

Climate Change and Security in Africa

Vulnerability Discussion Paper

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About ACCES

The negative impacts of climate change combined with a growing population, poverty, the current number of existing conflicts, weak state structures, and low capacities to respond have potentially high consequences on security in Africa.

In order to jointly address the security risks of climate change in Africa from a development and security perspective, the Madariaga - College of Europe Foundation and the Folke Bernadotte Academy, in cooperation with the EU Council Secretariat, initiated a structured Dialogue Process on “Africa, Climate Change, Environment and Security” (ACCES). The initiative has been implemented in cooperation with the General Secretariat of the Council of the European Union and involving the UN system (including UN-DPA, UNDP, UNEP, UNECA, and UNIDO), the World Bank Group, EU institutions and Member States, the European Investment Bank, the International Organization for Migration, the African Union, the African Development Bank, the Global Water Institute, the Institute for Environmental Security, and the Parliamentarians Network for Conflict Prevention and Human Security.

The Dialogue Process will promote building up multilateral and multilevel collaborative platforms. The participants will apply an integrated approach and facilitate coherent conflict preventive and peacebuilding engagement. **It will be a "learning by doing" process where the sharing of lessons learned and best practices will play important roles.**

The initiative fits in very much with the EU’s own recognition that climate change is a “threat multiplier which exacerbates existing trends, tensions and instability” in developing countries¹. Such tensions include conflict over resources such as land, water, and food. There is also a great risk posed by increased desertification and migratory pressures. The EU also recognised that while its conflict prevention capacities have been greatly enhanced, there is a “need to improve analysis and early-warning capabilities. The EU cannot do this alone. **We must step up our work with countries most at risk by strengthening their capacity to cope” with climate change.**² Furthermore, following a joint progress report³ in December 2009, the European Council underlined the need for international cooperation “with the aim to create dialogue, common awareness, share analysis and cooperatively address the challenges in all relevant existing fora, including the UN.”⁴

The resolution⁵ adopted unanimously by the UN General Assembly in June 2009 expressing "deep concern for the possible security implications of climate change" and the UN Secretary General's report⁶ that followed, highlighted further the importance of the issue and the need for concerted action.

The organisers have established “Vulnerability Cells” focusing on: **i) food security; ii) water security; iii) energy security; iv) migration; and v) natural disasters** in the context of climate change and

¹ European Council, “Climate Change and International Security”, Paper from the High Representative and the European Commission to the European Council, Brussels, 14.03.2008, S113/08. (2008).

² Report on the Implementation of the European Security Strategy, Brussels, 11 December 2008, p.6.

³ EU: Joint progress report and follow-up recommendations on climate change and international security (CCIS) to the Council, 16645/09, December 2009.

⁴ Foreign Affairs Council 8 December 2009, Presidency Conclusions.

⁵ UN General Assembly resolution A/63/281 of June 2009.

⁶ UN: A/64/350 Secretary General's report on Climate Change and its possible Security Implications.

security. These cells have formulated a document that will be the working paper for discussion at the Dialogue Forum which will take place in **Addis Ababa on 11 October, 2010**. This event is scheduled as a pre-event to the 7th African Development Forum arranged by the UN Economic Commission for Africa, the African Union Commission, and the African Development Bank.

The Vulnerability Document maps the security implications of climate change in Africa in a holistic way by assessing the macro- and micro-level security risks in the five domains outlined above. Nevertheless, each cell has adopted its own methodology which is reflected in the differing approaches of the thematic analyses.

Without aiming at delivering exact predictions, the document attempts to **identify the hot spots in Africa with a view to call the attention of policy-makers to the most vulnerable countries and regions and so as to trigger early actions in a harmonised and effective way**. The Vulnerability Cells also take stock of various initiatives made to address challenges related to climate change in the given domains and the potential partners to be included in the future Dialogue Process.

The Dialogue Process should contribute – proactively – identify and develop projects improving climate resilience; for example, through disseminating good practice and build on past project examples. The Process endeavours to work closely with National Authorities to better understand the priorities of national adaptation strategies. The Process also seeks to collaborate with other financiers, academia and NGOs to share knowledge, develop synergies and engage in appropriate co-financing options such as grants and lending (e.g. blended finance). The Process also puts a premium on increasing the capacities of project promoters to absorb and allocate adaptation funding effectively, and to work with promoters to systematically include parameters to address climate change impacts at the planning and design stage.

The Vulnerability Document is an open-ended document, which serves as starting point for further assessments and elaboration of "fundable" projects in the later stage of the Dialogue Process.

Based on the outcome of discussions during the Dialogue Forum, the authors of the Vulnerability Document will finalise the document and submit it to the next Africa-EU Summit in November 2010 and the Cancun Summit on Climate Change in December 2010.

It is expected that the Vulnerability Document and the entire ACCES process will trigger a new wave of international engagement and sustainable dialogue between main international stakeholders and African counterparts that will result in effective, long-term partnerships for **building-up the appropriate response and resilience capacities in a conflict sensitive and preventive manner in Africa**.

After the Dialogue Forum in Addis Ababa the Preparatory Committee will make further efforts to continue the activities to establish cooperative platforms and partnerships in broader networks, which will focus on enhancing African capabilities to address the security risks posed by climate change. The results of the activities will be reviewed in autumn 2011.

Executive Summary

The Vulnerability Cells confirmed the assessments prepared by numerous organisations and institutions, that Africa is the most vulnerable continent in terms of the capacity to adapt to the predicted effects of climate change.

The analysis contained in the Vulnerability Maps suggests that with a large part of the population lacking access to clean and safe water, as well as a high dependence of African economies on water-intensive sectors like agriculture and energy, the **availability and access to water** remarkably influences development and stability in terms of food and energy security as well as migration and natural disasters. Therefore, it is crucial to devote specific attention to the **development of the water sector and management of water issues**.

Though it is difficult to make exact assessments related to climate change issues, and while recognising that most African countries do and will suffer from the security implications of climate change, when aggregating the outcome of individual mappings **Burundi, Chad, the Democratic Republic of Congo, Kenya, Ethiopia, Niger, Nigeria, and Sudan** were identified as the most vulnerable states in Africa in the context of climate change and security. The **Sahel region** is considered the most threatened region in the continent.

Climate change will likely lead to substantial changes in precipitation patterns, including more infrequent droughts, floods, and storms. The sub-tropical zones have become more arid, and desertification continues in the Sahara. The forecasted higher surface temperatures will increase evaporation rates, making water increasingly scarce and **Water Security** unstable, in turn strongly affecting human security and increasing the risk of water-related conflicts. The number of people in Africa experiencing water scarcity may increase by 75 million until 2020 and several hundred million by 2050. One of the key areas impacted on is the **Nile Basin**. The area is of particular importance because 7 out of 10 countries constituting East Africa, with a combined population of 180 million people sharing the Nile Basin's water, have experienced some of the most brutal conflicts that the world has witnessed in recent years. These countries include among others the **Democratic Republic of Congo, Burundi, Uganda, Rwanda, and Sudan**.

In Africa, climate models warn especially about the immediate impact of changing rainfall patterns on grain yields, runoffs, water availability, and the survival of plant and animal species that are expected to shift production seasons, alter productivity, and modify the set of feasible crops. A large part of the population is engaged in subsistence agriculture and farm marginal lands under rain-fed conditions that make the population particularly vulnerable to the adverse effects of climate change. The Vulnerability Cell on **Food Security** pointed to the fact that from among 22 countries across the globe considered to be in protracted food crises, 17 come from Africa. The Vulnerability Cell selected **Chad, Cote d'Ivoire, the Democratic Republic of Congo, Ethiopia, and Zimbabwe** as "hot spots", which together account for 64% of the total undernourished population of African countries.

Africa is the lowest consumer of energy, there are 500 million people living without electricity in sub-Saharan Africa where 23 of the 48 countries are vulnerable to "energy shocks". Given that approximately 90% of African households use biomass fuels (e.g. wood and vegetation) for cooking and water heating, the mixture of unsustainable harvesting of forests prone to climate change threatens with decreased

forest cover rates, increased soil degradation and supply disruption, and, as a consequence, poses threat to human security. Furthermore, energy in Africa is unequally distributed and has led to **energy** dependence between states. A move towards “energy autarky” by some states to protect energy supplies may lead in itself to inter-state disputes. At the same time, Africa’s energy resources are the focus of global competition fuelled by population growth and economic demands, and Africa’s energy resources constitute a new geopolitical challenge to international security. The Vulnerability Cell on **Energy Security** set **Burundi, the Democratic Republic of Congo, Kenya, Uganda, and Zambia** as the hottest spots due to their increased exposure to climate change, human security conditions, and high reliance on hydro-electric power, biomass fuels, and low stocks of energy resources.

Whilst stating that one cannot assume that climate change alone will lead to mass migration, it is expected that the majority of **environmental migration and displacement** will be internal or close to bordering countries (as opposed to international migration). In the early and intermediate stages of environmental degradation, migration is likely to be temporary, circular, or seasonal in nature. At the same time, when environmental degradation becomes severe or irreversible, for instance, due to sea-level rise, migration can become permanent and may require relocation of affected populations, either internally or in another country. A much larger number of people are expected to migrate due to gradual deterioration of environmental conditions rather than natural disasters. Such movements can lead to increased tensions in receiving areas if not addressed, particularly when resources are already scarce or strained in these areas. The seasonal migration of pastoralists has already been affected by climate change, bringing increased competition between pastoralist groups, but also between pastoralists and sedentary farmers. In conjunction with other factors, this increase in competition can potentially lead to localised and or cross-border conflicts, as already witnessed in **Eastern Africa**.

Natural disasters are increasing in number and frequency, and affect most countries in Africa. Sub-Saharan Africa is one of the most severely affected areas of the world. In 2008, there were 96 disasters recorded and they included 44 floods and 9 droughts that affected 16.3 million people and incurred economic losses estimated at some 1 billion dollars. Three of the five regions across the globe that are at risk of flooding in coastal and deltaic areas of the world are those located in Africa: North Africa, West Africa, and southern Africa. A high proportion of Africans live in coastal areas: one-quarter of the population resides within 100 kilometres of a sea coast. **The Sahelian countries**, which are some of the poorest in the world with the most degraded environments, are among those that are the most vulnerable to the estimated effects of climate change.

Introduction

The security implications of climate change are of increasing relevance to international peace and security. Continents such as Africa, where adaptation mechanisms are weak or uncoordinated, are especially vulnerable to insecurity related to water, food, energy, and natural disasters. This will be a major challenge not only for African countries but also international partners involved in climate change mitigation and adaptation efforts.

Security in the context of climate change is a complex and often misunderstood concept and insecurity can be found at many different societal levels. One has to clearly differentiate between security at the level of the individual and security at the level of states. At the level of the individual, security encompasses a wide range of spheres (notably food, water, and energy) of which physical security is only one element. The concept of “human security” encompasses these various components of an individual’s wellbeing, and this need not be so readily equated to conflict even if it poses a developmental challenge in itself.

One should also be wary of automatically equating climate change with conflict. Although a cause-effect relationship is often assumed, there is still disagreement on the nature of this relationship. If anything, this disagreement should highlight the complexity in linking climate change and security. **Climate change acts as a “threat multiplier” by exacerbating existing vulnerabilities, and must be analysed in relation to the adaptive capacity of those affected (individuals, communities and states), taking account of the wider political, socio-economic and demographic context.** This task becomes even more challenging because of the diversity of geography and climate predictions between and within African states. These different elements will condition the ability of each African state to cope with the security implications of climate change. The analysis below makes an attempt to incorporate factors beyond the direct impact of climate change.

This document also recognises that climate change poses different challenges according to the type of change, through the divergent nature of its impact (i.e. affecting some countries more than others), and through the ability of groups of people and institutions to adapt to changes in climatic conditions. Throughout the document there has been an attempt to integrate each of these aspects of climate change into the analysis.

Water Security

Water and Security: Understanding the Overall Complexities

Water is a key resource for sustaining life and society through agricultural production, industry, and hydro power, as well as health and human development at large. No community and economy will prevail without water of sufficient quality and quantity.

Water and security are primarily linked in two ways:

- Resource conflicts can arise over water, especially if the amount available becomes scarce and competition increases;
- Water scarcity can impact on human security and potentially lead to instability, migration, and increased resource competition.¹

Conflicts around water can arise between and within countries. The dynamics, nature, and actors of internal water conflicts differ considerably from international water conflicts. At the internal level, **unequal water access and/or availability affecting already marginalised groups can exacerbate existing tensions and make a community more prone to conflict**. Inter-state water conflicts can occur between riparian groups—that is when water sources cross borders. These water resources are not limited to rivers and lakes but also include other sources, for example, groundwater aquifers. The likelihood for international water conflicts is impacted on by the socioeconomic dependence of countries on the trans-boundary resource. Another important risk multiplier is large and rapid change, like the construction of a dam, an irrigation scheme, or territorial realignment.²

Water scarcity depends on water availability and/or access, which in turn are primarily impacted by three linked sets of factors:

- Water management and infrastructure, including questions of institutions, good governance, and adequate technology;
- Climate change;
- Human impact on the environment, including, in particular, the degradation of ecosystems, which may exacerbate the other impacts.

Scientific estimates of the impacts of climate change are developing rapidly. **The earth's water cycle is being altered and is leading to substantial changes in precipitation patterns, intensity, and extremes**. Climate change may, indeed, result in a greater number of extreme weather events, like droughts, floods, and storms. Higher surface temperatures will increase evaporation rates, making water gradually scarcer and this may impact the recharge rates of groundwater aquifers. Science has also predicted that rising temperatures will increase snow-melt, which in turn, may result in more and more river runoff in the short-term, but will lead to sharp declines in the long-term once the snow is gone. Essentially, climate change will lead to increased climate variability and reduced predictability.³

In parallel, global demands for water and waste treatment will rise with economic development, urbanisation, population rise, and changes in consumption patterns. This combination of effects may

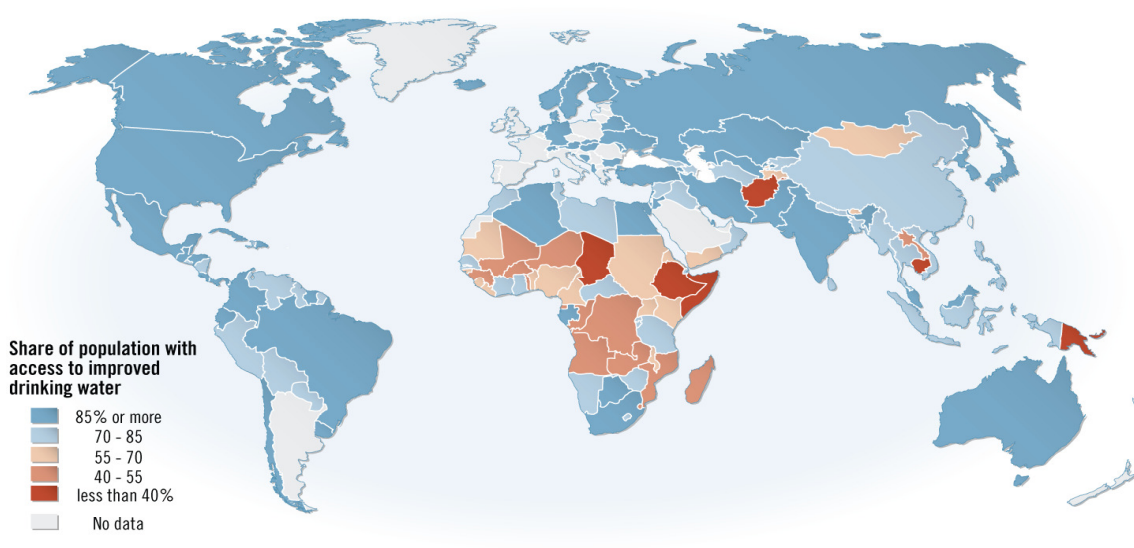
not only increase water scarcity and thus impact human security, but also may increase the risk of water-related conflicts due to the combination of mutually exacerbating trends. In the case of Africa, **it is estimated that by 2025 21 countries – nearly half of the continent – will experience water stress and 9 are facing extreme scarcity**, with less than 1000m³ of renewable freshwater per capita available per year.⁴

Understanding Continental Dynamics in Africa

With a large part of the population lacking access to clean and safe water as well as a high dependence of African economies on water-intensive sectors like agriculture, water is the nexus of Africa’s development challenges. Yet, water scarcity is currently becoming a crisis on the continent, and this is not only in relation to the Millennium Development Goal (MDG) No. 7 on the environment, which includes halving the global population with insufficient access to water by 2015.⁵ Indeed, the **impacts of climate change are likely to stall or reverse most of the progress made towards achieving the MDGs, and, in particular, achieving MDG No. 7.**⁶

Figures 1, 2 and 3 below show populations using improved drinking water, respectively, a) disparities between Africa and the rest of the world; b) the percentage of the total sub-Saharan populations; c) and d) disparities between urban and rural populations.

FIGURE 1 – Global population with access to safe drinking water



Having access to safe drinking water should be interpreted in terms of lower rate of child diseases and deaths related to waterborne diseases, better living conditions, environmental security (stability & peace), population fertility (i.e. low rate of child deaths), and economic development in a broader sense.

