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Global Problems, African Solutions: African Climate Scientists' Perspectives on Climate Change

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CIGI was founded in 2001 by Jim Balsillie, then co-CEO of Research In Motion (BlackBerry), and collaborates with and gratefully acknowledges support from a number of strategic partners, in particular the Government of Canada and the Government of Ontario.

Le CIGI a été fondé en 2001 par Jim Balsillie, qui était alors co-chef de la direction de Research In Motion (BlackBerry). 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.

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This paper is dedicated to the memory of Christina Scott, Africa's late, great science journalist, who passionately supported popular education on climate change.

ABSTRACT

This paper offers a preliminary survey of Africa's climate scientists' views on the critical problem of climate change, which has been described as an "out of Africa" problem crying out for "made in Africa" solutions. Based on interviews with these scientists, this paper presents their views on the state of African climate science; discusses the challenges of undertaking scientific research in Africa and ways that research could be done better; identifies the impacts of climate change on contemporary African society and its potential impacts in the future; identifies gaps in the current research agenda on energy, urbanization and migration; and explores the links between climate change and other environmental problems, such as water pollution and deforestation. Finally, while Africa's scientists value their involvement in international scientific assessments, they would welcome more opportunities to collaborate with their peers on the continent, more dialogue with African policy makers and a broader program of public education, to better equip Africans to take practical actions to meet the challenges of climate change.

INTRODUCTION

Climate change ranks as one of the most important issues facing global environmental policy makers. It is also a crucial issue on the international development agenda, raising important concerns about equity between nations: the carbon emissions that are generated in wealthy parts of the world are having negative consequences in poor communities, whose carbon emissions are typically more modest. Nowhere is this contrast starker than in Africa. Africa's per capita emissions make a negligible contribution to overall global emissions, but the potential consequences of climate change for Africa's people and its ecological systems are very severe (Boko, 2007).

Climate change represents a significant threat to Africa's development. Africa is a relatively dry continent and many of its people are dependent on rain-fed agriculture for both their food and much of their livelihood. Recent analyses of the impact of climate change on Africa's weather patterns emphasize the following potential impacts:

- increased climate irregularity, making it difficult to predict seasonal rains and therefore to plan for planting and harvesting;
- greater extremes in the climate with more frequent periods of drought and torrential rains;
- more frequent natural disasters, notably an increase in both droughts and forest fires;
- a rise in sea levels and flooding, with potentially severe consequences for low-lying coastal areas and small island states;
- changes in weather patterns leading to altered distribution patterns of insects and other disease vectors;

- changes in weather patterns affecting biodiversity and reducing animal populations in Africa's nature conservation areas; and
- a potential increase in desertification in the Sahel region. (Solomon et al., 2007)

Analyses of the social impacts of climate change on Africa emphasize:

- a potential reduction of agricultural productivity and the reduction of the ability of states to feed their populations;
- the loss of agricultural livelihoods, as well as the potential loss of arable land, leading to an exodus of rural populations to Africa's cities and potentially to other regions;
- new challenges in public health, notably the spread of malaria and other vector-borne diseases, such as meningitis; and
- political discontent when governments fail to meet the social challenges of climate change, leading to either unstable or authoritarian styles of governance. (Parry et al., 2007)

The direct impact of climate change is less significant than its role as an amplifier of the effects of other trends already underway in Africa, notably:

- a high rate of population increase anticipated over the next few decades before it begins to stabilize;
- a high rate of urbanization, with significant challenges in the governance of megacities;
- stagnation in agricultural productivity; and
- anthropogenic environmental damage, notably increasing deforestation and soil erosion, and declines in soil fertility, particularly in vulnerable semi-arid regions.

Without an effective policy response, climate change could serve as the proverbial "straw that broke the camel's back" in Africa's already difficult development context (Boko, 2007).

The challenges that Africa faces as a result of climate change were discussed during the Conference of Parties of the UN Framework Convention on Climate Change held in Durban, South Africa in December 2011. The conference was preceded by a meeting of the Intergovernmental Panel on Climate Change (IPCC) held in Kampala, Uganda, in November 2011, that pinpointed the need for disaster management in the event of floods, typhoons and other drastic weather events. While these two international conferences emphasized the significance of climate change and the very real concern of Africa's leaders on its consequences for their development strategies, very little was accomplished in terms of developing a practical action plan to address climate change (International Institute for Sustainable Development, 2011).

