the increased chance of curbing an outbreak.

BROADBAND IS CHANGING THE LANDSCAPE

These innovations, based mostly on the mobile phone, are helping Africans to improve capabilities and response time when coping with the effects of climate change. As a limiting factor, most mobile phones in the developing world cannot carry significant amounts of data well and access to the Internet is severely limited in many African countries, with only 6 percent of Africans connected (Uys, 2009), and many of them using LAN houses and cybercafés. Without reliable access, Africans have been missing out on opportunities to develop made-in-Africa technologies and solutions.

But that is about to change. More and cheaper international bandwidth — courtesy of increasing numbers of undersea fiber optic cables running up the coasts of Africa and linking to Europe and South Asia — is expected to provide sub-Saharan Africa's countries with enormous opportunity for growth. Kenya's recent activation of two high-powered, undersea communication lines, the Seacom and TEAMS cables, and a third to go live in 2010 is expected to deluge the country with ample Internet capacity for the foreseeable future (Noble, 2009). A democratizing of Africa's Internet will take place one step at a time as costs are brought down through private sector investment and markets are opened up through government deregulation, thereby giving access to millions more users.

THE UNPREDICTABILITY OF TECHNOLOGY

The track record for predicting how technologies will be used is terrible. More often than not they are underestimated. When the first mobile phone was invented in 1973 by Motorola, its creators never imagined its many and varied applications beyond telephony. Thomas Watson, then-chairman of IBM, predicted in 1943 that the computer would never be meant for home use. Not only are computers now commonplace in the home, but one in five households worldwide — some 422 million — will have a fixed broadband connection in the home by the end of 2009 (Grant, 2009).

THE WAY FORWARD – KEY RECOMMENDATIONS

Considering the unpredictability of technology use, African governments can harness the potential for growth and sustainability by investing on two fronts: access and education.

Invest in Access

Access is perhaps the most pivotal element in extending Africa's technological footprint. By ensuring that the foundations are in place for technology in every African country, a healthy platform or springboard is created for developing new and convergence technologies. Without this, Africans risk being shut out from the surging technological and information revolution and left languishing on the sidelines. Broadband access is a starting point that should be widely available and affordable to users across the continent. There are at least eight undersea fiber optic broadband cables currently serving Africa, but experts es-

timate that it will be another five years before the whole of Africa is hooked up (Edwards, 2009) — and this does not include remote areas that fail to offer adequate profit margins to private companies supplying access.

Over and above investment in terrestrial broadband networks is equally important satellite technology. Satellites offer the double benefit of getting high-speed broadband access to hard- to-reach areas — essential to climate change research — and pushing ahead of the curve as 3G (third generation) networks evolve to 4G and 5G, and laptops evolve to netbooks, smartbooks and whatever surfaces as the next big thing. Both terrestrial and satellite access require huge investment, but also offer significant expected returns. For every dollar invested in broadband, fixed and wireless, the US economy expects to see a tenfold return (World Economic Forum, 2009). More modest but similarly impressive returns could be expected in Africa. On a positive note, network infrastructure has much lower costs than infrastructure hurdles at earlier stages in history. But aside from moderate amounts of investment in South Africa, Egypt, Nigeria, Kenya and Senegal, government investment in ICTs is currently low across the continent and as a result these funds will likely need to be provided by private capital, foreign direct investment and multilateral organizations, where public funds play a supplementary role.

Invest in Education

If access gives Africans a foot in the door, then education and training allows them to push it wide open. Great strides will be made as fluency in all areas of technology is made a priority and a critical mass of Africans are ready and equipped to employ their skills in the field of climate change and other vital areas of concern. The Commission for Africa has recommended investing in a network of Centres of Excellence in Science and Technology on the continent. African governments, in collaboration with donor countries and multilateral institutions, can band together to make relatively small investments on the education front and reap significant rewards in climate change response and *inter alia* in job creation, economic growth, industry, return migration and so on. Indeed, building on Africa's regional technology capacity and proficiency — especially in research and development — will work against the current siphoning out of money that takes place as imported technology vendors and foreign service providers earn a profit from African customers and send it overseas. Setting forth with a mandate to invest in education and training opportunities will go a long way in developing regionally relevant technologies and their application to climate change coping strategies.