FIGURE 2 – Sub-Saharan population with access to safe drinking water

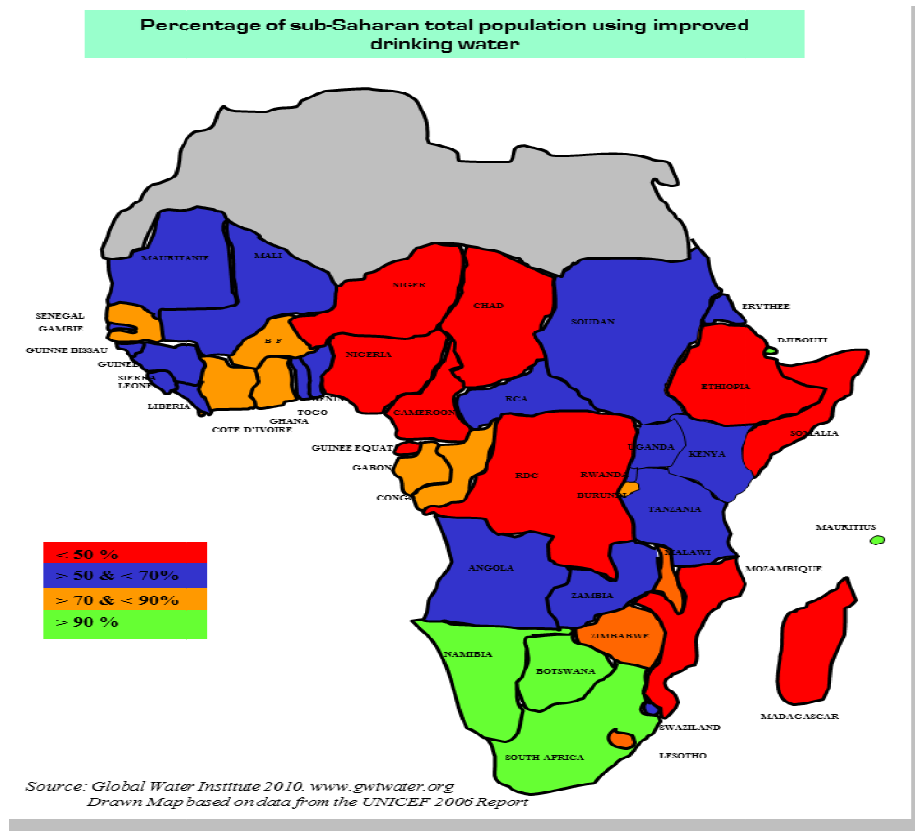
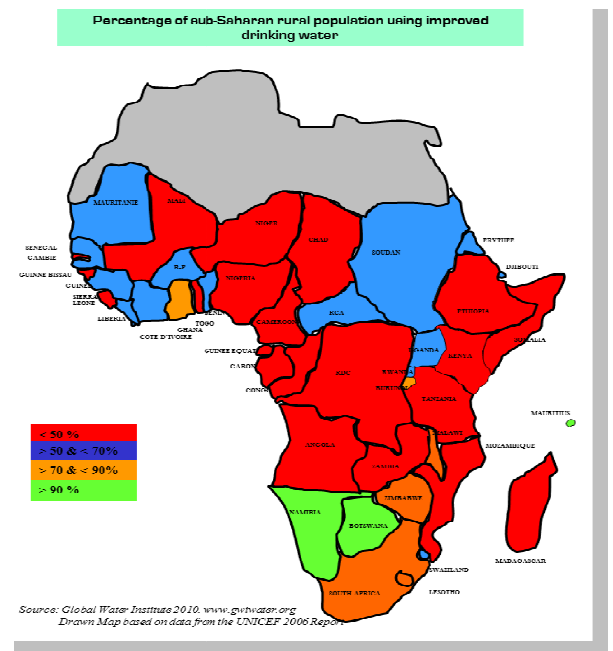
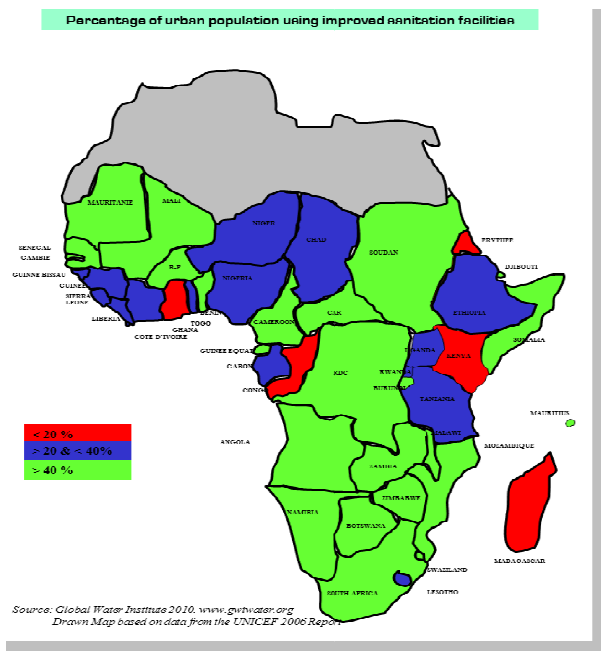


FIGURE 3 – Urban and rural populations with access to safe drinking water



Other socioeconomic challenges such as endemic poverty, poor sanitation and lack of hygiene, rapid urbanisation, and limited governance in some areas make the situation even more difficult. **Fragile and weak states are not only less capable of adapting to climatic change but also of managing and controlling conflicts peacefully.** As a consequence, Africa is highly vulnerable to the impacts of climate change, as its ability to cope with the adverse impacts remains low.

Africa has warmed over the recent decades and continues to do so above the global average, though there are significant regional variations across the continent.⁷ The sub-tropical zones have become particularly more arid, and desertification continues south of the Sahara as well as southern Africa. As Africa already has largely hot climate, any further increase in warming is likely to diminish agricultural production and lead to higher evaporation rates. This will affect virtually all African countries.⁸ **With many African economies heavily dependent on water, particularly hydropower, rain-fed agriculture but also irrigation— some well over 30%—this will decrease economic stability and human security.**

African countries are highly sensitive to precipitation as well. Changes in rainfall are likely to be varied across the continent: particularly southern Africa may see a decrease, but for many other regions, current research is insufficient to draw conclusions whether rainfall will increase or decrease.⁹ Variability is likely to multiply, thus making it likely that increases in rainfall will result in more frequent heavy rains. This would increase the risks of floods and disasters, negatively impacting human development, health, and economic development as well as creating refugee flows and displaced persons.

The population of Africa is likely to nearly double from its current (2010) level of just over one billion to nearly two billion in 2050.¹⁰ The Intergovernmental Panel on Climate Change (IPCC) asserts that the number of people in Africa experiencing water scarcity may increase by 75 million until 2020 and several hundred million by 2050.¹¹ Concurrently, **water demands are likely to rise steeply. This, combined with increasing climate variability, may exacerbate competition between different user-groups and sectors and create livelihood challenges.**

A particular challenge is a current lack of data and detailed regional as well as country-specific projections. This makes it difficult to make adequate assessments on the concrete national impacts of climate change.

Water Security Hot Spots

One of the key areas impacted will be the Nile Basin. The area is of particular importance because 7 out of 10 countries constituting East Africa, with a combined population of 180 million people sharing the Nile Basin's water, have experienced some of the most brutal social conflicts that the world has witnessed in recent years. These countries include among others Democratic Republic of Congo, Burundi, Uganda, Rwanda, and Sudan. However, the size of the Nile Basin as well as the varying challenges countries in the region face makes it necessary to break it down to three smaller, sub-regional hot spots.¹²

Wider Nile: Ethiopia and Kenya

It has been estimated, that possibly over 600,000 people died because of drought in the 20th century alone in Ethiopia, Eritrea, and Somalia.¹³ Already today, Ethiopia is suffering from water stress with large parts of the population being poor, not having access to clean and safe drinking waters and dependent on subsistence agriculture. Ethiopia relies strongly on hydropower for electricity generation, making increasing climate variability a significant challenge.¹⁴ **The diversion of more**

water from the Nile to mitigate these challenges has been met with stern resistance from downstream countries. Kenya has experienced volatile climatic conditions and also low-level violence with regard to water and land.¹⁵ Particular access to land has been politicised in the past.¹⁶ Heat stress and evaporation are likely to negatively impact Kenya's coffee production, one of its key agricultural export goods, while its dependency on hydropower makes Kenya further vulnerable to climate changes and variability. In addition, glacial retreat has accelerated in the past couple of decades as well, leading to increased run-off in spring time from mountains such as Kilimanjaro.

Wider Nile: Democratic Republic of Congo and Burundi

Burundi remains among the most densely populated countries of Africa. It shares with its neighbour, the Democratic Republic of Congo (DRC), past ethnic-related violence and conflict, from which they are slowly emerging. The majority of all economic sectors of Burundi and DRC will be affected by climate change. While, in principle, relatively abundant in water compared to other countries in Africa, weather extremes, including droughts, leading to widespread famine and heavy rain leading to floods are known and have occurred repeatedly over the past few decades.¹⁷ **This alternation of dryness and heavy rain may intensify, threatening food security and economic development further,**¹⁸ especially if water management remains deficient. Both countries face extreme poverty and have low socioeconomic development, which will hamper adaptation efforts. Lake Tanganyika may become a critical issue, as it is increasingly utilised by both countries with limited co-ordination between them.

Wider Nile: Sudan and Chad

Situated in the Sahel-zone, Chad and Sudan face increasing desertification, significant warming, and changes of precipitation patterns. Large parts of their population are impoverished and highly dependent on subsistence agriculture in a region known for its droughts. This has already led to mass migrations in the 1970s and 1980s.¹⁹ Both countries have faced civil wars in the past, which have been driven in part by competition over natural resources and environmental degradation.²⁰ **The violent conflicts also spilled over in the neighbouring countries and left weak governmental institutions and a fragile political situation.**²¹

Rising water scarcity induced by climate variability and growing population levels may amplify tensions related to water control and, if not addressed, will sufficiently imperil post-conflict processes and prevent stabilisation. Sudan is furthermore strongly dependent on the Nile River. Changes of use in upstream countries such as increased use may further aggravate the situation for Sudan.

Wider Niger Delta: Niger and Nigeria

Regional warming will lead to decreasing agricultural production and unpredictable rainfall patterns pose the risk of food shortages. Both Niger and Nigeria border the Sahel zone and have witnessed increasing desertification in their impoverished Northern regions, which may serve as a further driver of migration towards coastal areas.²² **This is accentuated by the risk of sea-level rise, which may increase salt-water intrusion and degrading ground water in coastal areas, thus creating multiple challenges.** The Niger Delta has and continues to witness low-level violent conflict, among others over environmental degradation as a result of oil exploration. In addition, Nigeria has only limited governance capacities and has yet to develop a National Action Programme of Adaption (NAPA) to address the challenges posed by climate change.

Limpopo Basin: Mozambique

Southern Africa is likely to become significantly drier over the coming decades due to climate change.²³ This will increase water stress and thus negatively impact food security,²⁴ but may also

increase the risk of disaster: in the case of Mozambique, annual average precipitation has decreased slowly over the past decades and it is likely to decrease further.²⁵ Yet, at the same time, the number of heavy-rain events has increased, as did the risk of flash floods, which could accelerate soil erosion. In other words, while actual average annual rainfall may only change only slightly, the distribution over the year will change, and possibly quite dramatically. Consequently, **a significant challenge emerges from alternating droughts and floods, making it impossible to recover from either extreme event**. An additional challenge, particular to Mozambique, will be sea-level rise, as more than 60% of the population lives within 50 km of the coast, and salt-water intrusion may degrade groundwater.²⁶

Water Security: Needs of Communities and Countries

Dialogue, raising awareness, fostering cooperation and participation in decision-making processes within and between countries are essential. Institutional cooperation from the local to international level in the face of increased climate variability should be improved. Conflict resolution mechanisms such as the Nile Basin Initiative and other existing local and international institutions equipped with climate preventive strategies should be reinforced. **African traditional knowledge and local adaptation strategies are key entry and starting points for any purposive action.**²⁷

Data gathering and analysis of potential climate impacts need to be improved. The development of appropriate adaptation measures has to be based on strategic information sharing that is culturally oriented and easily understandable by local communities. Capacity development in the area of analysis and adaptation will be vital, including education and offsetting-up dedicated climate centres and statistical databases. This will enhance the capacities of governments and communities to make informed choices and become further resilient to potential impacts and improve advanced planning.²⁸

Strategic management of variability by creating adequate buffers and improving resilience of societies and economies will be important. **“No-regret” measures, which will have benefits, irrespective of the concrete impacts of climate change, are critical.** This includes for example, improving water conservation and efficiency. In particular, it is necessary to avoid that adaptation measures have negative unintended effects or increase horizontal inequalities. Improving inter-sector cooperation between various ministries will be important to minimise such risks.

Road Map toward Water and Sanitation for All

Climate change is a long-wave event adding to the existing impacts of poverty to challenge basic water resources on the African continent. Nexus for collaboration between the South and the North using water-related programmes can greatly contribute to preventive measures for human security and conflict prevention.

Adaptable intersectoral common programme lining different ministries including environment, health, security, and social development and the Ministry in charge of the reintegration of ex-combatants is ultimately needed as it is essential for **continuous monitoring for assessing populations’ needs and assisting the most vulnerable populations to adapt to the impacts of climate change.**

Intersectoral co-ordination and collaboration between the above ministries are essential for paying special attention to the needs and vulnerable population, taking into consideration gender type and age differences.

Increasing the resilience of the most vulnerable African population requires scaling up efforts from the North to the South in order to meet the MDGs’ goal on water. This will reduce risks caused by many of the socioeconomic and security factors that are contributing to the exacerbation of climate change’s impact.

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Food Security

Food and Security: Understanding the Overall Complexities

Africa is considered the most vulnerable region in the world in terms of climate change because of its physical and socioeconomic characteristics. Sub-Saharan Africa includes the mixed arid–semi-arid systems in the Sahel, arid to semi-arid rangeland systems and coastal areas of eastern Africa, and many of the drier zones of southern Africa. **A large part of the population is engaged in subsistence agriculture and farm marginal lands under rain-fed conditions with relatively limited access to productive assets, inputs, technology, and services.** Because of the fragility of its economy, Africa is disproportionately affected by adverse effects of climate change.¹

In Africa, climate models warn especially about changing rainfall patterns and their immediate impact on grain yields, runoffs, water availability, and the survival of plant and animal species. Long-term changes in the patterns of temperature and precipitation, that are part of climate change, are expected to shift production seasons, alter productivities, and modify the set of feasible crops. **Where these impacts encounter limited adaptive capacity and unsustainable resource management practices, the consequences are wider and more persistent food insecurity.** Currently, most African countries are net importers, with over 50% and between 25 and 50% of the food requirement of North Africa and sub-Saharan Africa imported.²

Preserving and enhancing food security requires agricultural production systems to change in the direction of higher productivity and also, essentially, lower output variability in the face of climate risk and risks of agro-ecological and socioeconomic nature. In order to stabilize output and income, production systems must become more *resilient*, i.e. more capable to perform well in the face of perturbing events. **More productive and resilient agriculture requires transformations in the management of natural resources and higher efficiency in the production system** (e.g. water use, soil nutrients, and genetic resources). These transformations are particularly needed in smallholder systems that are the main source of food and income for most of Africa's poorest people.

Achieving the necessary transformation of agricultural systems will require action at all levels, from the farm to international organisations. Farmers need to adopt different practices and perhaps productions, which policy has to facilitate at the local, national, and international levels. **Climate change increases the demand for three key functions of institutions: information production and dissemination, coordination of production, and marketing activities and financing.** In most cases, increasing and expanding capacity of existing agricultural institutions to meet the new requirements imposed by climate change is likely to be more effective than trying to establish new ones. Providing adequate financial resources to farmers and local institutions to make needed transformations is problematic. High transactions costs, and deferred returns to these investments suggest that public sector involvement will be necessary for the near term, and integration of mitigation financing into existing agricultural financing channels will be an efficient way to relieve the financial constrain on smallholder mitigation.

Food Security Hot Spots

According to the State of Food Insecurity in the World 2010, 22 countries,³ 17 from Africa, 4 from Asia, and 1 from the Latin America and Caribbean, are currently considered to be in protracted crises.⁴ These countries have suffered from recurrent natural disasters and/or conflict, several years of food crises, breakdown of livelihoods, and insufficient institutional capacity to react to the crises. **A country is considered in protracted crisis if it appears on the GIEWS's list of countries in crisis requiring external assistance for food for eight years or more between 2001 and 2010**, received 10% or more of their official development assistance (ODA) as humanitarian aid since 2000, and appear in the list of Low-Income, Food Deficit Countries (LIFDC). Of the 17 African countries, 5 representing different regions of the continent have been selected as hot spots for food insecurity. These are: Chad (from Sahel), Cote d'Ivoire (West Africa), Democratic Republic of Congo (Central Africa), Ethiopia (East Africa), and Zimbabwe (southern Africa). The five countries together account for 64% of the total undernourished population of African countries in protracted crises.