"WITHOUT AN EFFECTIVE POLICY RESPONSE, CLIMATE CHANGE COULD SERVE AS THE PROVERBIAL 'STRAW THAT BROKE THE CAMEL'S BACK' IN AFRICA'S ALREADY DIFFICULT DEVELOPMENT CONTEXT"

AFRICA'S CLIMATE SCIENTISTS

There is no community within Africa that knows more about the scientific issues of climate change, the future consequences for the continent and the strategies that should be adopted to mitigate and adapt to the effects of climate change than the continent's own climate scientists. Although this community has participated actively — albeit in modest numbers — in international assessments of the impacts of climate change and are available to serve as policy advisers to their home governments, they have not spoken out about what should be done to equip the continent to cope with the real climate challenges ahead. This paper is a preliminary survey of the views of Africa's climate experts on the nature of the problem, the scientific, governance and public education issues, and ways of adjusting Africa's development and energy strategies to meet these challenges.

In order to undertake this qualitative survey, the author compiled a list of Africa's internationally prominent climate scientists participating in the IPCC's review process.[1]

> "THERE IS NO COMMUNITY WITHIN AFRICA THAT KNOWS MORE ABOUT THE SCIENTIFIC ISSUES OF CLIMATE CHANGE...THAN THE CONTINENT'S OWN CLIMATE SCIENTISTS"

The IPCC is an independent intergovernmental body, consisting of both scientists and state representatives assigned the responsibility of summarizing the "state of the science" for global climate change. It has recently embarked on the fifth assessment of climate change, which is due to be published in 2015. A total of 830 scientists from around the world have been named to the IPCC's three committees:

- Working Group I assesses the physical science of climate change;
- Working Group II assesses the effects and adaptation to climate change; and
- Working Group III assesses how to avoid or mitigate climate change.

As part of the working group, each scientist is assigned to a chapter of the review, in one of three roles: as a coordinating lead author, lead author or reviewing editor.

Drawn from a range of backgrounds in the physical, biological and social sciences, the scientists participating in the IPCC assessment are nominated by their home governments or, if they have been selected for their specialist qualifications, have been subsequently endorsed by their home countries. The process is highly competitive; only one in three scientists nominated by governments to serve in the IPCC review has been accepted, thus selection is considered a great honour, equivalent to being elected to an international scientific academy. While geographic balance is one factor for selection, professional excellence and specialist knowledge are by far the most important factors. Once selected, the scientists participate in their personal capacity, rather than as national delegates.

1 To access this list, please visit the IPCC website, available at: www.ipcc.ch/activities/activities.shtml#.UOxJ_rZied5.

African scientists have participated in growing numbers in these surveys since the first IPCC review in 1990 (see Tables 1 and 2). A small number of these scientists have participated in multiple reviews and have ascended to positions of leadership within the IPCC. They coordinate key chapters of the review and are involved in generating the key documents that serve as summaries for policy makers. These senior individuals assume significant international responsibilities, but they also serve as team leaders and supervisors of young researchers in universities or government research facilities. They also often serve as policy advisers to government and international institutions. While their numbers are small, they serve as the visible tip of the iceberg, rising from a substantial foundation of active junior researchers in Africa's academic institutions.

Table 1: African Scientists' Participation in IPCC Reviews, by Region

	First Review	Second Review	Third Review	Fourth Review	Fifth Review
Southern Africa	*	*	20	17	24
West Africa	*	*	12	11	11
East Africa	*	*	16	8	8
Horn of Africa	*	*	0	4	6
Alliance of Small Island States	*	*	0	4	6
Central Africa	*	*	2	3	2
Totals	0	0	50	47	57

*Data not available

Table 2: African Scientists' Participation in IPCC Reviews, by Working Group

	First Review	Second Review	Third Review	Fourth Review	Fifth Review
Working Group 1	6	*	9	5	9
Working Group II	1	*	35	28	34
Africa Chapter (within II)	*	*	19	15	7
Working Group III	*	*	6	14	14
Totals	7	0	50	47	57

*Data not available

Who are Africa's IPCC review climate scientists and what are their backgrounds? There are 52 Sub-Saharan African scientists — 10 of whom are serving for the second or third time in IPCC reviews — involved in the current review, roughly six percent of the scientists assigned to the project. To put this into perspective, the United States is represented by 192 scientists; Canada by 25; China by 34; India by 28; and Brazil by 26. Seventeen Sub-Saharan African countries are represented, but representatives are largely drawn from its most developed regions and elite institutions, with South Africa dominating both in absolute numbers and in scientists' assignments to IPCC leadership positions. The African contribution to the IPCC is heavily biased towards Working Group II, adaptation and impacts, with 34 scientists contributing to this program. Seven of these scientists are currently engaged in the preparation of the Africa chapter of the review. The majority of the

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participants in Working Group II are social scientists with a strong grounding in policy and development. In contrast, Africa's representation in the other two working groups is quite modest. Most of the physical scientists are biologists or ecologists, rather than physicists or climate modellers, even though meteorology and climate modelling represent the IPCC's core scientific disciplines.