KEY POLICY RECOMMENDATIONS

- Invest in access to terrestrial broadband and satellite communication.

- Invest in education to promote widespread use and innovation in communication technologies.

References

Adero, Brian (2009). "MTN Uganda, Google launch mobile application," *ITS News.* July 7. Available at: http://www.itnewsafrica.com/?p=2851.

Armstong Moore, Elizabeth (2009). "If a mosquito bites in Sub-Saharan Africa, grab your cell phone," *CNet News*. August 4. Available at: http://news.cnet.com/8301-27083_3-10302258-247.html.

Arnquist, Sarah (2009). "In Rural Africa, a Fertile Market for Mobile Phones," *The New York Times*. October 5.

Edwards, Paul (2009). "Fibre Optics: Africa on Information Super Highway," *Ghana News Agency*. September 15.

Grant, Ian (2009). "422 million homes will have broadband by the end of the year," *Computer Weekly*. September 28. Available at: http://www.computerweekly.com/Articles/2009/09/28/237887/422-million-homes-will-have-broadband-by-the-end-of-the.htm.

Higgins, Alexander G (2009). "Annan backs better weather forecasting for Africa," *USA Today*. June 18. Available at: http://www.usatoday.com/weather/news/2009-06-18-annan_africa_forecasting_N.htm.

"Mobile Marvels" (2009). *The Economist.* September 24.

Moyo, Dambisa (2009). "The Next Big Thing: Africa," *Foreign Policy*. May/June.

Noble, Christopher. (2009). "Kenya on the brink of Internet breakthrough," *MarketWatch*. September 25. Available at: http://www.marketwatch.com/story/kenya-seeks-transformation-with-new-internet-links-2009-09-25.

Reuters (2009). "Zain, Ericsson and GSMA Continue Efforts to Save Lives by Launching Safety and Security Initiative across Lake Victoria." July 27. Available at: http://www.reuters.com/article/pressRelease/idUS63866+27-Jul-2009+MW20090727.

Sulaiman, Suad (2007). "How is climate change shifting Africa's malaria map?," SciDevNet. August 1. Available at: http://www.scidev.net/en/opinions/how-is-climate-change-shifting-africas-malaria-ma.html.

Uys, Pieter (2009). "Africa's Second Communications Revolution," *Global ICT 2009*, Article No. 11.

World Economic Forum (2009). *Annual Meeting Report: ICT for Economic Growth: A Dynamic Ecosystem Driving the Global Recovery.* Available at: http://www.weforum.org/pdf/ict/ICT%20for%20Growth.pdf.

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ABOUT CIGI

The Centre for International Governance Innovation is an independent, nonpartisan think tank that addresses international governance challenges. Led by a group of experienced practitioners and distinguished academics, CIGI supports research, forms networks, advances policy debate, builds capacity and generates ideas for multilateral governance improvements. Conducting an active agenda of research, events and publications, CIGI's interdisciplinary work includes collaboration with policy, business and academic communities around the world.

CIGI's work is organized into six broad issue areas: shifting global order; environment and resources; health and social governance; international economic governance; international law, institutions and diplomacy; and global and human security. Research is spearheaded by CIGI's distinguished fellows who are leading economists and political scientists with rich international experience and policy expertise.

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Le CIGI a été fondé en 2002 par Jim Balsillie, co-chef de la direction de RIM (Research In Motion). Il collabore avec de nombreux partenaires stratégiques et exprime sa reconnaissance du soutien reçu de ceux-ci, notamment de l'appui reçu du gouvernement du Canada et de celui du gouvernement de l'Ontario. Le CIGI exprime sa reconnaissance envers le gouvern-ment du Canada pour sa contribution à son Fonds de dotation.

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