Chad

Chad has a population of 11.2 million⁵ who are primarily reliant on crop and livestock production for their livelihoods. An estimated 80% of resident Chadians rely on subsistence agriculture. The north of Chad extends into the Sahara and has, therefore, very little rainfall all year round while the south has a tropical climate and experiences a rainy season between May and October. The major climate-related event is the drying of Lake Chad that has shrunk to 10% of the surface it covered in 1963. At the current pace, it is bound to disappear by 2030. Human management of lake water (e.g. dam construction) as well as increased drought incidence are the main factors driving the loss of lake water.⁶ Currently, 30 million people rely on the lake's water and its basin, which extends to Central African Republic, Algeria, Sudan, and Libya. In addition to serving as the main source of drinking water, **Lake Chad provides food and livelihoods (derived from the lake's fishery), and plays an important role in supporting subsistence agriculture.**⁷ The Lake Chad Basin Commission expects the progressive drying to cause security problems as the competition for shrinking waters grows. In recent years, the food security crisis in eastern Chad has increasingly become protracted as 320,000 refugees from Darfur in neighbouring Sudan, 180,000 displaced Chadians and the native population of 700,000 jostle for resources.

Cote d'Ivoire

An estimated 68% of Cote d'Ivoire's 21.1 million people (2009) are employed in agriculture. Cote d'Ivoire is the world's largest producer and exporter of cocoa beans and a major exporter of coffee. A West African model of political stability and economic miracle in the 1980s, Cote d'Ivoire had collapsed by the 1990s because of resource depletion and declining agricultural productivity. Climate change in Cote d'Ivoire is manifested visibly in coastal flooding in the south as well as drought and delays in the start of the rain season in the north. Even drought-resistant crops often fail to survive early summer droughts in the northern parts of the country. On the other hand, the south is more and more frequently affected by intense rains and flooding in August and September, like other West African countries. Deforestation has worsened the consequences of these changes. **Agriculture, uncontrolled fires, and logging for tropical woods—once the country's largest export by volume—are the primary causes of forest loss in Cote d'Ivoire, which has the highest level of biodiversity in West Africa.** The country's food security situation worsened largely as a result of the ten-year wave of political turmoil that started with the 1999 coup and degenerated into the 2002–2004 civil war. The socio-political crises have jeopardised the continuity of the State and the social order, and thereby led to a break in the relatively long period of political stability. Continued election

delays and political turmoil have, for years, been used as excuses to justify poor governance and the lack of investment in public services.

Ethiopia

With 82.8 million,⁸ Ethiopia is the second most populous country in Africa (after Nigeria). About 85% of the population is dependent on low-productive, rain-fed agriculture, which is the main reason for the high rates of food insecurity in the country—44% of the population was estimated to have been undernourished over the period 2004–2006.⁹ Drought and land degradation are the main causes of vulnerability, low farm incomes, and the consequent protracted food security crisis. In the 2000 and 2003 production seasons, major drought affected the food security of over 10 million people leading to episodes of famine.¹⁰ Pastoral communities in the lowlands frequently experience severe drought that results in the loss of up to 40 or 50% of their cattle, sheep, and goats. It is estimated that **more than 85% of the cultivated land is moderately to very severely degraded due to poor land-use practices** (e.g. depletion of soil nutrients, overgrazing) and population pressure. The average farm size has declined to less than one hectare due to very high population pressure, particularly in the highland farming areas, where the bulk of the population lives. Combined with increasing land degradation and recurrent droughts, small farm sizes have contributed to declining crop productivity. Increased human and livestock populations have also led to agricultural encroachment on to marginal areas, significantly reducing the already dwindling forest and woodland resources.

Democratic Republic of Congo (DRC)

Despite its immense natural resources, the Democratic Republic of Congo (DRC) is ranked as one of the poorest countries of the world. Agriculture provides employment for 70–75% of the active population and, through agro-industries, an additional 10%.¹¹ The DRC is the size of Western Europe and has rich and diverse natural resources but the vast majority of its 66.0 million people (2009) live in abject poverty. As its resources such as timber, diamonds, gold, coltan, and cassiterite (tin ore) are used to finance conflict, the number of hungry people rose from 11 million in 1990–92 to 43 million people in 2003–05, and the proportion of undernourished population soared to 69%, the highest in the world, in 2005–07.¹² The security situation has improved in recent years, but outbreaks of violence have occurred, especially in north-eastern parts of the country. **Continued insecurity and severe droughts in eastern DRC have curtailed farming activities, leading to loss of produce and further population displacements.** Central and southern regions also experienced relatively dry periods in 2008, which negatively affected staple crops such as sorghum and millet. Despite this enormous potential, agricultural gross domestic product (GDP) declined by almost 40% (from US\$ 3.4 billion to US\$ 2.1 billion) between 1990 and 2001. Agricultural exports, which represented 40% of GDP in 1960, now account for only 10 percent. About one-third of the food consumed in the country is imported.

Zimbabwe

Zimbabwe has a population of 12.5 million (2009), 65% of which was estimated to be unemployed in 2009. The 1998–2002 war in the Democratic Republic of the Congo imposed a heavy financial toll on the country. The commercial farming sector, the traditional source of exports and foreign exchange and the provider of 66% of jobs (400,000), is now seriously damaged and Zimbabwe has turned into a net importer of food products. After the political changes of February 2009 some economic improvements have occurred, including the cessation of hyperinflation, but the sustainability of the positive developments depend on future political stability and the climate. Drought is expected to be the biggest problem facing Zimbabwe. Since some 80% of Zimbabwe's population are farmers, with 30% of them being city-dwellers but also engaged in agro-industry, the economic damage and human suffering associated with droughts are enormous. **The country is experiencing more hot days and**

fewer cold days, and the amount of precipitation it receives is deviating from the mean more frequently. Average temperatures have increased by about 2 degrees Celsius in the last 30 years, while precipitation patterns show a mean reduction of 30. Floods and droughts in the region are gradually increasing in number and frequency. Zimbabwe belongs to the area in Africa on which there is the widest expert agreement over heavy climatic changes.

Food Security: Needs of Communities and Countries

Achieving food security under a changing climate and environmental degradation, combined with rapid population growth and persistent political turmoil and or conflict for the most part, requires substantial increase in food production on a sustainable basis on the one hand, as well as improved access to adequate and nutritious food on the other hand in the hotspot countries.

Community-based development processes need to be fostered in order to build sustainable and climate resilient livelihoods and ensure peace and stability, and thereby move out chronic poverty and food insecurity.

There are a few community initiatives that need institutional and fiscal support to be sustained and expanded:

- Resilient farming systems—farmers are repository for traditional and indigenous knowledge, enterprise, skills, and practices related to crop and animal production;¹³
- In Humbane village in Gwanda, Zimbabwe, traditional method rainwater harvesting is used so that families can harvest enough food even when the rains are low;¹⁴
- Ethiopian farmers have adopted a range of adaptation measures in response to climate changes, including altering crop varieties, adopting soil and water conservation, and changing planting and harvesting periods, in response to changes in rain. In the Nile River Basin (Ethiopia), for instance, farmers grow 48 different crops and those who took adaptation methods produce more per hectare than those who did not;¹⁵
- Conflict resolution and community services—in DRC, local people relied on their own institutions, known as *chambers dex paix* or ‘peace councils’ and composed of elders, to deal with issues related to access to land that were fuelling the conflict. Apart from resolving conflicts, some local associations introduced collective fields, established micro-credit systems, informed farmers about their property rights, provided information and the legal framework regulating access to land and advocated at national level for a modification of the existing land laws. However, despite their potential in addressing the key drivers of food insecurity, these local associations and the *chambers dex paix* lacked technical and financial capabilities and they are seldom recognised and integrated in the action plans of intervening agencies.¹⁶

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Energy Security

Energy Security and Climate Change: Understanding the Complexities

Energy security implies that a state, region and/or continent have secure, sustainable, affordable, and diversified supplies of renewable and non-renewable energy. A lack of energy security can influence economic productivity, in turn impacting upon the capacity for achieving the MDGs, the maintenance of livelihoods through economic growth and social and environmental well-being.

“Energy shocks” through declining energy stocks, supply disruption (supply not meeting demand), weakened infrastructure, over-consumption, political instability, high-commodity prices, and natural disasters implies having to find alternative suppliers, energy sources, and/or policies. This process, in turn, can put **increased demand on overall energy supplies thus fuelling competition for resources between national, regional, and international actors**. Local, regional, and international competition for threatened energy supplies (e.g. forest-based hard woods and water) compounded with rising levels of population growth, population density, and urbanisation could lead to mass intra- and inter-state migration and displacement.

Increased global demand for traditional fossil fuels is having a detrimental impact upon climate change mitigation efforts. Increased climate volatility through floods, droughts, and storms can impact on the functioning of key energy infrastructures (e.g. refineries, rigs, hydro-electric plants) within countries. Climate change mitigation efforts, encouraging a shift from fossil fuels to renewables, can inadvertently exacerbate energy security risks.¹ Biofuel usage, for example, can alter land-use patterns away from food production, in turn leading to an increase in agricultural commodity prices (“agflation”²).

Energy Security and Africa: Continental Dynamics

Africa is the lowest consumer of energy (Africa consumes 3% of global energy consumption and contributes 3.8% to global greenhouse gas emissions³), is the lowest emitter of carbon, is one of the largest exporters of sub-soil natural resources but **faces the greatest security risks and is underdeveloped to deal with mitigation efforts** (including low measures against the impact of floods on key energy infrastructure).

Five Hundred million⁴ people in sub-Saharan Africa live without electricity; only 4% of Africa’s full hydropower potential is used;⁵ Africa’s huge solar, wind, and geothermal resources are severely underused; and, 23 of the 48 countries in sub-Saharan Africa are vulnerable to “energy shocks”.⁶ Without energy diversification and efficiency measures, Africa is not shielded from energy shocks and conflict.

Approximately 90% of African households use biomass fuels (e.g. wood and vegetation) for cooking and water heating.⁷ The mixture of unsustainable (often illegal) harvesting of forests and climate change (including unpredictable rainfall levels, drought, and flooding) **threatens this high rate of biomass users with decreased forest cover rates, increased soil degradation, and supply disruption**.

Energy supplies in Africa are unequally distributed and have led to energy dependence between states, which may potentially increase exposure to supply-shocks when climate change is considered. **A move**

towards “energy autarky” by some states to protect indigenous energy supplies could lead to energy shortages and potential inter-state disputes.

Africa’s energy resources are the focus of global competition, fuelled by global population growth and economic demands. Africa’s energy resources constitute a new macro-level challenge to international security and may fuel or lead to national and regional economic and political instability. This challenge is compounded by threats and risks that directly relate to energy security such as water availability and the occurrence of natural disasters.

Energy Security Hotspots

Five hot spot countries most at risk from climate change and energy insecurity—at both the micro and macro levels—have been selected as a basis for further dialogue between partners. It should be explained that **the selection of five countries in no way seeks to overlook the severity of energy insecurity in other countries and regions of Africa.**

The selection was based on a number of criteria, these included:

- geographical spread so that the central, western, eastern, and southern regions of Africa were adequately represented by three states selected on the basis of qualitative research (academic articles, reports, and news media);
- a quantitative assessment of a range of energy (e.g. energy production (Mtoe)), political (e.g. political stability), social (e.g. population growth), environmental (e.g. flood and drought risk), and economic (e.g. human development ranking) indicators for each country was conducted with each indicator being assigned “Extreme”, “High”, “Medium”, “Low-Medium”, and “Low” risk categories;
- the total number of “Extreme” and “High” risk indicators were totalled to give a single country risk figure;
- the individual risk totals for each country were added to their fellow regional countries to give an overall weighted regional average; and,
- countries within the selected regional groupings were selected on the basis of the individual risk they face.

Thus the chosen hot spots are a compound of not only quantitative and qualitative analysis, but also a consideration of individual and regional risk. Thus one may notice from Annex I that countries in other regions are under greater individual risk, but taken in their regional grouping, this risk is relatively decreased. A full list of indicators and results can be found in Annex I. The five “hot spots” selected are, in alphabetical order, as follows:

Burundi

With low to non-existent stocks of energy resources such as oil and gas, Burundi is forced to make use of biomass fuels, which currently accounts for approximately 94% energy usage in the country. With a low level of forest cover compared to other African countries, and increased deforestation to make room for the habitation needs of its 9 million densely populated residents (Burundi has the highest rate of population density compared to all the countries selected with 306 people per km²), there are also strains on Burundi’s wood stocks. Increased competition for biomass fuels will impact on this poverty-stricken country, which has already experienced conflict along ethnic lines. **As a land-locked country, Burundi’s main source of electricity production comes through Lake Tanganyika.**

Climate change threatens the productivity and water-levels of this lake, which not only impacts upon the ability to irrigate Burundi's forests (located adjacent to the lake) but also puts Burundi in competition with its neighbours (e.g. DRC) that also make use of the lake for livelihoods. Burundi is also exposed to high costs for oil imports and thermal electricity generation.

Democratic Republic of Congo (DRC)

With a population of approximately 68 million people, and with one of the largest refugee populations in sub-Saharan Africa (185,809⁸), the supply of energy will be a key development task for the country. **The country has a high potential for renewable energy sources but less than 20% of the population have access to electricity.** The DRC has a relatively low level of energy production, low electrification, and renewable sources are underused.⁹ The DRC has plentiful stocks of hard wood given that it has the world's second largest rain forest; however, global demand has increased the rate of legal and illegal logging and put pressure on the 21 million or so hectares currently allocated for timber production. Excessive logging leads to a loss of livelihoods, soil erosion, flood risk, and increased competition between groups. This competition is of particular importance given the DRC's extant problems with local violence (conflict in the Nord Kivu region) and its close proximity to surrounding countries such as the Cameroon, which also depend on the rainforest. In terms of cross-border conflict (the DRC shares 9 borders), Eastern DRC derives a substantial amount of its electricity from hydropower produced in Lake Kivu which is shared with Rwanda; low water levels in the Lake, to be potentially exacerbated by climate change, could strain relations with neighbours.

Kenya

One of the biggest security challenges currently facing Kenya is drought due to volatile climatic conditions, particularly as the country is home to approximately 40 million. With approximately 81% of renewable energy sources coming from outside the country, and its 60% dependency on hydro-electric power produced by the drought-prone Tana River (Kenya witnessed the worst drought for 60 years in 2001), Kenya is in urgent need of dealing with energy shocks. Pressures on the Tana River and major usage of biomass (the country's rural population is 90% dependent on this resource) are likely to increase in line with population growth and subsequent demand. With a problematic national programme for reforestation and lower water levels, **climate change will add to the problem of resource access in a country only recently emerging from conflict and unrest.** While Kenya has invested in a greater degree of energy diversification, it is still substantially exposed to flood and drought risks¹⁰ with, for example, the drought between 1999 and 2002 drastically affecting hydropower generation and in the year 2000 with a reduction of 25% in capacity.¹¹

Uganda

Uganda is currently one of the lowest producers of energy in Africa and severely underutilises electricity (only 10% of its full electricity potential is currently utilised¹²) in favour of wood fuels.¹³ Biomass resources such as wood and charcoal comprise approximately 93% of the country's energy consumption, and this is placing an increasing strain on Uganda's low stock of forest cover.¹⁴ Drought is on the increase in the country, which is placing strain on water sources such as Lake Victoria, and, in turn, can increase water access tensions with neighbouring countries, Kenya and Tanzania. During the droughts of 2004 and 2006, for example, Lake Victoria's water level was reduced and this impacted on hydropower generation by approximately 50 MW and strained supply and led to higher electricity prices.¹⁵ Uganda has attempted to diversify into modern renewable energies such as solar, wind, and geothermals but it currently only uses 4% of these types of energy resource.¹⁶ With a population reaching close to 40 million people, relatively high population growth rates and high population density **Uganda is faced with a number of structural pressures on energy security.**

Zambia

Approximately 70% of Zambia's 13 million population is in poverty and so the requirement to provide equitable access to energy resources under affordable prices is essential. The country is currently dependent on wood, petroleum, and hydropower for its energy supplies, but **rural areas are insufficiently connected to the national electricity grid and low rainfall levels place strain on production capacities.**¹⁷ The country also has one of the lowest rates of energy production in sub-Saharan Africa.¹⁸ Furthermore, climate change will potentially affect the country's forest areas, which currently cover 60% of Zambia's landmass. Should deforestation of this cover occur, soil erosion and increased competition for remaining resources will likely result. An increasing population—having borders with 8 other energy-needy countries—drought, and low access to biomass fuel, all impact Zambia's energy security. Low rainfall levels also affect the country's ability to generate electricity, with the 1991–92 drought, for example, reducing hydropower energy produced at the Kariba Dam on the Zambezi River by up to 30%.¹⁹

Energy Security: The Needs of these Communities

Energy diversification is required to ease the burden on single energy commodities through the development of local renewables. This can be achieved through the provision of technical training and investment into entrepreneurial small–medium enterprises. Governments have a role to play here by offering fiscal incentives for investment into energy infrastructures, whilst also ensuring a regulatory framework that safeguards environmental and social welfare.