Although most of these IPCC scientists are based in Africa, a significant number of them work for international organizations, rather than African national institutions and universities. There is, nonetheless, a cluster of IPCC scientists associated with three key institutions: the University of Cape Town, with its strength in climate modelling, the University of Dakar and the University of Khartoum, both of which specialize in the social and policy issues related to adaptation.

"ALTHOUGH MOST OF THESE IPCC SCIENTISTS ARE BASED IN AFRICA, A SIGNIFICANT NUMBER OF THEM WORK FOR INTERNATIONAL ORGANIZATIONS, RATHER THAN AFRICAN NATIONAL INSTITUTIONS AND UNIVERSITIES"

METHODOLOGY

Qualitative interviews were conducted with a representative sample of 12 scientists appointed to current or previous IPCC assessments who agreed to participate in confidential, semi-structured interviews, where they were asked about their perspectives on the state of climate science in Africa, their experience in international scientific initiatives on climate change, the impact of climate change on the continent and policy options to mitigate the effects of, and to adapt to, climate change in the future. In addition, qualitative interviews were conducted with four agricultural scientists who had assessed climate change's impact on agricultural productivity and resilience in the 2008 International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) review (IAASTD, 2009). Notes were taken by hand and later transcribed. A number of key themes of the discussion were identified at this stage, and follow-up interviews were made in some cases to address gaps in the interview process. These interviews took place between September 2011 and June 2012. The interviews were conducted in person during two visits to Africa, in November 2011 and June 2011, and by telephone.

While the IPCC scientists represent the most visible African contribution to international climate science, they invest their own hopes in the next generation of climate scientists who are now younger faculty, post-doctorates and graduate students. In order to meet and interview this younger cadre of African scientists, the author attended the African Academy of Science's first continent-wide conference on "Climate Change: The Road for Africa," held in Nairobi in November 2011. Thirty-four scientists, drawn from 24 countries, delivered papers primarily focussed on adaptation issues, with a particular concentration on agriculture, water and public health. Nineteen young scientists participated in short interviews; 11 of these participated in a focus group on food security and climate change. The participation of the younger scientists broadened the geographic, linguistic and disciplinary breadth of the sample group.

A key source of information was the Consultative Group on International Agricultural Research's (CGIAR) research plan on global climate change that integrates the work of a substantial number of African agricultural scientists

on climate change and agricultural productivity. A second important source was the Climate Change Adaptation in Africa Program, a joint initiative of the International Development Research Centre and the Department for International Development that provides grants to young African climate scientists and promotes institutional collaboration on climate science within Africa. This program's reports provide useful information on the locations and research agendas of African climate change centres.

The interviews form one component of a larger study examining the role of scientists in intergovernmental science panels. The larger study explores the impact of these panels in the global policy debate around three major, interlinked development issues of the twenty-first century: climate change, food security, and biodiversity and habitat preservation.

WHAT AFRICAN SCIENTISTS SAY

The State of the Science

The African climate scientists that were interviewed had much to say about the state of African climate science. While the scientists fully support the work of the IPCC, the word they most frequently used to describe the state of African climate science was "uncertainty."[2] They expressed a real concern about the quality of the basic climate data for Africa, which they attributed to a long-term decline in investment in weather monitoring in Africa amid years of political instability and economic stagnation. They argued that the "coarse" analysis — the general trend lines of temperature increase and unstable precipitation patterns — was clear, but a "fine-grained" or detailed analysis of a given region or a sound prediction on future patterns remains out of reach. There is an urgent need to strengthen basic weather and climate monitoring data, whether through reinvestment in traditional weather stations or the introduction of more high-tech monitoring equipment. Without this basic data, advising local governments and communities about a sensible response strategy to climate change becomes very difficult.

> "THE SCIENTISTS REPEATEDLY RAISED CONCERNS ABOUT AFRICA'S LIMITED CAPACITY TO 'CRUNCH THE NUMBERS' AND DESIGN CLIMATE CHANGE MODELS"

The scientists repeatedly raised concerns about Africa's limited capacity to "crunch the numbers" and design climate change models. To a great extent, African scientists still depend on work that is done elsewhere on Africa's climate system, notably the influential work undertaken at the Hadley Centre in the United Kingdom (Hulme et al., 2001; Low, 2005). While such work, which serves as the foundation for their own research, is appreciated, there are reservations over dependence on overseas researchers. Can overseas centres be trusted to ask the right questions about Africa and its needs? As one scientist commented, "When it comes to science, Africa is still more studied by foreigners than understood by its own people."

A third concern was about the organization of climate science research within Africa. Science is a team effort, never more so than in climate science, but scientists specializing in this work often work in isolation, widely separated from one another and hampered by limitations in

2 All comments in quotations are drawn from interviews with, or comments from, the focus group of African scientists.

communications technology, such as Internet access and bandwidth. Those communications links that do exist often extend along global North-South lines rather than as a network across Africa itself. As a result, African scientists are more likely to be in contact with their European or North American peers than their colleagues elsewhere in Africa. This makes it difficult to arrange collaborative projects within Africa, or to compare and contrast data generated in neighbouring countries. Participation in the IPCC assessment is one of the rare occasions when local data on Africa can be "scaled up" to facilitate regional assessments. Several scientists commented that it would be useful to invest resources to create strong research facilities at key centres where a critical mass of researchers could be built up into an "African Hadley."

"AFRICAN SCIENTISTS ARE MORE LIKELY TO BE IN CONTACT WITH THEIR EUROPEAN OR NORTH AMERICAN PEERS THAN THEIR COLLEAGUES ELSEWHERE IN AFRICA"

Mind the Gaps

African scientists also recognized important gaps in African climate research, which they believed reflected broader issues within the African research community. Good marks were given to the work being done on the impact of climate change on agriculture, water policy, public health and biodiversity. These are areas of strength within the African scientific community and are highly relevant areas of African public policy. Little work, however, was being done on climate change's potential impacts on urban populations, population migration or on the built environment; these are important areas of study that need to be addressed as they are in other regions in the global South.

Since African development will be contingent on dependable and sustainable energy sources, energy is, in the scientists' view, a particularly important area for further study. Africa is an important and growing exporter of hydrocarbons and it will be important for policy makers to have accurate forecasts of energy demands and sources for the future. While Africa is currently a negligible source of carbon emissions, this will not necessarily be the case in future, especially if high rates of economic growth continue. The scientists further recommended that more work should be done to identify appropriate technologies to help transition from the use of biomass for heating and cooking to more efficient and healthier fuels.

Another gap the scientists identified is that there is very little understanding of the potential impact of the rise of sea levels in fast-growing cities that are in low-lying areas of West and East Africa. Africa's urban population has grown at an average annual rate of 4.3 percent, reaching 353 million in 2005 (Parry et al., 2007). During the interviews, scientists predicted that a situation might arise where inland populations were forced out of their homes by repeated droughts, while coastal populations were moving inland after repeated floods. But here, too, they argue, predictions are uncertain due to an absence of dependable data and analysis.

Climate scientists who have participated in the "roll-up" of information in the chapter on Africa in the IPCC's 2007 review noted that there are also important gaps in the regional database. Central Africa, in particular, has been studied very little, largely because of political instability in the region. This is not only a problem for the Congolese, but also makes it difficult

to identify broader climatic patterns, given the scale of the forest cover (an important carbon sink) within this region and its important impact on broader weather patterns.

Finally, interviewees were also concerned that climate change was not yet being fully integrated, or "mainstreamed," as a key variable in African research programs. While African scientists and policy makers recognized that the study of climate change is important, it is often treated as an afterthought in the design of scientific research projects. One climate scientist compared the state of climate change research to the early days of gender analysis in development studies, when everyone "nodded in women's direction" but still treated its study as a footnote. This particular scientist suggested that it would be useful if the key agencies developed tools and techniques to integrate climate into research design and evaluation *ex ante,* beginning with the development research projects they currently support.

International Collaboration

The climate scientists who participated in this study are all highly enthusiastic about their roles with the IPCC and in related initiatives such as the climate change research undertaken by CGIAR. They acknowledged that such international research endeavours represent a time-consuming commitment that takes them away from their own research, but also brings them many professional advantages. First among these was the ability to network with peers working on similar problems in other centres. These contacts led to collaborations outside the IPCC when, in the course of their research discussions, they identified new issues beyond the scope of the IPCC study and opted to work on them collaboratively. As a result of these strengthened networks, the scientists were also able to help their talented junior staff by finding them post-doctoral and graduate placements elsewhere and by bringing colleagues from other regions to teach and train their students new techniques. Participation in international teams also facilitated the acquisition of laboratory equipment and other research resources. Last but not least, the scientists believed that their international collaborations facilitated acceptance of their articles in high-impact international journals.