Sustainable access and use of untapped local resources are needed to ease the short-term supply for energy resources, and over the longer-term sustainable use and consumption of key energy infrastructures such as lakes and rivers should be promoted. **Over the long term universal access to modern energy should be ensured with the highest degree of local renewable energy in order to avoid strong external energy dependence.** More also needs to be done to ensure that over the longer-term forest cover is replaced by reforestation projects and conservation programmes are implemented to promote sustainable use of firewood. Simultaneous efforts should be made to wean populations off complete dependence on biomass fuels to ones that are less impacted on by climate change.

Energy access disparities between rural and urban areas in many of these countries need addressing, and government efforts need gearing towards developing the required efficiency of transport and delivery; this will require improved technical capacity, regulation, and public knowledge.²⁰ **Training and investment is also required to increase energy efficiency of the current energy infrastructure.** Better and in-depth statistical data is required in order to forecast potential supply disruptions and to tackle alleviation efforts at an early stage of energy insecurity in these countries. Such data should be collected by government and local authorities but made use of on a continental basis.

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Migration

Overall Complexities of the Climate Change–Migration–Security Nexus: Climate Change and Migration

Throughout history, migration has been used as a coping strategy in the face of environmental change. However, it cannot be assumed that climate change alone will lead to migration or displacement. Climate change plays an indirect role in such movements, by exacerbating existing vulnerabilities. Low “adaptive capacity” is an essential element of vulnerability to climate change, whether it is at the level of the individual, the family, the community/region, or the state. Adaptive capacity depends on factors such as demographic pressure, poverty, level of development (e.g. state provision of social safety net, basic services), weak or inequitable governance (land tenure being a key aspect), each of which can be important “drivers” of migration or displacement.¹ At the level of the individual, and in addition to the above, other factors such as information/education, social networks, and physical condition can also influence the potential for environmental migration.

The number of people who migrate or are displaced by the effects of climate change will also depend on national and international policies (and funding) for adaptation. **It is key to understand that migration is a multi-causal phenomenon.** For example, “pull” factors also have to be taken into account (e.g. the lure of higher income through wage-based employment in cities).

The picture is blurred further by the fact that migration as a coping strategy is not open to all—those most vulnerable to environmental and climatic factors may actually be those who are unable to use migration as an adaptation strategy. The high cost of migration and the lack of education/information/networks concerning the possibilities for international migration explains why most analysts predict that the majority of environmental migration will be internal or to bordering countries.

Migration is distinct from the other themes presented in this paper (food, water, energy, natural disasters), as it is not a vulnerability *per se*. **It can be both a negative and a positive response to vulnerability linked to climate change**, depending *inter alia* on the extent to which it is planned/voluntary or forced.²

Environmental migration: A complex typology³

Natural hazards can be of the **sudden-onset** kind, for example, storms and seaquakes; they can also be **slow-onset** in nature, such as droughts that can last for longer periods of time. Natural hazards turn into **natural disasters** when they wreak havoc on human settlements, taking lives, destroying livelihoods, including homes and infrastructure, and forcing people to flee for sheer survival. However, these sudden, large-scale displacements of population are often temporary and localised, with cross-border movement occurring if there are no other escape routes. In most cases, return might be possible, especially if adequate support is offered.

Gradual environmental change includes processes such as desertification, reduction of soil fertility, coastal erosion, and sea-level rise. **Environmental degradation** occurs when these processes

negatively affect human livelihoods and the ecosystem services that a community depends on. Climate change exacerbates these processes, which have a medium- to long-term impact on existing livelihood patterns and systems of production. They may trigger different types of migration:

- In the early and intermediate stages of environmental degradation, migration can represent a logical and legitimate livelihood diversification option. It is an adaptation strategy for affected populations to help them cope with the effects of environmental degradation and climate change. In this context, **migration is likely to be temporary, circular, or seasonal in nature.**⁴ Remittances and skills (“social remittances”) transferred back to families and communities of origin may contribute to building resilience in degraded areas;⁵
- However, when environmental degradation becomes severe or irreversible, for instance, due to sea-level rise, migration can become permanent and may require relocation of affected populations, either internally or in another country. Several studies in Western Africa have found that **persistent droughts and land degradation contributed to both seasonal and permanent migration.**

Overall, a much larger number of people are expected to migrate due to gradual deterioration of environmental conditions rather than natural disasters, even if, in most cases, their fate does not catch headlines. In many parts of the world, environmental degradation and natural disasters combined can have devastating effects, as in Eastern Africa where heavy rain that often follows drought season can lead to flash floods. **Populations exposed to such cumulative vulnerabilities are particularly at risk.**

Migration, especially the mass influx of migrants, can affect the environment in places of destination and origin, and along routes of transit. In particular, unrestrained urbanisation, as well as camps and temporary shelters, may put a strain on the environment if improperly managed.

This two-way connection between migration and the environment can result in a vicious circle. If inadequately managed, large-scale movements can lead to overexploitation of natural resources and further destruction of peoples’ livelihoods in the host environment. This may, in turn, provoke further migration and displacement, in addition to creating tension with the receiving communities.

However, out-migration in places of origin may alleviate population and land-use pressure, sometimes allowing a degraded local ecosystem to recuperate. **This complex interaction between human beings and their environment makes it difficult to predict the scale of future movements.**

Migration and Security:

The causal relationship between security and migration is clearly established (the millions in refugees and IDP camps as a result of war are a sad testimony) but when the sequence is inverted, the link between migration and security is far less clear. Prior to the study of environmental migration, analysts have already investigated the impacts of large-scale population movements in the form of refugee/IDP camps in relation to potential tension with hosting communities. **The empirical evidence for a causal relationship between migration and security in this context is ambiguous,**⁶ with some studies⁷ having found statistically significant evidence for a link while others⁸ have found none.

The destabilising effects of large-scale in-migration must be considered in parallel with contextual factors in the receiving area. Conflict may arise when migrants, particularly those of a different nationality or ethnicity, move quickly or in large numbers to areas already suffering from tensions over access to scarce resources and where coping mechanisms are absent. Property claim disputes

and increased demands on limited publicly funded health and social systems can also generate frictions.⁹ However, it should be noted that in such cases, migration is an exacerbating factor rather than a determining factor—in a context of existing political instability, weak governance, and structural development issues. In this context, it is also important to consider the relevance of mutual *perceptions* among host and refugee communities when trying to assess the likelihood of (violent) conflict in receiving areas.¹⁰

In the context of migration linked to slow-onset phenomena, which typically involves drawing on existing social networks (including community members who have already migrated) to plan the destination, pockets of migrant population concentration in destination areas may pose challenges for receiving communities in terms of capacity to integrate the new arrivals. However, in contrast to the potentially major destabilising effects of large-scale conflict-induced migration, recent studies suggest that where environmental migration caused by slow-onset phenomena may be linked to tensions, these will most likely be short-term low-intensity.¹¹

Climate Change, Migration and Security in Africa—Continental dynamics

There is general consensus that some of the most severe effects of climate change will be felt in Africa, ranging from increasingly frequent extreme weather events, to desertification. **An estimated 10 million people in Africa have already migrated or been displaced over the past two decades**, mainly because of slow-onset phenomena such as environmental degradation and desertification.¹² While many parts of Africa are particularly vulnerable in virtue of already fragile geo-meteorological characteristics, the effects are expected to be all the more devastating due to the existing vulnerability of some States (*inter alia*: reliance on rain-fed agriculture; demographic pressure; recent history of conflict¹³) and a generalised lack of adaptive capacity. The level of vulnerability of African societies to climate change depends in large part on their economic, political, and institutional capabilities.¹⁴

Climatic processes (slow- or sudden-onset) linked to climate change will vary geographically across the continent, as will the likely associated forms of population movement and security implications. The majority of movements will remain essentially internal.

Natural disasters caused by **sudden-onset events such as storms and flooding** will cause significant population displacement on the African continent, most notably on the eastern coast of southern Africa, which has already experienced severe displacement in recent years. However, most of this displacement is likely to be temporary and is less likely to be an exacerbating factor for conflict. In general, security implications are more likely when natural disasters are a recurring feature. It is predicted that far greater movements will result from slow-onset processes.

Migration and displacement due to **slow-onset phenomena** such as **droughts, desertification, and soil degradation** linked to changing rainfall patterns, and the resulting scarcity of productive agricultural land is expected to be a major issue in Africa, with the Sahel belt (stretching from Dakar in the west to Mogadishu in the east) predicted to be the worst affected zone. Chad and Niger could potentially lose their entire rain-fed agriculture by 2100 due to changing rainfall patterns and degraded land, while in Mali, cereal harvests could decline by 30 percent.¹⁵ **Desertification is likely to cause the largest share of (forced) migration in Africa over the long term**, both rural–rural and rural–urban.

Obviously, only countries having a maritime border are subjected to the risk of forced migration caused by **sea-level rise**, but the threat posed varies considerably among such countries (countries with large population concentrations on low-lying deltas being the most exposed). The West African coast between Liberia and Nigeria is particularly vulnerable given the extent of population concentration and growth in low-lying coastal mega-cities such as Lagos. The same can be said of Egypt's Nile Delta region. Preventive

actions are needed, including where necessary planned relocation, otherwise there is a risk of security consequences linked to unmanaged migration

Unmanaged urbanisation involving the growth of slums is a major vulnerability for numerous African countries. The largest growth in city populations—nearly 50%—is expected to occur in Africa and Asia. In 2005, 72% of the urban population of sub-Saharan Africa and 56% in South Asia lived in slums.¹⁶ It is estimated that the phenomenon of urbanisation in West Africa has led to the departure of more than 80 million people from rural zones to urban zones during the last 45 years.¹⁷ Although there are multiple reasons for such phenomena, of which the most important is rapid population growth at the country-wide level,¹⁸ rural–urban migration linked to slow-onset climate change effects such as soil degradation and desertification will put increasing pressure on cities already overcrowded and straining to provide basic services such as health, water, education, and employment opportunities to their inhabitants.¹⁹ The food riots in 2008 illustrated in a number of countries in West Africa (Mauritania, Senegal, Ivory Coast, Burkina Faso, etc.) the specific vulnerability of populations to food insecurity in the cities and the potential for violence,²⁰ although the influence of rural–urban migration is likely to be minor in relation to other factors. In addition, poor urban dwellers (often including rural migrants) are often forced to inhabit land that is most exposed to other climate change-related threats such as sea-level rise (most major African cities are located near the coast), flash-flooding, and related landslides.

The seasonal migration of pastoralists (herders) can be considered an ancient form of environmental migration and one that remains prevalent in a number of African countries. Climate change (among other factors such as governance) is affecting the capacity of herders to use migration as an effective response to seasonal climatic variability, by extending the duration of dry seasons, drying up water sources, or by desertification of pasture lands. **Localised conflicts between pastoralist groups**²¹ in relation to land and water access are on the increase,²² with pastoralists forced to travel ever greater distances to access grazing and watering points, thereby encroaching on lands beyond their group's "range". The conflict risk is exacerbated by the introduction of unfavourable land-tenure legislation, tightening of international border crossing procedures (the ranges of many groups across international borders), and related governance factors. This difficult situation has led many pastoralists to abandon their way of life in favour of permanent relocation to towns/cities. Another common response is temporary labour migration (also to urban areas) of one or more group members.

Climate change is also causing **increased competition between pastoralists and sedentary farmers**, bringing with it a higher potential for localised conflicts. Faced with higher risks of crop failure linked to increased drought frequency, desertification, and land degradation, a widespread response by farmers across the continent is the diversification of income source to reduce reliance on a single activity. As such, sedentary crop farmers are increasingly developing livestock activities, increasing competition for grazing lands with pastoralists and destabilising the traditional balance based on exchanges between the two groups. The reduction of exchanges between pastoralists and sedentary farmers has weakened traditional mediation mechanisms at the local level. Throughout Africa, straying cattle are the main source of violent conflict between farmers and herders.

Migration: Hot Spots

Whilst the difficulty of making predictions in relation to environmental migration and its possible security implications has already been highlighted above, the following represents an attempt to identify some regions which combine unfavourable climate change predictions and existing geo-meteorological vulnerability with major socioeconomic and demographic challenges. In regard to the latter, level of development, reliance on (rain-fed) agriculture and population growth rate are among the indicators which have informed the choice of these regions.

The western Sahel²³

Environmental migration caused by slow-onset phenomena, such as soil degradation and desertification is expected to account for the majority of movements stemming from climate change over the long term in this region. Climate variability has already had devastating effects in this region, which experienced **repeated droughts from the 1960s to the 1990s, leaving an estimated 500,000 people dead**. As many as one million people left Burkina Faso during the droughts, most of them settling in the urban areas of other West African countries. Farmers depending on rain-fed agriculture make up 50 to 80% of the total population, depending on the country, and cereal consumption meets 80 to 85% of the calorie requirements of the population.

The main challenge in this region is food security, while rural tension over land and water, rapid population growth, and unmanaged urbanisation also represent key (often inter-related) challenges. **Migration has consistently been used as an adaptation strategy**, in particular through temporary or seasonal movements that contribute to alleviating demographic pressures in sending areas but also allow for income diversification and skill transfer. This strategy has been one of the privileged forms of adaptation strategies for communities living in the Sahel regions, including pastoralists and herders but also fishermen and farmers. In the Inner Delta region of Mali, seasonal migration has been observed as early as the 1950s, with a third of the work force engaged in temporary movements. Although seasonal migration at the time was mainly to other rural areas, this trend slowly evolved in the 1970s and 1980s in favour of seasonal migration to urban areas where the need for labour to support urbanisation increased at the same time that rural demand for labour decreased due to mechanisation.

Environmental migration and displacement resulting from both sudden- and slow onset phenomena is primarily internal, with a small proportion of movement taking place between neighbouring countries and an even smaller proportion migrating long distances. In addition, movements are mainly temporary, with the exception of irreversible environmental degradation leading to permanent relocation as witnessed in fragile areas of the Sahel that have experienced severe droughts in the past two decades (e.g. the Lake Faguibine region in Mali). Although significant, this type of permanent movement presently represents a smaller proportion of the overall number of environmental migrants, although this is expected to change over the longer term.

Seasonal migratory movements of herders are already increasing pressure on farmers. As a result of lack of pasture and watering points in the north, herders return south sooner, encroaching on crops before they have even been harvested. As just one example, the Fula people and their herds have worked their way several hundred kilometres into the humid savannas. The traditional division between the herding north and agricultural south is becoming blurred. Transhumant spatial dynamics (transhumance corridors) have changed. Thus, in Niger, many Fula breeders from the Dallol Bosso area have taken refuge in Benin and Nigeria.²⁴ These dynamics are weakening the traditional division of labour and patterns of exchange between herders and farmers, which can undermine traditional conflict mediation mechanisms at the local level.²⁵

Eastern Africa:

Eastern Africa has numerous pastoral groups in a broad geographical band that stretches from the Kenya-Somalia border northward into Ethiopia; and northwest to encompass regions of Uganda, Sudan, the Democratic Republic of the Congo and the Central African Republic (CAR). The human security of pastoralist communities living along the borders is under threat due to increased cross-border armed conflict over resources. These regions have suffered large-scale intra-state wars that have supplied pastoralist groups with modern weaponry, resulting in protracted conflicts with numerous neighbours. Along with the availability of small arms, depleted livestock, limited pasture

and water—the cumulative effect of three years of drought—are **driving aggressive pastoralist cross-border movement in search of pasture and water in ways that are triggering violent cross-border conflict**. Cattle-rustling incidents have increased in the region in recent months, as owners seek to restock herds badly affected by the searing drought across local communities in Eastern Africa. While drought is not uncommon to this region, a steady decline in rainfall has become the norm over the past two decades, a phenomenon that is likely related to the effects of climate change.

The issue of cross-border conflict and pastoralists' access to key resources such as water and pasture in the region is a major security challenge in East Africa. The region has the largest grouping of pastoralists in the world, with Sudan having the highest percentage. In Kenya, semi-arid and arid land constitutes 80% of the country's total land area, supporting 25% of the Kenyan population and half of its livestock. At the core of these cross-border conflicts are pastoralists' desperate need to sustain their livelihood in the face of recurring droughts that are eroding their traditional coping capacities.²⁶

Southern Africa:

Countries in southern Africa are particularly vulnerable to seasonal heavy rainfalls, which usually result in flood, affecting and displacing thousands of people. The region is vulnerable to early and unusually heavy rains due to the meteorological phenomenon called "La Niña." **In 2008, approximately 450,000 people were affected and more than 111,000 hectares of farmland destroyed**. About 60% of the affected populations were in Mozambique, the country most vulnerable to flooding and storms in the region.

The Zambezi River basin has been hit in recent years by massive flooding aggravated by periods of prolonged drought. The increasing frequency of natural disasters, driven by climate change, has led to repeated destruction and disruption of families' livelihoods through crop loss and displacement. Families affected by recurrent flooding also face higher risk of food insecurity as a result of natural disasters, due to high levels of economic, social, and environmental vulnerability and weak capacity at the community and district level to respond to and recover from recurring disasters.