Another advantage of participation was the prestige it offered and, along with it, increased influence at their home institutions. The scientists believe this form of international recognition has been a factor in promotions and professional recognition in the broader academic community, such as invitations to participate in symposia and key committees — mentioning somewhat ruefully that it also added to their already heavy workload. International participation has also brought a measure of "glamour" to climate research, helping to attract younger scholars to the field. The scientists did not, however, want to emphasize these benefits too much, as, they argued, international prestige was no substitute for a solid record of academic publication and institutional leadership.

Participation in the IPCC also brought the scientists greater impact in policy circles. As all IPCC climate scientists must be either nominated or endorsed by their home governments, this affords government officials a rare occasion to review the state of climate science at their own institutions.

"WHILE AFRICAN SCIENTISTS AND POLICY MAKERS RECOGNIZED THAT THE STUDY OF CLIMATE CHANGE IS IMPORTANT, IT IS OFTEN TREATED AS AN AFTERTHOUGHT IN THE DESIGN OF SCIENTIFIC RESEARCH PROJECTS"

Some countries, such as Kenya, Sudan, Senegal and Tanzania, make a point of honouring their nationals through nominations to the IPCC. Sometimes this translates into policy influence for the scientists at home, at least in terms of identifying the issues, if not the policy choices adopted by governments. The scientists also believed that the IPCC assessments, and especially the executive summary and Africa chapter, were more likely to be read in government circles precisely because they were international documents and therefore seen as more important than the same research published in peer-reviewed publications. African research thus benefitted from a "boomerang effect," moving from Africa to international circles and then back, gaining momentum and influence along the way (Hochstetler, 2002).

Nonetheless, with the possible exception of those from South Africa, the climate scientists do not believe that their participation in the IPCC has led to more investment in climate research from cash-strapped African governments. To a great extent, they still rely on international sources and Western donors for financial support. The IPCC's trust fund, which supports the participation of Southern scientists in its gatherings, was, in the scientists' views, an indispensable tool for integrating African perspectives into intergovernmental scientific panels. This echoes the perspective of Southern scientists from other regions as well (Agrawala, 1998).

"AFRICAN RESEARCH THUS BENEFITTED FROM A 'BOOMERANG EFFECT,' MOVING FROM AFRICA TO INTERNATIONAL CIRCLES AND THEN BACK, GAINING MOMENTUM AND INFLUENCE ALONG THE WAY"

In interviews, the scientists consistently reported that they enjoy their involvement in the IPCC and similar international initiatives, and they believed they participate on a level playing field with their peers from other regions. This is in interesting contrast to Brazilian researchers in another study, who reported that language issues proved a daunting barrier to their full participation in the IPCC process (Lahsen, 2004). Language barriers did not seem to pose a problem for African scientists: even those who are French-speaking had worked or studied overseas prior to their involvement in the IPCC and were comfortable working with their peers in English, the primary language used at IPCC. At the same time, it is worth noting that there are few — if any — Spanish- or Portuguese-speaking African scientists at these gatherings.

More broadly, interviewees suggested that involvement in the IPCC breaks the isolation that African scholars feel and allows them to see themselves as belonging to a global epistemic community of climate scientists sharing a common research project, scientific practices and a policy agenda to combat the consequences of climate change (Haas, 1992).

THE EFFECT OF CLIMATE CHANGE ON AFRICA

The African climate scientists who were interviewed generally conveyed a sense of resignation at the inevitability of climate change's effects. Given that climate change is a global phenomenon and Africa is only a modest source of emissions, the scientists believe there is little that Africans can do to mitigate its impacts by changing their patterns of industrial production or consumption. One ecologist summarized the situation as an "out of Africa" problem with major consequences for the continent, and called out for "made in Africa" solutions. A clear distinction is drawn between the

African community's responsibilities, compared to the responsibilities of the prosperous countries in Europe and North America and the major carbon emitters in Asia.