The majority of families settled in these areas are subsistence farmers living on less than one dollar a day and lacking opportunities for diversification of income and food sources. Climate extremes are causing prolonged periods of drought and delayed or erratic rains. This puts even more pressure on families to produce along river beds, further increasing their exposure to floods.

Although the displacement caused by flooding and storms is usually only temporary, the increasingly recurrent nature of such extreme events poses major challenges for the affected communities (including for the receiving communities) and countries in terms of coping capacity.²⁷

The Needs of these Areas

Concerted action is needed at all levels, on the one hand to prevent forced migration, and on the other hand to manage migration flows, including the facilitation of migration as an adaptation strategy. **Adaptation should systematically include disaster risk reduction and community stabilisation** (through support for sustainable livelihoods), two elements which can significantly reduce forced movements.

Action to address the expected increase of environmental migration must address all of the associated drivers: food, water and energy insecurity, population dynamics, weak governance (conflict prevention/mediation, natural resource management/land use policies, migration policies, urban planning, etc.).

It is a fact that the most cost-effective and humane policy options involve obviating the need for environmental forced migration by intervening at the earliest stage possible (national adaptation measures, implemented in **close co-ordination with vulnerable communities and integrated into national development/poverty plans**).

In relation to migration specifically, the first need is for better data on present and past migratory movements, including geo-spatial, time-series mapping which overlays geo-meteorological data with socioeconomic and demographic data in order to allow for effective policy planning. The development of nationally-owned and regularly updated 'migration profiles' represents one useful tool that analysts and policymakers can draw on in this regard.²⁸ **Better data will allow policymakers to identify existing migratory trends, determine the linkages with climate change-related events, and prioritise action in expected 'hotspot' areas (both rural and urban).**

Most of the countries identified above have already developed national adaptation documents²⁹ but very few adequately address the migration/displacement dimension.³⁰ When this aspect is mentioned, it is usually only as a negative expected consequence of climate change: new thinking needs to be brought in which allows for the potential for migration to constitute a positive element of the adaptation equation. Migration, when planned at an early stage of environmental degradation (and thus closer to the voluntary end of the migration decision spectrum) can contribute to building resilience of affected communities, for example, through the provision of alternative income via remittances, or skill transfer for adaptation projects. In addition, migration alleviates the demand for resources in the origin region, potentially facilitating the natural recovery of over-farmed, degraded land. Conflict prevention should be built into adaptation planning.

Given that the effects of climate change have scant regard for national borders, one key need is for bilateral, regional, and/or continental cooperation and policies that address the issue of environmental migration in an integrated way. This is particularly important for addressing the needs of cross-border pastoralism, and in relation to the management of large-scale cross-border displacement caused by natural disasters. However, within national borders, much needs to be done to accord climate change the prominence needed, and to improve coordination between the ministries, agencies and local government entities concerned.

Planning for the environmentally sustainable return of displaced populations is also a key aspect for those countries already grappling with the effects of population displacement linked to climate change (equally applicable to those displaced by non-climate factors). The mass population displacement in Sudan represents a key challenge, and ongoing efforts to address this dimension should prove instructive.³¹ It should be noted that a relevant framework already exists, as laid out in the UN's Guiding Principles on Internal Displacement. The framework for durable solutions contained therein outlines the different scenarios (return, relocation, or local integration in the receiving community) and provides norms and standards for each scenario.

References

1. Note on terminology: "migration" generally conveys a voluntary decision to leave, while "displacement" generally conveys a situation of forced and unplanned movement. The term "forced migration" is also commonly used to describe forced movement, including displacement, but also forced movements planned and carried out to protect the individuals or in the context of development-related programmes (relocation, resettlement).
2. To capture this complexity, the International Organization for Migration (IOM) proposes the following definition: "Environmental migrants are persons or groups of persons who, predominantly for reasons of sudden or progressive changes in the environment that adversely affect their lives or living conditions, are obliged to leave their homes or choose to do so, either temporarily or permanently, and who move either within their country or abroad."
3. Typology taken from "Compendium of IOM's Activities in Migration, Climate Change and the Environment" International Organization for Migration (IOM) 2009.
4. The longstanding tradition of temporary labour migration from countries in the western Sahel region to bordering countries and/or coastal areas internally where applicable (Ghana) during periods of drought provides an interesting illustration. Often only one family member is designated for migration in this scenario.
5. The new economics of labour migration (NELM) argues that migration may set in motion a development dynamic, lessening production and investment constraints faced by households in imperfect market environments and creating income growth linkages. There is empirical evidence that remittances may be a positive factor in economic development.
6. Warnecke, A., Tänzler, D., & Vollmer, R., "Climate Change, Migration and Conflict: Receiving Communities under Pressure?", June 2010, German Marshall Fund.
7. Salehyan, I., & Skrede Gleditsch, K., "Refugee flows and the spread of Civil War," International Organization, 60(2) (2006): 335-366, cited in Warnecke *et al*, *op cit ibid*.
8. Weidmann, N. B., Kuhn, P. & Nikolic, V., "Refugees as local catalysts of conflict? A statistical assessment," paper presented at the 48th ISA Convention, Chicago (2007). Cited in Warnecke *et al*, *op cit ibid*.
9. Report of UN Secretary General, "Climate change and its possible security implications", September 2009.
10. Martin, A., "Environmental conflict between refugee and host communities," *Journal of Peace Research*, 42(3) (2005): 329-346, cited in Warnecke *et al*, *op cit ibid*.
11. Gleditsch, N.P., Nordas, R. & Salehyan, I., *Climate Change and Conflict: The Migration Link, Coping with Crisis Working Paper Series*, International Peace Academy, (2007), cited in Warnecke *et al*, *op cit ibid*.
12. IOM Contribution to the UNSG Report « Possible security implications of climate change », 2009.
13. Brown, O., & Crawford, A., *Assessing the security implications of climate change for West Africa - Country case studies of Ghana and Burkina Faso*, International Institute for Sustainable Development, 2008.
14. Centre for Social and Economic Research on the Global Environment, "The Impacts of Climate Change on Africa", Working Paper GEC 95-12, University East Anglia and University College London, 1995.
15. UNEP. Climate Variability and Climate Change in the Sahel Region
16. UNPD, *World Population Prospects: The 2006 Revision Population Database*, (2006), cited in Warnecke *et al*, *op cit ibid*
17. Schachter, J.P., *Enhancing Data on Migration in West and Central Africa, The Utilization of Household Surveys for the Measurement of Migration in West and Central Africa: Past, Present, and Future*, (IOM, 2008).
18. High birth rate accounts for 70 to 80 per cent of urban population growth in the Sahel for example (CILSS).
19. Nonetheless, provision of services such as drinking water is generally better in urban as opposed to rural areas.
20. Forthcoming inter-agency UNEP-led report on climate change, conflict and migration in the Sahel.
21. OECD/SWAC, *Climate, Climate Change and Agro-pastoral Practices in the Sahel Region*, Regional brief, May 2008.
22. It is worth noting that there is a distinction to be made between nomadic pastoralist groups on the one hand, and transhumance pastoralist groups on the other, in which certain members of the group move the herd seasonally from one area to another, while the rest of the group is able to stay in a base location.

23. For an example in the Horn and East Africa, see the Inter-agency Security in Mobility initiative (OCHA, IOM, ISS, UNEP), “Advocating for Safe Movement as a Climate Change Adaptation Strategy for Pastoralists in the Horn and East Africa” (Project Report), June 2010.
24. The Sahel is the transitional zone south of the Sahara, stretching from Senegal in the west to Somalia in the east. It is characterised by extreme aridity in the north, progressively becoming greener and more fertile further south. This section will focus on the western Sahel, (Senegal, Mauritania, The Gambia, Guinea Bissau, Cape Verde, Mali, Niger, and Burkina Faso) although much of the analysis is equally applicable to the eastern Sahel countries, which are facing similar challenges linked to climate change.
25. Internal IOM paper *Climate change, migration and agriculture in the Sahel*, June 2010.
26. This paragraph draws on IOM’s contribution to the forthcoming inter-agency UNEP-led report on climate change, conflict and migration in the Sahel.
27. This paragraph draws extensively on the “Compendium of IOM’s Activities in Migration, Climate Change and the Environment” International Organization for Migration (IOM) 2009.
28. This paragraph draws extensively on the “Compendium of IOM’s Activities in Migration, Climate Change and the Environment” International Organization for Migration (IOM) 2009.
29. IOM, with EC funding, has already worked with a number of governments in West African countries to produce national migration profiles and build capacity for data collection.
30. National Adaptation Programmes of Action (NAPAs) are available on the UNFCCC online database: http://unfccc.int/national_reports/napa/items/2719.php.
31. Martin, S., ‘Climate change, migration and adaptation’, June 2010, German Marshall Fund.

Natural Disasters

Natural Disasters and Human Security

Africa, the world's second-largest and second most-populous continent is home to 900 million people, accounting for approximately 14 per cent of the world's population. Climate change poses a massive challenge to Africa's future growth and development. **Not only is Africa the most vulnerable continent to climate change and climate variability, this is aggravated by the interaction of multiple stresses occurring at various levels, and is further compounded by low adaptive capacity.** There are three factors that make Africa one of the continents the most vulnerable to climate change. Because of its position on the globe, Africa already has a warm climate and is exposed to inconsistency in rainfall, prevalence of poor soils, and flood plains. Second, most economies are dependent on sectors¹ that are susceptible to climate variations; and third the lack of good governance, widespread poverty, poor economic and social infrastructure, conflicts, and limited human, institutional and financial capacities mean that as a continent, it is least able to cope with the effects of climate change.

Climate change is expected to intensify existing problems and create new combinations of risks, given the existing widespread poverty and dependence on the natural environment. So far, African governments' poverty reduction strategies have paid little attention to environmental issues in general or to climate change in particular, but the situation is slowly improving as concern about climate change grows.

The potential for livelihood security and other aspects of human security to interact with geo-strategic security issues is high when there are national and regional upheavals that climate stress may put on livelihood systems already vulnerable and incapable of adapting. Over the past decade, **the concept of linkages among conflict, poverty, climate change, security and development has become more widely accepted** – and that responding to these challenges must be rooted in the ethos of collective security and development.

Natural disasters² and Africa: Continental Dynamics

While the number of major natural disasters in the world increased from 100 to more than 400 per year, from 1975 to 2005, it is **Africa that has experienced the fastest rate of increase in the incidence of natural disasters** over the last three decades, and a threefold increase in such disasters has been experienced in the last decade alone.³ Whereas people in developed countries suffer mostly economic damages that are often insured, those in developing countries do suffer proportionally greater losses when measured as a percentage of GDP.⁴ Economic loss to disasters in Africa, estimated at US\$ 10 billion, is low compared to other world regions, but is high as a proportion of Africa's GDP.

The main hazards that affect the region are climatological and hydrological in nature. On average, these **hazards affect 12.5 million people each year with drought causing the highest human and socioeconomic effects.** In sub-Saharan Africa, drought and floods account for 80% of loss of life and 70% of economic losses linked to natural hazards; other hazards include tropical cyclones and strong winds, storm surges, extreme temperatures, forest fires, sand or dust storms, and landslides. In 2008

there were 96 disasters recorded and they included 44 floods and 9 droughts that affected 16.3 million people and incurred economic losses estimated at some 1 billion dollars.

More people were also killed or affected by volcanic eruptions in Africa than in any other region between 1996 and 2005, despite there only being five eruptions. The continent's low resilience was demonstrated in the 2002 volcanic eruption of Mount Nyiragongo, which destroyed 40% of buildings and displaced 250,000 persons in Goma (Democratic Republic of Congo).⁵

Three of the five regions across the globe that are at risk of flooding in coastal and deltaic areas of the world are those located in Africa: North Africa, West Africa, and southern Africa. Towards the end of the 21st century, projected sea level rise will affect low-lying coastal areas with large populations, with associated costs estimated at least 5–10% of gross domestic product (GDP). A high proportion of Africans live in coastal areas: one-quarter of the population resides within 100 km of a seacoast. Lagos in Nigeria, which has a population of over 10 million, is one of the most vulnerable cities in the world, lying only 2 metres above sea level. **Urban areas across the continent face threats that arise from unpredictable rapid-onset disasters such as storm surges, flashfloods, and tropical cyclones.** Climate-related disasters, in particular, are threatening development gains in many African countries.

Climate Change Assessments

Africa is a very diverse continent, so any statement on the impact of climate change cannot be assumed to be applicable to the entire continent. IPCC assessments are based on global models, and have not yet been scaled down to the sub-regional or national levels. Nevertheless, for the continent of Africa, available science does indicate, with some confidence, that across most of the region, annual rainfall is likely to decrease, though eastern Africa is likely to see an increase in rainfall. North Africa will experience both a temperature rise, anticipated to be greater than the global mean annual warming, and reduced average annual rainfall and increased aridity and droughts. Southern Africa will experience a drying, especially in the south. West Africa in general and the Sahelian region in particular are characterized by some of the most variable climates on the planet. The long-term decline in annual rainfall since the 1970s in these regions is expected to continue.

- Projected rainfall increases in some parts of East Africa (Kenya and with smaller increases over most Tanzania, Uganda, and north-eastern Zambia), may result in various hydrological outcomes. Previously, malaria-free highland areas in Ethiopia, Kenya, Rwanda, and Burundi could experience modest changes to stable malaria by the 2050s, with conditions for transmission becoming highly suitable by the 2080s;
- While rainfall may decrease, it may also come with increasing intensity bringing recurrent floods, in some cases linked to ENSO events, and resulting in important economic and human losses. Such has been the case in Mozambique; even countries located in dry areas (Algeria, Tunisia, Egypt, Somalia) have not been flood-free. **Large numbers of people are currently at risk of floods particularly in coastal areas, where coastal erosion is already destroying infrastructure, housing, and tourism facilities;**
- Droughts have mainly affected the Sahel, the Horn of Africa and southern Africa, particularly since the end of the 1960s. Drought-period models indicate increasing probabilities of dry spells or dry years in the tropics, to the south-west of the subcontinent and especially over western South Africa and over eastern Southern Africa, including Mozambique. In southern Africa, droughts have been linked to ENSO in recent decades. The Horn of Africa (HOA), composed of Djibouti, Eritrea, Ethiopia, Kenya, and Somalia, suffers frequent natural disasters that commonly result in losses of life, destruction of infrastructure, and reduction of agricultural production;

- The projected rise in sea level will have significant impacts on the coastal megacities of West Africa, **where 40% of the population live, because of the concentration of poor populations in potentially hazardous areas** that may be especially vulnerable to such changes. Other coastal and deltaic areas at risk are those located in North Africa and southern Africa;
- About 25% of Africa’s population (about 200 million people) currently experience high water stress. Northern African countries in particular will exceed the limits of their economically usable land-based water resources before 2025. Parts of southern Africa that are highly vulnerable to climate variability and change are predicted to face heightened water stress in some river basins. Areas at risk from climate change and water towers requiring protection: i) coastal areas—West Africa, Eastern and southern Africa, the Nile Delta; ii) Great Lakes; iii) Semi-arid regions—Sahel, central and eastern Southern Africa, and the Horn of Africa.

Hot Spot Countries and Sub-Regions

Identifying which areas are the most vulnerable is determined to a large extent by the methodology used. The continent’s vulnerability is driven partly by geography, but also by low adaptive capacity. This is because countries that face similar patterns of natural hazards often experience widely differing impacts when disasters occur, depending in large part on the kind of development choices they have made. The origin of natural hazards can be hydrometeorological (floods, cyclones, etc.); geological (earthquakes, landslides); or biological (epidemic diseases).

There are many different methodologies for identifying, at the most detailed scale possible, which areas are most vulnerable. Busby *et al.*⁶, in their working paper on “Locating Climate Insecurity”, identify four main processes:

- Physical exposure to climatological disasters;
- Household and community vulnerability;
- Governance vulnerability and political violence; and
- Population density.

The Natural Disaster Risk Index (NDRI) developed by Maplecroft (the global risks intelligence company) takes a narrower perspective. The Index evaluates the global economic impact of earthquakes, volcanic eruptions, tsunamis, storms, flooding, drought, landslides, extreme temperatures and epidemics between 1980 and 2010. It measures the risk to property and infrastructure, and the indirect economic impact on populations. In its May 2010, the Maplecroft reports that the African countries at extreme risk are Mozambique, Ethiopia and Sudan, with 95 percent of casualties due to drought. Since 1980 drought has caused 9,800 deaths in Ethiopia, 5,300 in Sudan (ranked fifth) and over 3,400 in Mozambique (ninth). Drought damage is more difficult to detect, both in terms of human lives and economic loss because it is a slow onset disaster.

Mozambique

Maplecroft places Mozambique as the world's second most likely country to suffer economic hardship due to natural disasters^{7,8}. **“Mozambique ranks third amongst the African countries most exposed to risks from multiple weather-related hazards....** As much as 25 percent of the population is at risk from natural hazards”.⁹ Seasonal floods, epidemics, cyclones and prolonged are the most frequent disasters disrupting livelihoods and services, and exhausting limited coping mechanisms and exacerbating population vulnerabilities. Droughts, which affect by far the largest number of people, occur primarily in the Southern and Central regions, with a frequency of 7 in 10 and 4 in 10 years, respectively. Floods occur every 2-3 years along major river basins, low coastal plains, and areas with

drainage problems. In 2000, Mozambique was hit by the worst floods in 50 years, which killed 800 and caused economic losses estimated at US\$419m. The World Bank also reported that Mozambique is at increasing risk from storm surges (flood of water caused by wind and low pressure) due to climate change and estimates that 41% of the country's coastal area and 52% of coastal GDP is vulnerable.¹⁰

Mozambique - Natural Disasters from 1980 - 2008¹¹ Overview		Mozambique - Top 10 Natural Disasters Reported¹² Affected People		
No of events:	65	Disaster	Date	Affected
No of people killed:	104,335	Drought	1981	4,750,000
Average killed per year:	3,598	Flood	2000	4,500,000
No of people affected:	22,202,592	Drought	1991	3,300,000
Average affected per year:	765,607	Storm	1994	2,502,000
Economic Damage (US\$ X 1,000):	779,650	Drought	2005	1,400,000
Economic Damage per year (US\$ X 1,000):	26,884	Drought	2002	600,000
		Flood	2001	549,326
		Drought	2007	520,000
		Flood	1981	500,000
		Flood	1985	500,000

More than 60 percent of Mozambique's population of 21 million lives in coastal areas, and is therefore highly vulnerable to cyclones and storms along its 2,700 km coastline.

Ethiopia

Ethiopia, **home to over 80 million, has experienced at least five major national droughts since 1980**, along with numerous local droughts. Between 1999 and 2004 more than half of all households in the country experienced at least one major drought shock.¹³

Ethiopia is regularly hit by floods. In 2006, more than 600 people were killed and a further 300 000 affected by unusually heavy floods that ravaged several regions in the Horn of Africa country. An epidemic of cholera following the extreme floods in 2006 led to widespread loss of life and illness. More than 183 000 people were affected in 2007. A contributing factor is that Ethiopia's watersheds are heavily degraded and the water runs off hillsides because the soil cannot absorb heavy rains. The heavy rains of 2006 caused more damaging flash flooding than was experienced in years past with heavier rains. This year flash floods sparked by heavy rainfall in August displaced more than 11 000 people in the central Amhara region and resulting mudslides killed 19, and in September 2010 floodwaters displaced nearly 16 000 people in north-eastern Ethiopia. The subsequent outbreak of water-borne diseases led to widespread loss of life and illness.

Ethiopia - Natural Disasters from 1980 - 2008¹⁴ Overview		Ethiopia - Top 10 Natural Disasters Reported¹⁵ Affected People		
No of events:	78	Disaster	Date	Affected
No of people killed:	313,285	Drought	2003	12,600,000
Average killed per year:	10,803	Drought	1983	7,750,000
No of people affected:	46,160,070	Drought	1987	7,000,000
Average affected per year:	1,591,727	Drought	1989	6,500,000
Economic Damage (US\$ X 1,000):	31,700	Drought	2008	6,400,000
Economic Damage per year (US\$ X 1,000):	1,093	Drought	1999	4,900,000
		Drought	2005	2,600,000
		Drought	1997	986,200
		Flood	2006	361,600
		Flood	1990	350,000

Run-off to Nile tributaries is projected to be reduced by up to one third due to climate change (World Bank). Ethiopia has twelve major river basins, including the Blue Nile. Its riparian systems, combined with its eleven major lakes, make Ethiopia the “water tower” of Northeast Africa. Climate change is projected to cause a drying of wetlands (affecting threatened bird species breeding sites). **Although, Ethiopia has relatively abundant water, it has one of the lowest reservoir storage capacities in the world** (World Bank).

Sudan

Inadequate supplies of potable water, soil erosion, desertification, and periodic drought all plague Africa’s largest country, and fifth largest population. **The population, which is overwhelmingly agrarian, remains largely dependent on rain-fed farms.** Sudan suffers from a chronic shortage of freshwater overall - insufficient and highly variable annual precipitation is a defining feature of the climate of most of Sudan. In addition, water distribution is extremely unequal, with major regional, seasonal and annual variations. Underlying this variability is a creeping trend towards generally drier conditions.

In addition to and separately from the variation in precipitation, there is mounting evidence of long-term regional climate change in several parts of the country¹⁶. Sudan has suffered a number of long and devastating droughts in the past decades. All regions have been affected, but the worst impacts have been felt in the central and northern states. Darfur has experienced below-normal annual rainfall for several years increasing tensions over scarce water resources and pasture as desertification has added significantly to the stress on the livelihoods of pastoralist societies, forcing them to move south to find pasture.

<i>Sudan - Natural Disasters from 1980 – 2007¹⁸ Overview</i>		<i>Sudan - Top 10 Natural Disasters Reported¹⁹ Affected People</i>		
No of events:	68	Disaster	Date	Affected people
No of people killed:	160,468	Drought	1991	8,600,000
Average killed per year:	5,731	Drought	1983	8,400,000
No of people affected:	28,897,157	Drought	1987	3,450,000
Average affected per year:	1,032,041	Flood	1988	2,500,000
Economic Damage (US\$ X 1,000):	526,200	Drought	2000	2,000,000
Economic Damage per year (US\$ X 1,000):	18,793	Flood	1998	1,000,000
		Drought	1990	600,000
		Flood	2007	565,335
		Flood	2003	325,056
		Drought	1996	160,000

Heavy rains provoke flooding along the Nile and its tributaries, causing large-scale displacement of communities, loss of crops, and damage to infrastructure. Outbreaks of disease often accompany flooding.

Over the last 180 years some areas in Sudan have experienced severe earthquakes that resulted in damages of various degrees, although most of the severe earthquakes occurred in remote areas that are lightly populated. The recent increase in magnitude and frequency of seismic activities in the Nile Basin along the Great African Rift warrant attention¹⁷ given the risk to infrastructure in Khartoum, and also to dams, roads and bridges.

Zimbabwe

On The Natural Disasters Economic Loss Index (NDELI) published by Maplecroft,²⁰ of the seven countries rated at "extreme risk" in the high frequency index, are two African countries Mozambique second after Haiti, and Zimbabwe fifth. Although Zimbabwe is less prone to serious natural disasters like earthquakes and flooding, **it is the country's precarious economic climate that makes it particularly vulnerable to loss in the event of such emergencies occurring.**

Climate change impacts in Zimbabwe are related to water supply and food security. The country is already prone to droughts, which have become more recurrent over the last two decades. The geographical location of Zimbabwe in the tropics makes it vulnerable to shifting rainfall patterns, and water resources availability²¹ Zimbabwe is also vulnerable to climate driven health impacts from vector borne diseases such as malaria worsened by the HIV/AIDS pandemic. Given the heavy dependence of the country on rain-fed agriculture, absence of natural lakes, frequent occurrence of droughts in the region and a growing population, **the potential social and economic impacts from climate change could be devastating.**

Zimbabwe - Natural Disasters from 1982 - 2008²²		Zimbabwe - Top 10 Natural Disasters Reported²³ Affected People		
Overview		Disaster	Date	Affected
No of events:	29	Drought	2001	6,000,000
No of people killed:	2,122	Drought	1991	5,000,000
Average killed per year:	79	Drought	2007	2,100,000
No of people affected:	14,707,809	Drought	1982	700,000
Average affected per year:	544,734	Epidemic	1996	500,000
Economic Damage (US\$ X 1,000):	2,827,700	Flood	2000	266,000
Economic Damage per year (US\$ X 1,000):	104,730	Drought	1998	55,000
		Flood	2001	30,000
		Epidemic	2008	29,522
		Flood	2003	18,000

The Sahel

The Sahel is the region lying between 12°N and 20°N longitude, covering the semi-arid and arid climate zones. It covers all or parts of 12 countries from the Atlantic Ocean to the Red Sea: Senegal, the Gambia, Mauritania, Mali, Burkina Faso, Niger, Nigeria, Chad, Sudan, Ethiopia, Eritrea, and Djibouti. While Sahelians may have adapted, in varying degrees of success, to **an unpredictable climate in which the availability of and access to food, water, and energy resources vary dramatically, climate change threatens to overwhelm the coping mechanisms of the region:** in the past 25 years, the Sahel has experienced the most substantial and sustained decline in rainfall recorded anywhere in the world. The Sahelian countries, which are some of the poorest in the world with the most degraded environments, are among those that are the most vulnerable to the estimated effects of climate change.

When discussing climate change and its estimated effects on the Sahel, the area cannot be viewed as one environmental or geographical entity, but rather as several areas with diverse climates and climate-change-related stressors. Empirical evidence does not support the claim that climate change would automatically lead to mass migration or spur conflict. **The reality, rather, is more complex than that, and the possible implications of climate change in respect to conflict and/or migration need to be examined in the context of pre-existing vulnerabilities** (social, economic, and environmental threats or stresses), which are key factors to the security of individuals, communities, and States. These include, among others, the persistence of poverty, hunger and disease,

demographic pressure, inappropriate urban/rural planning, weak national/local governance, declining ecosystems, and unsustainable coping strategies in connection to growing scarcity of land, water, and other resources. Under these circumstances, climate change is best viewed as a threat multiplier, which exacerbates existing tensions, trends, and vulnerabilities in the region. A key challenge is that these changes threaten to overburden the already fragile, poor, and vulnerable states that, in addition, have limited state capacities to respond to these challenges.

More details on the Sahel Case Study can be found at Annex II

Africa's Response to Hazards

Not only is Africa the most vulnerable continent to climate change and climate variability, but this is aggravated by the interaction of multiple stresses occurring at various levels—political, social, economic, and environmental—and is further compounded by low adaptive capacity. The interaction of these multiple stressors affects vulnerability and adaptive capacity in Africa.

Disasters are exacerbated by unplanned and unregulated land use, weak environmental controls, poor enforcement of building standards, urbanization, and other development-linked factors that increase the vulnerability of people, property, and infrastructure. Lack of good governance, widespread poverty, poor economic and social infrastructure, conflicts, and limited human, institutional and financial capacities mean that as a continent, it is least able to cope with the effects of climate change.

A list of early-warning systems in Africa to predict climate change and disasters can be found at Annex III

Areas for support

- Policy advocacy and field-based interventions aimed at raising awareness and enhancing knowledge management of national and local capacities for ecosystems-based approaches to risk reduction (including climate change-related risks);
- Improving forecasting, early-warning systems, identification and assessment of natural hazard risks. Early-warning systems to predict climate change/disasters have a number of elements: vulnerability assessment and monitoring; seasonal climate forecasting; environmental monitoring; sentinel case surveillance; and planning, preparedness, and response. It is imperative that the reduction of risks is viewed as a continuous set of activities across social, economic, governmental, and professional sectors. Policy should include a system of prioritization of individual development projects and programs. Activities within these sectors need to be integrated into planning, recovery plans, and development strategies that enables and encourages widespread exchange of information;
- Identify the sub-regions and countries particularly at risk—the “hot spots”; prepare processes for supporting countries that will be (or are) particularly badly impacted by climate change;
- Sectoral analysis: assessing the need for climate change considerations in the context of SEAs (especially agriculture, water, energy) across the region (link to trade, etc). There is a lack of evidence regarding both the impact of climate variability on climate-sensitive development outcomes and the benefits of climate information to improve these outcomes;
- The need for monitoring, mapping, and analysis of disaster incidents, linked to risk factors and vulnerability profiles;

- The linkages between adaptation and mitigation are weak—most decisions are oriented to one or the other, not both. Analytical frameworks for evaluating the links between adaptation and mitigation are inadequate.
- Assessments of the impacts on specific sectors that are important for livelihood security, e.g., agriculture and rural livelihoods;
- The effects on specific social and economic groups needs to be documented (place-based studies);
- Traditional adaptation strategies for coping with climate variability and extreme events are not well documented, neither is there an adequate sharing experience of which techniques work and which need to be adjusted for facing additional risks;
- Strengthening collaboration and co-ordination across regionally based structures that include government, UN, donors, and civil society. The conflict-disaster interface, which is strongly linked in many countries, will also be better understood and responses better co-ordinated through inter-agency structures;
- Advocating DRR in the high-level environment-related conferences including African Ministerial Conference on the Environment (AMCEN) and African Council of Water Ministers (AMCOW) meetings;
- Establishment of partnerships with national and local stakeholders and the private sector, building on the network of partners and their capacity to engage in project activities such as awareness-raising workshops and training events in project pilot demonstration sites;
- Establish network of climate and development Innovation Centres in association with the RECS and Regional Development Bodies. They should provide mechanisms through which information and experience can be shared;
- Strengthening regional and trans-regional networks in mitigating and responding to climate change related security risks (migration);
- Policy advocacy aimed at raising awareness and enhancing knowledge management; sharing knowledge;
- Capacity-building programmes for strengthening Peace and Security within the AU PSC to increase understanding of climate change and security links—mitigating/preparing for migration, raise awareness of associated risk; integrating disasters risk reduction; mitigating and managing scarcity and resource-related conflicts. Include the various regional trans-boundary water commissions;
- Capacity should be strengthened at national and sub-regional organisations to improve their understanding of the environmental dimension of disaster management and sustainable development;
- Integrating CC adaptation into National Policy/Sectoral development (Partners: National + UNDG, UNEP, UNISDR, UNESCO; role of UNDAF; working with donors and civil society);
- Tool kits for policy development, strategies for integrating into national action plans;
- Mass media face challenge of ensuring that messages are relevant, accurate and timely, and are received and understood;
- National hydro-meteorological services should be upgraded to work effectively, in cooperation with a regional and sub-regional clientele, in monitoring and forecasting;

- National level issues as identified by the International Research Institute for Climate and Society of Columbia University, IRI:

“Climate data from developing countries are often limited, in terms of both quantity and quality. The number of stations collecting climate data is generally inadequate in African countries, and stations are often unevenly distributed. The data therefore cannot fully reflect the range of climates across the country, and averages, in particular, will not have much meaning. A further complication is that national meteorological services are often reluctant to ‘give away’, their data. They may only release data from a small number of stations, which limits their usefulness for national, regional, and global applications. New techniques are available that can help overcome these limitations. And concerted local and international efforts are under way to make climate data more available and more useful.”

- National governments and sub-regional organisations should strengthen applied research services;
- Rescuing data: “Many African countries hold historical data in diverse locations and in a variety of formats that, if “rescued” (i.e. collected and archived electronically in a uniform format), could be very useful. For example, analysis of rescued historical data can provide evidence of trends in climate to support today’s forecasting needs. It could also allow assessment of the relationships between climate and different social or environmental outcomes, and could also help to validate theoretical links hypothesized from climate modeling experiments.”

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Dialogue Questions

Water Security

- Are there adaptation measures to climate change imbedded in a given national or global planning to support local community in strengthening economic growth-based for the purpose of improving population's climate resilience using water-related programmes?
- Which measures are reliable, have demonstrated net economic benefits and could attract global investments and prompt local innovations and regional partnerships, especially in vulnerable countries?
- In countries seriously affected by either frequent floods or droughts, what can the international community do to help local governments reduce delays in the implementation of water-related programmes?
- Are decision makers in vulnerable countries willing to make the trade-off between water objectives and other competing national priorities? If not, what should be done to change their mind?

Food Security

- What can be done to reduce the risks of climate change impacts on food security in areas of protracted crises affected by conflict and lack of functioning institutions?
- What are key steps required to link climate finance (both adaptation and mitigation) to actions that reduce the vulnerability of the food insecurity to climate change?
- How should external assistance be reformed to match the particular needs and institutional constraints on the ground?
- How can governments, communities, and households plan adaptation and mitigation strategies in the absence of concrete forecasts of climate change and its impact on food production?

Energy Security

- What can be done at a governmental level to achieve diversification of energy supplies as a method of decreasing dependence on single sources of energy and promoting usage of renewable energy stocks?
- What can be achieved at a regional level to coordinate energy supplies between countries in order to cushion supply disruption and improve energy infrastructure?
- Are there any initiatives that could be undertaken in order increase the efficiency and sustainability of production and usage of energy supplies?
- What can be done at an international level to lessen the frequency and impact of supply shocks felt on the African continent?

Migration

- Migration as a response to environmental changes can take different forms (from the 'survival response' to a more planned adaptation response). The type of movement will depend in large part on the nature of the phenomenon, ranging from sudden onset events such as floods to slow processes of environmental degradation such as desertification. In this light, how can we ensure that environmental migration is properly taken into account in policy development?
- The human security approach seems to provide the most adequate lens to assess and respond to the security implications of climate change for individuals, but how can we further develop our understanding of the implications for communities or at the national level?
- In the area of origin, out-migration is often an indicator that the conditions are changing. At the same time, migration can have an impact in the area of destination. As such, how should population movements be integrated into Early Warning Early Action systems?
- Even through a security lens, migration can have a positive impact on the *area of origin* by alleviating pressure on the environment and allowing for income diversification. How can the potential of migration as an adaptation strategy be better harnessed to alleviate potential tensions in the area of origin?
- In the *area of destination*, unmanaged migration at a sustained rate can have destabilizing effects. How can migration management tools contribute to peaceful co-habitation and integration? And how can these tools be integrated into conflict prevention systems?