According to interviewees, with Africa generally helpless to influence events through its own mitigation strategies, these scientists' energies are focussed on creating adaptation strategies that prepare Africans to live in a generally hotter climate with irregular climatic seasons. Their prescriptions for action include:

- intensified agricultural research, to provide seeds for staple cereals and indigenous crops that are better adapted to drought conditions, irregular rainfall and higher salinity;
- the development of improved "climate smart" agricultural techniques, generally designed to reduce water demand;
- encouraging afforestation and conservation initiatives to preserve forest cover, in order to protect existing carbon sinks and facilitate shade-grown agriculture; and
- increasing research on pests and other crop and animal diseases so that farmers are prepared for these new threats in a hotter climate.

Although physical scientists are concerned about the potential loss of productivity due to climate change, they are not necessarily pessimistic about the future. Some argued that Africa's productivity is comparatively low at present, especially compared to the productivity of tropical agriculture in Asia. This suggests that there is considerable built-in resilience in Africa's biosystems that could be unlocked through efficient agricultural techniques. Even if climate change were to reduce Africa's potential agricultural productivity by a factor of 10 percent, examples elsewhere, such as Asia, suggest that introducing new technology (in the form of improved seeds, techniques, irrigation and storage systems) could increase Africa's effective productivity by at least 600 percent (The Royal Society, 2009). Under ideal conditions, Africa could not only weather the effects of food security under climate change very easily, it has the potential to become the "breadbasket" of the world (ibid.). The scientists pointed to foreign companies' recent acquisitions of large tracts of African land as evidence that at least some foreigners were betting on a booming future for African agriculture.

Others, social scientists in particular, were skeptical that the introduction of technology alone could lead to greater productivity, unless it was accompanied by the extensive reform of social and political support systems for Africa's indigenous farmers. The scientists see the social and political challenges associated with a substantial increase in agricultural productivity as enormous, and worry about the potential dislocations to community life. One social scientist commented that his villages are populated by "seven- and 70-year-olds" as a result of migration and the depredations of AIDS; he doubted, frankly, whether African villages still had the essential reserves in terms of labour and agricultural skills to mount a "green revolution."

"SCIENTISTS' ENERGIES ARE FOCUSSED ON CREATING ADAPTATION STRATEGIES THAT PREPARE AFRICANS TO LIVE IN A GENERALLY HOTTER CLIMATE WITH IRREGULAR CLIMATIC SEASONS"

A third group of scientists saw climate change as just one, and not necessarily the most important, form of anthropogenic change that Africa must face in the next few decades. Climate change is distinctive as a global phenomenon, while other anthropogenic changes affecting the continent are largely a result of Africans' environmentally unsustainable activities. These include deforestation — the result of both "slash and burn" agricultural techniques and the conversion of upland forests into agricultural production; the destruction of watercourses; downstream water pollution associated with excessive water diversion; soil erosion; the loss of soil fertility due to the abandonment of traditional soil conservation techniques; declines in biodiversity resulting from habitat destruction, animal poaching and overfishing; and black carbon (soot) air pollution, because of Africans' pervasive reliance on wood as a fuel for cooking. These issues are viewed by the scientists as structural problems that impact villagers all the time, while the impact of climate change is seasonal or variable. Anthropogenic damage to the environment is a serious issue for Africa and will only get worse as the anticipated population increases pose additional burdens on Africa's ecosystems. From the perspective of these interviewees, unlike climate change, something can be done to mitigate the impact of each of these problems by adopting "made in Africa" solutions. Adopting mitigation strategies to deal with these problems will also increase community resilience and help Africans to cope with climate change.

"SCIENTISTS SAW CLIMATE CHANGE AS JUST ONE, AND NOT NECESSARILY THE MOST IMPORTANT, FORM OF ANTHROPOGENIC CHANGE THAT AFRICA MUST FACE IN THE NEXT FEW DECADES"

One exception to the scientists' emphasis on adaptation over mitigation is their belief in the possibility of reducing black carbon emissions. Black carbon is considered the second- or third-largest global source of carbon emissions; it is dubbed the "greenhouse gas of the poor" (Ramanathan and Carmichael, 2008). Africa relies heavily on burning wood and other organic fuels — putting great pressure on its forest cover — largely because rates of electrification are so low. Only 53 percent of urban residents and eight percent of rural communities are electrified (United Nations Development Programme [UNDP], 2007). In the short term, Africa would benefit by introducing more efficient wood stoves and planting woodlots. Over the longer term, Africa would benefit from massive electrification. The investment costs and the availability of appropriate energy sources for large scale electrification, however, represent a major challenge (Nkomo, Nyong and Kulindwa, 2006).