Natural Disasters

- How can we raise awareness and enhance knowledge management of national and local capacities for relating climate change adaptation and disaster risk reduction?
- What are the tools and knowledge required for developing an effective methodology for identifying which areas in Africa are most vulnerable to the different types of hazard and at the most detailed scale possible?
- What practical actions are necessary for improving forecasting, early-warning systems, identification and assessment of natural hazard risks?
- What are the elements of useful toolkits for policy development and integrating Climate Change adaptation and DRR strategies into national policy and sectoral action plans?

Initiatives and Partners

Water Security

ACP-EU Water Facility

This water-dedicated strategy works directly with those most affected by water shortages and sanitation problems in the African, Caribbean, and Pacific Countries. The facility provides funds for technical assistance, acts as a catalyst for additional funding, and enables more effective co-financing between EU grant aid and EIB financing instruments. The Water Facility will mainly fund two types of activities: improving water management and governance, as well as co-financing drinking water and sanitation infrastructure. The activities relating to improved water management and governance are institution building and support for reforming the sector and integrated management of water resources at national level and of ACP river basins. For the second category of activities, the Water Facility uses flexible and innovative methods to finance water and sanitation projects and programmes for low-income users and socially disadvantaged areas.

EU Water Initiative Africa

The Africa Working Group (AWG) is one of the “regional components” of the EU Water Initiative (EUWI) and is responsible for its activities in Africa. The purpose of this partnership is to make an effective joint contribution to the achievement of water and sanitation related MDGs in sub-Saharan Africa. The AWG can support African partners (like AMCOW and AfDB) on request in enabling partner countries to develop and implement policies, strategies, and priorities.

EU-Africa Strategic Partnership on Water Affairs and Sanitation

The objectives of this partnership are to contribute to the MDGs on water and sanitation, to develop integrated water resources management and water efficiency plans, including, where applicable, co-ordination of trans-boundary water resources, and to ensure that the action programmes to achieve these targets balance human water needs with those of the environment. This is being done by developing joint-action programmes to improve water governance, supporting the establishment and strengthening of river and lake basin organisations and appropriate legal framework, capacity-building in the water sector, encouraging the development of innovative financing mechanisms, and developing financially sustainable strategies.

UNEP Regional Office for Africa:

The Nairobi River Basin Programme

This programme aims to demonstrate how environmental, industrial, and socioeconomic factors contribute to the pollution of the Nairobi rivers by increasing access to information and methodologies in order to address the above mentioned factors, strengthening capacity building amongst stakeholders to manage those factors, and improve water and environmental quality of the river basin.

Support to the African Ministers Council on Water

As part of the implementation of the UNEP’s Water Policy and Strategy, the Regional Office for Africa (ROA) is providing technical support and guidance for the mainstreaming of the Rivers and Lakes Basin Organisations and development of a collaborative framework into the AMCOW process,

participating in the UN inter-agency collaboration in the water sector (UN-Water/Africa) in the context of the implementation of the AMCOW Work Programme, and overseeing , the implementation and monitoring of the AMCOW Work Programme under the overall supervision of AMCOW President Office.

UNDP Programme of Drinking Water and Sanitation for the Millennium

Launched in 2003, the Programme of Drinking Water and Sanitation for the Millennium is designed to ensure the sustainable supply of drinking water for 2.3 million people in Senegal's rural areas. It aims to raise the rate of access to clean drinking water of households to 82% by 2015 from 64% in 2004.

African Development Bank

The African Development Bank is currently partially financing a number of water projects, in the water and sanitation sector. These mainly include provision of new water supply facilities in rural areas and cities, rehabilitation of existing water facilities, waste-water management in cities, and institutional support and capacity building for local and basin authorities.

The following are other relevant water initiatives covering hot spot regions and countries that have identified in this paper:

- World Bank's Water and Sanitation Programme (WSP);
- UN HABITAT: Water for African Cities Programme;
- International Union for Conservation of Nature;
- The Water and Nature Initiative;
- Economic Community of the West African States (ECOWAS), Water Resources Co-ordination Unit (WRCU);
- African Development Bank;
- East African Community, Lake Victoria Basin Commission;
- Nile Basin Initiative;
- Southern African Development Community (SADC) Water Sector;
- African Centre for Technical Studies (ACTS);

Practical Action

The above mentioned programmes have significantly achieved quality results in terms of water programme implementation. Their best practices are accessible at their respective websites and are referenced herein under "References for best practices."

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World Bank's Water and Sanitation Programme. See: www.wsp.org/wsp/regions/africa. September 2010.

World Bank: Water in Africa. See: <http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTWAT/0,,contentMDK:21634926~menuPK:4708891~pagePK:210058~piPK:210062~theSitePK:4602123,00.html>. September 2010.

Food Security

Comprehensive Africa Agriculture Development Program (CAADP)

The CAADP of the African Union (AU) is intended to eliminate hunger and reduce poverty through increasing agricultural production. This is to be achieved through sustainable land and water management (Pillar 1), improved market access (Pillar 2), increased food supply and reduction of hunger (Pillar 3), and agricultural research (Pillar 4). Several initiatives have been launched under CAADP, including:

- The Pan-Africa Rice initiative, targeting the dissemination of NERICA varieties—under implementation in West Africa with a 33.5 million dollar investment;
- Pan African Cassava Initiative (PACI)—has the goal of disseminating new cassava processing technologies and developing regional markets for the crop (supported by IFAD and CGIARs);
- The TerrAfrica Initiative—has mobilised US\$1 billion for investment in country programmes for sustainable land and water management through the Global Environment Facility (GEF) Strategic Investment Programme;
- Making Markets Work for the Poor—enhancing Food Security and Productivity Growth in Eastern and Southern Africa (MMWP), funded by World Bank/DFID-UK (\$3.8 million);
- Improved Regional Trade in Food Staples (RTFS), total \$5 million, with start-up funding by the World Bank.

Other major initiatives of the AU to develop agriculture and improve food security include:

- Sirte Declaration on Agriculture and Water (2004);
- The Abuja Declaration on Fertilizer for an African Green Revolution (2006);
- The Abuja Food Security Summit (2006);
- The Sharm el Sheikh Declaration on the High Food Prices (2008) (UNECA, 2009).

Southern Africa Development Community (SADEC)

SADEC's initiatives include:

- Regional Early Warning System (REWS)—provides advance information on food crop yields and food supplies and requirements;
- Regional Vulnerability Assessment & Analysis Programme (RVAA);
- Proposal to establish Regional Food Reserve Facility, which includes physical reserve, financial facility, and a risk insurance instrument to support farmers in times of disasters.

Economic Community of West Africa (ECOWAS) Agricultural Policy (ECEWAP)

Among the major goals of the regional agricultural policy of ECOWAS (ECOWAP) are:

- Food security for people in the region;
- Reducing food dependence and achieving food sovereignty;
- Intensifying production systems in a sustainable manner.

Common Market for Eastern and Southern Africa (COMESA)

Some of COMESA Secretariat's on-going agricultural sector programs aimed at attaining sustainable food security are:

- Agricultural Market Promotion and Regional Integration Project (supported by the AfDB);
- Irrigation Development in the COMESA Region (with the assistance of the Indian Government);
- Regional Food Security/Food Reserve Initiative among member states;
- The Food Security Policy and Vulnerability Reduction Program (to be supported by the 9th EDF).

Regional economic communities are also mandated to:

- Assist the implementation of CAADP among member countries;
- Sign and launch a Regional CAADP Compact which is expected to outline key-interventions common to member States or with spillover positive impacts in the region. ECOWAS has signed a regional Compact.

The Permanent Inter-State Committee on Drought Control in the Sahel (CILSS)

CILSS —established in 1973— aims at achieving food security while combating drought and desertification for a new ecological balance of the Sahel region. Its membership today includes nine States: The Gambia, Guinea-Bissau, Mauritania, Senegal, Burkina Faso, Mali, Niger, Chad, and Cap Verde.

National Level (five hotspot countries)

Member countries are expected to implement the continental and regional food security initiatives, in addition to developing their own national responses. However, national level responses in the five countries differ markedly. Public investment in agriculture and the Maputo Declaration African leaders have agreed to allocate 10% or more of national budgets to agriculture/ rural development by 2008. Only Ethiopia has met the 10% target.

National CAADP Compact

Ethiopia and Cote d'Ivoire have signed CAADP Compact (22 countries have signed by early September 2010). Public investment and development assistance to agriculture in the two countries will be based on the four pillars of CAADP.

National Adaptation Program of Action (NAPA)

NAPA provides a process for Least Developed Countries to identify priority activities that respond to their immediate needs to adapt to climate change. Ethiopia, Chad, and DRC have developed NAPA. The Chadian NAPA has identified the following as the three most important priorities (out of 10):

- Control and management of water for adaptation to climate change activities of agro-pastoral communities;
- Development of intensive and diversified crops adapted to extreme climate risks, and
- Implementation of the development, dissemination and sustainability of crop calendars for small farmers vulnerable to climate change,

Chad has recently (2009) banned the use of charcoal as part of an effort to halt tree-cutting for fuel, which authorities believe is essential to fight desertification.

Ethiopian National Adaptation Program of Action (NAPA)

The Ethiopian NAPA has identified 11 priority projects and the three most important are:

- Promoting drought/crop insurance programme;
- Strengthening/enhancing drought and flood early warning systems, and
- Development of small scale irrigation and water harvesting schemes in arid, semi-arid, and dry sub-humid areas of Ethiopia.

DRC National Adaptation Program of Action (NAPA)

Top priorities for adaptation projects in DRC's NAPA include:

- Managing and rehabilitating water reservoirs;
- Carrying out rural and urban electrification projects;
- Increasing the capacity of agriculture and pastoral production.

National Early-Warning Units

National Early-Warning Units—established in Zimbabwe (as member of SADC), Ethiopia, Chad (as member of CILSS). The National Early-Warning System (EWS) has been in place in Ethiopia since 1976.

Social Protection Programmes

National Emergency Food Reserve—The Ethiopian National Emergency Food Reserve maintains up to 400,000 MT of food. Chad has recently established a National Reserve Fund for the Prevention and Mitigation of Disasters (*Comité d'Action pour la Sécurité Alimentaire et la Gestion des Crises* - CASAGC).

Safety Net Programmes

Safety net programs—Ethiopia has a safety net scheme (known as the Productive Safety Nets Program, PSNP) which reaches about 7.3 million rural dwellers with transfers of food or cash to help bridge food deficit periods while generating community asset.

Energy Security

The Africa–EU Energy Partnership (AEEP)

AEEP seeks to increase the access of an additional 100 million Africans to sustainable energy sources, doubling cross-border electrical interconnections, doubling the use of natural gas and renewable energies by 2020 (targets include building 10,000 MW hydropower, 5,000 MW wind power, and 500 MW solar power facilities by 2020⁷). The AEEP have drafted an “Action Plan and Road Map” for a Joint Renewable Energy Cooperation Programme.

⁷ Africa-EU Partnership, *The Energy Challenge: Access and Security for Africa and Europe*, pp. 9-10.

The EU Energy Initiative for Poverty Eradication and Sustainable Development

This initiative seeks to stimulate new resources such as capital, technology, and human resources from the private sector, financial institutions, civil society, and end-users to promote and raise awareness of the link between poverty and energy.

The EU's Thematic Programme for Environment and Natural Resources Management, including Energy (ENTRP)

ENTRP is a key instrument seeking to assist African countries with environmental sustainability and climate change. This instrument focuses on the pressures related to population and development goals and makes available financial assistance whilst also promoting EU environmental policies worldwide.

The International Renewable Energy Agency (IRENA)

IRENA seeks to promote the widespread sustainable use of all forms of renewable energy, enhance energy security, reduce greenhouse gas emissions, and mitigate climate change and alleviate energy poverty through improving renewable energy knowledge that facilitates technology transfer and promotes the development of local capacity and competence, plus also promoting capacity-building services such as training and education.

The joint International Energy Agency-World Energy Council "African Energy Information" initiative

The initiative was a questionnaire sent to over 30 countries with a view to charting the energy situation in these African countries and difficulties in meeting energy supply shocks.

UN-Energy

UN-Energy was established in 2004 to help ensure coherence in the United Nations system's multi-disciplinary response to the World Summit on Sustainable Development. It is the interagency mechanism aimed at co-ordinating actions and policies on energy within the United Nations system. UNIDO's Director-General Kandeh K. Yumkella has been chairman of UN-Energy since January 2008.

The Advisory Group on Energy and Climate Change (AGECC)

AGECC was established in 2009 with a mandate to provide the UN Secretary-General with timely and politically-relevant recommendations on energy issues in the context of climate change and sustainable development. The group comprises representatives from business and industry, the UN system, including the World Bank, and research institutions and is also chaired by UNIDO. The AGECC promotes two ambitious goals, which are to ensure universal access to modern energy services and reduce global energy intensity by 40% until 2030.

The World Bank's "Clean Energy and Development Investment Framework"

The framework covers the following three different areas: i) energy for development and access by the poor; ii) transition to low-carbon economy; and iii) adapting to climate change. Indeed, the World Bank, together with the African Development Bank, the Africa Infrastructure Consortium and the European Investment Bank are working with other partners to raise Africa's energy access from the current 25 to 35% by 2015 and to 47% by 2030⁸.

The "Energy Sector Management Assistance Programme" (ESMAP)

World Bank is leading ESMAP which is investing US\$ 55 million between 2008 and 2013 for energy boosting and poverty reduction. Under this Programme the World Bank provides financial assistance to the "Energy for Rural Transformation Projects I&II" in Uganda.

⁸ African Development Bank Group, 6th Infrastructure Consortium for Africa (ICA) Annual Meeting, See: www.afdb.org/en/news-events/article/6th-infrastructure-consortium-for-africa-ica-annual-meeting-agreement-for-closer-collaboration-on-regional-projects-among-stakeholders-6689/ (Accessed 8 August 2010)

“Reform Energy Planning Project”

UNDP have an ongoing project which has contributed to the creation of national and sectoral analysis of energy access and development in Kenya.

UN-HABITAT’s “Promoting Energy Efficiency in Buildings in East Africa”

This programme helps reduce electricity consumption in buildings through demand management and the implementation of energy efficiency measures. The project will run until 2014 with a budget of US\$ 9.25 million.

Forum for Energy Ministers in Africa (FEMA)

FEMA seeks to alleviate insufficient power generation capacity, extremely low levels of energy access from business sector to households, and reliance on low-quality energy resources. FEMA have an “air pollution, climate change and energy initiative” in which they process and prepare eligible energy projects for carbon finance, meeting the requirements of the Clean Development Mechanism—and work for a common African position on energy security.

The 10-year programme ‘Climate Development in Africa’ (ClimDev Africa)

The programme developed jointly by the African Union, the UN Economic Commission for Africa (UNECA) and Global Climate Observatory System (GCOS) seeks to mobilise efforts in developing Africa’s largely unexploited hydropower, solar, and wind power potential and increasing energy access while limiting Greenhouse Gas emissions.

Regional Power Pools

There is a number of regional energy cooperation mechanisms aimed at pooling energy supplies and infrastructures across Africa termed the East African Power Pool (EAPP), and Central African Power Pool (CAPP). Emphasis is also given to increased intra-country energy connectivity.

The Southern African Development Community (SADC)⁹

SADC runs a number of projects in addition to the Southern African Power Pool (SAPP); including, the Short-Term Energy Market (STEM), which facilitates short-term contracts for electricity supply; the Regional Energy Planning Network Project (REPN), which affords technical and human resources to signatories to conduct energy planning needs, promote institutional efficiency and energy supply forecasts; and, the Western Corridor Project (WESTCOR), which seeks to harness the large water resources of the Congo River at Inga to produce and supply electric power, including the construction of a hydroelectric dam.

ECOWAS Regional Centre Renewable Energy and Energy Efficiency (ECREEE)

The ECOWAS Commission in collaboration with UNIDO has successfully established the ECREEE at the end of 2009. The Centre will support the development of renewable energy markets in West Africa through policy interventions aimed at creating an enabling environment and favourable framework conditions for the establishment of renewable energy and energy efficiency markets, capacity building, and the development of new and innovative approaches to delivering and deploying clean energy technologies.

The Common Market for Eastern and Southern Africa (COMESA)

COMESA also invests in energy programmes; including, the East African Power Pool (EAPP) to facilitate regional integration on energy supplies and distribution; establishing “Regional Technical Secretariats”, one of which, the Electrical Energy Standards Secretariat, dedicated to electricity generation, transmission, and distribution, is located in Kenya; and has established a Regional Association of Energy

⁹ For all of SADC’s projects see: www.gfse.at/fileadmin/dam/gfse/gfse%206/pdf/SADC_GFSE-6_Briefing_Paper.PDF (Accessed 5 August 2010)

Regulators for Eastern and Southern Africa (RAERESA) in order to harmonise energy regulation between states.

The East African Community (EAC)

The EAC including membership by Kenya, Uganda, and Burundi—dedicates time and resources to the development of new and renewable energy sources in the region by promoting energy efficiency and conservation projects. Projects include the East African Power Master Plan (EAPMP) Study to facilitate optimal development of the region’s power sector and the “Cross-Border Electrification Programme” which promotes energy interdependence.