African Farmers and Climate Change

What do Africa's farmers think? In a focus group of agricultural scientists who work directly in farmers' fields, participants agreed that farmers are "exquisitely sensitive" to weather fluctuations and possess a richly detailed form of indigenous knowledge, relying on phenomena such as patterns of insect population changes to forecast the weather. According to these scientists, farmers are generally convinced that they are already in the midst of significant climate change; however, they are less concerned about an overall increase in temperatures than they are about climate fluctuations, such as delays in the arrival of the seasonal rains that make it difficult to plant their seeds, deeper, more intense droughts and more violent rainstorms that wash away the topsoil.

The scientists reported that the farmers do not understand the concept of greenhouse gases; when they are asked what has caused the change in the weather, the farmers generally link the change to "cutting down the trees." Thus scientists suggest that if governments or the international community wish to embark on a program of grassroots education, they should stress "man-made changes in the environment," rather than global climate change. This focus offers farmers a menu of practical, local-level activities — from tree planting to watercourse protection — that could make a difference, and be understood, at the community level.

Climate Change and Policy

Climate scientists are generally reluctant to pronounce on policy issues, as they tend not to see themselves as playing decisive roles in the policy process. Most of the scientists commented that they have little or no direct contact with Africa's political leaders on the issue of climate change. One scientist, who does play an influential role as a senior policy adviser, believes that Africa's political leaders understand the importance of climate change and want to do something about it, but, he believes, they have no idea what to do and feel impotent to effect any change. In interviews preceding the Durban Conference on Climate Change, scientists expressed the hope for a breakthrough on a post-Kyoto climate treaty. They also hoped that the conference, the first of its kind on the continent, would increase the understanding of the challenges that Africa faces. In follow-up interviews after the conference, the scientists expressed disappointment with the outcome. Those who attended during the "agriculture" and "forest" days at the summit commented on the quality of the discussions.

"CLIMATE SCIENTISTS ARE GENERALLY RELUCTANT TO PRONOUNCE ON POLICY ISSUES, AS THEY TEND NOT TO SEE THEMSELVES AS PLAYING DECISIVE ROLES IN THE POLICY PROCESS"

Although they were generally disappointed in terms of their influence on policy and the results of the recent Durban conference, African scientists saw at least one important advantage of being based in Africa. They commented, with astonishment, about the savage attacks that North American and European climate scientists, including senior scientists in the IPCC, have endured from climate change skeptics. These attacks led one distinguished climate scientist, Stephen Schneider (2009), to describe climate science as a "contact sport." The African scientists suggested that this sort of attack reflects a general lack of understanding about the process of science, which advances through testing of hypotheses refining of models, and they fear that such bitter controversies may compromise investment in essential research. The scientists understand that the criticism is often rooted in concerns about the disruptive impact that mitigation strategies would have on well-entrenched economic and political interests and they are grateful that, at least so far, they have been spared these controversies. Some suggested that this is because climate change is still identified as a problem "caused by the West" but worry that the political tolerance they currently enjoy may deteriorate if important economic interests, such as West Africa's oil and gas industry, are affected.

As a final comment, many of the scientists stated that it was "unusual" and "refreshing" to be asked for their views on climate change. There is very little coverage of science issues in the African media, whether measured in the number of qualified science journalists or the amount of available

column space. The scientists see a real disconnect between the response of politicians and officials and the travails of Africa's farmers, and they often feel stuck in the middle. They believe that more information and educational materials targeted to a lay audience on climate change and the related problems of anthropogenic change would be useful in this regard. With so many of Africa's problems found at the intersection of science, poverty and the environment, the time for a thoughtful African debate on these issues has definitely come.

FOR THE FUTURE

Africa's climate scientists are a thoughtful, engaging and eloquent community, with many useful and practical ideas about how Africa should meet the climate challenge. Drawing on their suggestions, the following initiatives for strengthening African climate science and adapting to the impacts of climate change are proposed. To strengthen the science, Africa's regional institutions, governments and scientific academies, with the support of international agencies, should:

- Create a regional IPCC chapter for Africa — an intergovernmental panel where African science could be assessed in greater detail and in a more timely fashion than the global IPCC reviews. This would allow African policy makers and a substantially larger cadre of scientists to exchange ideas on meeting the challenge.
- Reinforce the existing centres of excellence in Dakar, Khartoum and Cape Town by seconding multinational staff to them and assigning them explicit regional assessment responsibilities.
- Create virtual networks of African climate scientists at other centres by developing listservs of active scientists, reinforcing communications facilities connecting African universities and supporting the creation of African climate science e-journals.
- Develop "train the trainer programs"; publish tools and techniques to integrate climate into research design and evaluation for development research.
- Invest in programs of science journalism that could offer an attractive career path for science graduates and raise the general level of understanding of key scientific problems in Africa.

To fill the gaps, all investors in African science should:

- Reinvest in the continent's weather monitoring systems that are the indispensable foundation for all other climate research. Particular efforts should be made to strengthen the systems along the equator and in central Africa.
- Invest in research on urbanization, including generating a list of urban "hot spots" — communities that are at particular risk because of their coastal or marine locations — and direct research into flood and waste management, and other critical issues of the built environment.

"THE SCIENTISTS SEE A REAL DISCONNECT BETWEEN THE RESPONSE OF POLITICIANS AND OFFICIALS AND THE TRAVAILS OF AFRICA'S FARMERS, AND THEY OFTEN FEEL STUCK IN THE MIDDLE"

To meet the challenge of climate change, African governments and their donor supporters should:

- Launch a major regional feasibility plan for large-scale electrification, a productive option for both development and climate change mitigation. This is a project that the New Partnership for African Development might take up.
- Invest in agricultural extension systems to help African farmers adopt climate-friendly agricultural techniques and develop a new generation of drought- and salt-tolerant seeds.
- Invest in research on the impact of climate change on pests and other vectors that affect plant, animal and human health.

Finally, to promote the understanding of climate change and its impacts, African governments and their communications media should:

- Develop public education programs that explain the impact of anthropogenic change on communities and recommend simple, practical steps that people can take to improve their environment, such as forest conservation, tree planting, watercourse preservation, crop rotation, mulching and avoiding overfishing.

These measures would not only help to preserve the environment, but would empower communities through cooperative action and imbue the people with the belief that they can control their own future: a "made in Africa" solution for a global problem.

"AFRICA'S CLIMATE SCIENTISTS ARE A THOUGHTFUL, ENGAGING AND ELOQUENT COMMUNITY, WITH MANY USEFUL AND PRACTICAL IDEAS ABOUT HOW AFRICA SHOULD MEET THE CLIMATE CHALLENGE"

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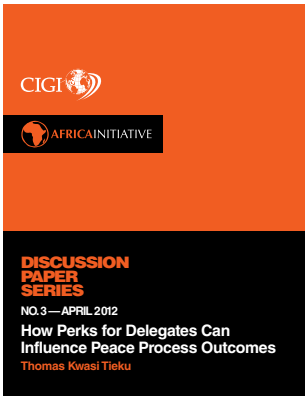

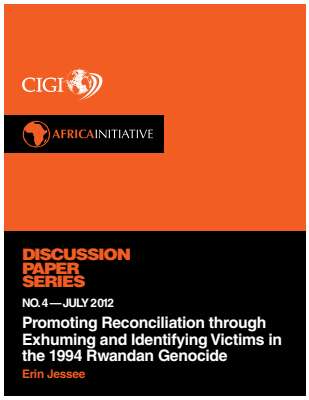

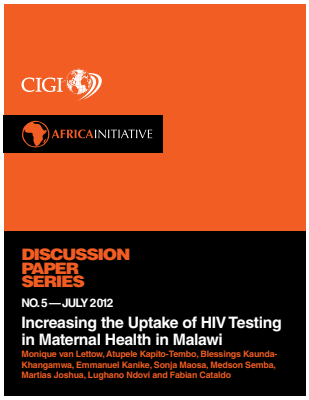

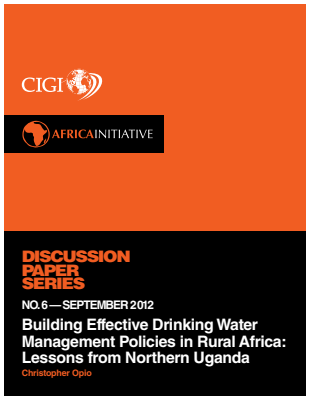

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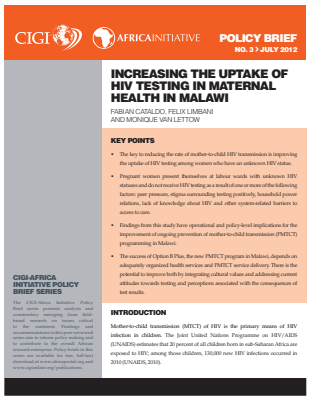

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