AfDB Power Transmission Project

The African Development Bank is part-financing energy projects; including, a “Power Transmission Project” in Zambia, which is constructing transmission lines, substations, distribution networks, and offering technical assistance; the “Projet Hydro-électrique de Rusumo Falls” for Burundi, Rwanda, Uganda, and Tanzania, which is building a hydro-electric plant and distribution lines; “Electricity Infrastructure Rehabilitation and Extension” project in Burundi; the “Grand Inga Hydropower” project in the DR Congo¹⁰; the “Bujugali Interconnection Project” in Uganda linking up electricity transmission lines and substations; and, the “Mombassa Nairobi Transmission Line Project” in Kenya.

The Congo Basin Forest Fund (CBFF)

The CBFF seeks to protect forests and reduce emissions from deforestation. It is a multi-donor fund inviting proposals for transformative and innovative initiatives to slow deforestation by building local capacities.

The Global Environmental Facility (GEF)

The GEF Strategic programme focuses on all West Africa countries including the ECOWAS region and additionally Burundi, Chad, and Mauritania. The GEF initiative aims at taking a programmatic approach to promoting renewable energy and energy efficiency projects at the national and regional level. UNIDO is the lead agency responsible for overall coordination of the GEF programme and implementing renewable energy based mini-grid projects in eight countries of the region.

UNIDO

UNIDO’s focus in all of Africa continues to be on renewable energy mini-grids for energy access and productive activities and increasingly on energy efficiency focusing its energy. For example, a project in Zambia aims at establishing three mini-grids in the country powered by renewable energy sources such as solar, biomass, and smaller hydro plants. As a pilot project, the initiative seeks to tie in local ownership by partnering with individual consumers, utility companies, and investors in Zambia.

Zambian Rural Electrification Programme

The Zambian Government, under its “Rural Electrification Programme”, has invested in a number of local energy projects including the electrification of Mkushi Farm Block, Kafue Gorge Lower and Itzhi-tezhi Hydro-electric Power Stations, and mini-hydro stations in North-Western Province.

Potential Partners in the Affected Communities and Africa

International Energy Agency	(IEA)
European Investment Bank	(EIB)
Africa-EU Energy Partnership	(AEEP)
EU Energy Initiative	(EUEI)
World Bank—Africa Energy Unit	(AFTEG)

¹⁰ African Development Bank Group, Project Portfolios, See: www.afdb.org/en/projects-operations/project-portfolio/energy-power/on-going/from/02-05-1991/to/05-08-2010/1/ (Accessed 4 August 2010)

World Energy Council	(WEC)
United Nations Department of Economic and Social Affairs	(UNDESA)
United Nations Industrial Development Organization	(UNIDO)
UN-Energy/Africa	(UNEA)
UN Environment Programme	(UNEP)
UN Development Programme	(UNDP)
International Renewable Energy Agency	(IRENA)
International Union for the Conservation of Nature	(IUCN)
Renewable Energy Policy Network for the 21 st Century	(REN 21)
Renewable Energy and Energy Efficiency Partnership	(REEEP)
Energy Sector Management Assistance Program	(ESMAP)
African Development Bank	(AfDB)
African Energy Commission	(AFREC)
African Oil Producing and Importing Countries	(AfrOPIC)
New Partnership for Africa's Development	(NEPAD)
East African Community	(EAC)
Southern African Development Community	(SADC)
Africa Energy Forum	(AEF)
African Energy Information Forum	(AEIF)
Forum of Energy Ministers of Africa	(FEMA)
Union of Producers, Transporters and Distributors of Electric Power in Africa	(UPDEA)
Energy and Environment Partnership Programme for Southern and East Africa	(EEP-SE&A)
The Intergovernmental Authority on Development	(IGAD)
The Economic Community of the Great Lakes Countries	(CEPGL)
Economic and Monetary Community of Central Africa	(CEMAC)
The Sahel and West Africa Club	(SWAC/OECD)
Ugandan Ministry of Energy and Mineral Development (Uganda)	(MEMD)
Ministry of Energy, Kenyan Government	(KMOE)
Ministry of Energy and Mines, Burundian Government	(BMEM)
Ministry of Energy, DR Congo Government	(DRCME)
Ministry of Energy and Water Development, Zambian Government	(MWED)
Practical Action, African Energy Policy Research Network (Kenya)	(AFREPREN)
African Centre for Technology Studies (Kenya)	(ACTS)
Renewable Energy Technology Assistance Programme (Kenya)	(RETAP)
Natural Resource Network (Réseau Ressources Naturelles) (DRC)	(RRN)

Migration

The Climate Change, Environment and Migration Alliance (CCEMA)

CCEMA is a multi-stakeholder global partnership aiming to bring together actors representing a range of perspectives including environment, migration, development, and humanitarian assistance. Its objective is to bring migration considerations to the environment, development, and climate change agendas and vice versa (www.ccema-portal.org).

IASC (Inter-Agency Standing Committee) informal group on Climate Change Displacement and Migration

One aspect of the group's work involves delivering inter-agency contributions to the UNFCCC secretariat to promote the inclusion of migration and displacement issues in the adaptation text of a post-Kyoto agreement. In relation to this, two side-events are foreseen at COP-16 in Cancun on human mobility (one

convened by UNHCR under the HLCP framework and one organized by IOM in coordination with UNU-EHS¹¹).

Transatlantic Study Team on Climate Induced Migration

Established by the The German Marshall Fund of the US (GMF): a 2009–10 initiative which involves: compiling existing data, policy analysis, and dialogue with policymakers, fact-finding missions, bringing together prominent opinion leaders on both sides of the Atlantic, promoting open dialogue, and helping to advance the policy debate (<http://www.gmfus.org/cs/grantmaking/immigration>).

UNFPA

UNFPA: publication to be launched in Mexico City, 13-15 October 2010 at event entitled *Population Dynamics and Climate Change II*, with IOM as a co-sponsor.

UNECA

UNECA—ongoing research climate change and migration.

EACH-FOR

EACH-FOR: “Environmental Change and Forced Migration Scenarios” project. A two-year research project carried out by an international consortium, with regional and country case studies in multiple continents (including Africa). For details: www.each-for.eu

Foresight Project on Global Environmental Migration

As part of the UK-based Foresight research programme, an ongoing project is bringing together leading experts from across the world, to assemble and analyse the latest evidence and research on global environmental migration. The project is sponsored by the Home Office and the Department of Energy and Climate Change. For details: www.foresight.gov.uk

West Africa:

Forthcoming inter-agency *UNEP-led report on climate change, conflict and migration in the Sahel (with IOM, OCHA and UNU-EHS)*

SWAC/OECD

SWAC/OECD regional analysis: *Security implications of climate change in the Sahel*. Includes analysis of the migration/displacement dimension: www.oecd.org/document/57/0,3343,en_38233741_38246823_43345721_1_1_1_1,00.html.

The UNCCD Sub-regional Action Programme (SRAP)

The UNCCD *Sub-regional Action Programme (SRAP) to Combat Desertification in the CILSS region* includes responses to mobility, migration, and associated conflicts (especially between farmers and livestock herders) but these are limited to transhumance and trans-boundary water resources.

North Africa

Arab Climate Resilience Initiative, UNDP (under development)

East Africa

Inter-agency Security in Mobility (SIM) initiative (OCHA, IOM, ISS, UNEP): “Advocating for Safe Movement as a Climate Change Adaptation Strategy for Pastoralists in the Horn and East Africa”.

Southern Africa

A regional preparedness and response plan for floods that allow more synergies and more adaptive responses to the local needs in Mozambique, Zambia, and Zimbabwe. (IOM).

¹¹ UN University - Institute for Environment and Human Security [UNU-EHS]), Bonn, Germany.

Potential Partners¹²

- Members of the Inter Agency Standing Committee (IASC) informal group on migration and displacement: IOM, UNHCR, NRC, UNEP, UNU-EHS, WFP, WHO, OHCHR, IFRC, OCHA, UNDP, IASC Secretariat;
- UNECA;
- UNFPA;
- IDMC (Internal Displacement Monitoring Centre);
- UNISDR (International Strategy for Disaster Risk Reduction);
- UNCCD (Convention to Combat Desertification);
- UN University for Peace;
- World Bank;
- Africa-EU Partnership on Migration, Mobility, and Employment;
- OECD;
- International Institute for Environment and Development;
- Sussex Centre for Migration Research (University of Sussex, UK);
- Stockholm Environment Institute;
- GCAP;
- Munich Re Foundation;
- WWF;
- Institute for Environmental Security;
- International NGOs;
- African Union;
- African Development Bank;
- African inter-State regional organisations;
- ACP Observatory for Migration;
- Institute for Security Studies;
- CILSS (Permanent Interstate Committee for Drought Control in the Sahel/Comité permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel);
- The Sahel and West Africa Club (SWAC, OECD);
- OSS (Sahara Sahel Observatory);
- Ministries of Environment, Development, Planning (including land-use planning), Migration, Local Administration, etc;
- Local government entities, village councils, CBOs, NGOs, etc.

Natural Disasters

Environment Initiative of the New Partnership for Africa's Development (NEPAD)

The African Union Commission (AUC) supported Environment Initiative of the New Partnership for Africa's Development (NEPAD), and its related action plan, acknowledge the economic importance of climate variability and change by including program area on combating climate change in Africa. In addition, the AUC-supported NEPAD Africa Regional Strategy for Disaster Risk Reduction recognises the importance of co-ordination across agencies for proactive disaster prevention and response strategies.

The African Ministerial Conference on the Environment (AMCEN)

In 2010, the African Ministerial Conference on the Environment (AMCEN) (13th session), the African Ministerial Conference on Disaster Risk Reduction (2nd conference) and the Conference of Ministers

¹² Not including academic research organisations.

responsible for Meteorology in Africa (first conference)—renewed and strong commitments of African countries were made to disaster risk reduction and the development of meteorology, bearing in mind the close relationship between climate change, natural disasters, and meteorology.

The Ministerial Declaration made at the 2nd African Ministerial Conference on Disaster Risk Reduction called on the AU, NEPAD, RECs, and Member States to create a network of capacity development institutions for training, research, and information management and exchange at country, sub-regional, and regional levels in collaboration with international and regional partners.

African Centre of Meteorological Application for Development (ACMAD)

African Drought Risk and Development Network (ADDN)

Standardized Precipitation Index (SPI) of the World Meteorological Organization (WMO)

African Development Bank

African regional economic communities (RECs)

RECs several have technical programmes highlighting the importance of DRR with strong linkages to Climate Change (especially ECCAS, ECOWAS, and SADC):

- Economic Community of Central African States (ECCAS);
- The Economic Community of West African States (ECOWAS);
- Intergovernmental Authority on Development (IGAD);
- IGAD Climate Prediction and Applications Centre (ICPAC)—technical branch of IGAD;
- Southern African Development Community (SADC) Drought Monitoring Centre;
- Southern African Regional Climate Outlook Forum (SARCOF), which comes under the umbrella of the Southern African Development Community (SADC). SARCOF's role is to facilitate information exchange and interaction among forecasters, decision makers, and climate information users in the 14 SADC member states;
- Indian Ocean Commission.

UN-AU Regional Coordination Mechanism

Cluster 4: Environment, Population, and Urbanization.

UNDG East and Southern Africa (UNDG-ESA) and UNDG West and Central Africa (WCA)

Clusters on Environment and Climate Change and on Emergency Preparedness for Humanitarian Action.

International Federation of Red Cross and Red Crescent Societies.

Meteorological Offices

The UK Met Office and Météo France's Tropical Cyclone Regional Specialized Meteorological Centre, in La Reunión, both provide such forecasts for southern Africa.

UNFCC

UNFCC focal point representatives in national governments (see list).

National Platforms, such as the National Disaster Management Institute of South Africa; Ethiopia's Disaster Prevention and Preparedness Agency.

Certain countries have made significant progress in dealing with the inter-related challenges of Climate Change and Disaster Risk, such as The Gambia, Tanzania, Kenya, Burundi, Mozambique.

The University Network for Disaster Risk Reduction in Africa (UNEDRA)

UNEDRA was formed in September 2005 for the purposes of enhancing capacity development in disciplines central to the goals of reducing disaster risks on the continent of Africa. UNEDRA seeks to bring together institutions with mandates and interests in disaster risk reduction training and research through network activities; collaborative research, joint/shared credit professional training programmes, and exchange of faculty and students.

Periperi U

Periperi U is a platform for university partnership to reduce disaster risks in Africa. It stands for 'Partners Enhancing Resilience to People Exposed to Risks'—with a special focus on advancing university action on risk and vulnerability reduction in Africa

ProVention Consortium

Information on DRM, links and partners. <http://www.proventionconsortium.org/index.htm>

The Center for Research on the Epidemiology of Disasters (CRED)

CRED has been active for over 30 years in the fields of international disaster and conflict health studies, with research and training activities linking relief, rehabilitation, and development. CRED promotes research, training, and technical expertise on humanitarian emergencies, with a special focus on public health and epidemiology.

UNU Institute for Natural Resources, Ghana

African Centre for Disaster Studies, North-West University, South Africa

University Network for Disaster Risk Reduction in Africa (UNEDRA)

University Network for Disaster Risk Reduction in Africa (UNEDRA) of ITC:
www.itc.nl/unu/dgim/unedra/default.asp

African Centre of Meteorological Application for Development (ACMAD)

Institute for Disaster Risk Management (IDRM)

International Institute for Disaster Risk Management Early warning and disaster management is one focus of the IDRM. www.idrmhome.org/index.html.

International Research Institute for Climate Prediction

International Research Institute for Climate Prediction, Research on climate prediction and its applications, with forecasts and information on El Nino and Malaria Early Warning and Response System (MEWS)

Research in Agriculture and Development

In several countries of Sahelian Africa, priorities in agricultural research and development are evolving to reflect the changing needs of resource-poor farmers. Agricultural research at the international and national levels over the past 25 years has led to increased understanding of the agricultural implications of climatic variability and change. These affect the priorities for both crop improvement and natural resource management.

ANNEX I – Energy Security Hot Spot Methodology

Region	Central Africa			Eastern Africa			Southern Africa			Western Africa		
Country	DR Congo	Burundi	Zambia	Kenya	Uganda	Ethiopia	Botswana	Zimbabwe	Madagascar	B. Faso	Mali	Niger
Energy Production (Mtoe) ¹³	18.41	-	6.83	14.72	-	20.86	1.11	8.67	-	-	-	-
Energy TPES (Mtoe) ¹⁴	18.09	-	7.44	18.3	-	22.81	2.02	9.45	-	-	-	-
Electricity Losses (% of output) ¹⁵	3.7	-	7.2	15.4	-	9.4	14.8	7.2	-	-	-	-
%age Alternative Energy Usage ¹⁶	3.9	-	11.3	6.4	-	1.3	0	4.7	-	-	-	-
Electric Power Consumption (kWh) ¹⁷	6*9	-	8*9	5*9	-	3*9	2*9	9*9	-	-	-	-
Electric Power Production (kWh) ¹⁸	8*9	-	9*9	6*9	-	3*9	1*9	9*9	-	-	-	-
Drought Risk (coefficient of variation) ¹⁹	0.1-0.2	0.1-0.2	0.1-0.2	0.4-2.7	0.1-0.2	0.2-0.3	0.3-0.4	0.2-0.3	0.2-0.3	0.1-0.2	0.2-0.3	0.2-0.3
Flood Frequency (1-50 year variation) ²⁰	5 - 50	1 - 5	5 - 50	1 - 5	5 - 50	5 - 50	1 - 5	5 - 50	5 - 50	5 - 50	5 - 50	5 - 50
Territorial borders ²¹	9	3	8	5	5	5	4	5	0	6	7	7
Water of Total Landmass (Sq Km) ²²	77,810	2,150	9,220	11,227	43,938	104,300	15,000	3,910	5,501	400	20,002	300
Forest Area of total landmass (%) ²³	47->%	0-9%	47->%	0-9%	0-9%	9-21%	9-21%	31-47%	21-31%	21-31%	9-21%	0-9%
Total Population (in millions) ²⁴	67.8	8.5	13.3	40.8	33.8	84.9	1.9	12.6	20.1	16.2	13.3	15.9
Population Growth (Annual %) ²⁵	2.7	3	2.5	2.6	3.3	2.6	1.5	0.1	2.7	3.4	2.4	3.9
Population Density (No. Per Sq Km) ²⁶	29	306	18	70	140	77	3	32	34	59	11	13
Total Resident Refugees ²⁷	185,809	24,967	56,785	358,929	127,345	121,886	3,525	3,995	0	543	13,538	325
Minorities under Threat of Violence ²⁸	8	3	0	12	2	5	0	3	0	0	0	3
Political Stability [16] (0-100%) ²⁹	2.4	10	54.5	12	18.7	6.2	81.3	8.6	30.1	38.8	35.9	20.6
Poverty headcount ratio (% of population) ³⁰	71.3	68	68	46.6	31.1	44.2	no data	34.9	68.7	46.4	63.8	63
Human Development Index Ranking ³¹	176	174	164	147	157	171	125	no data	145	177	178	182
Total State "Extreme" + "High" Risk	13	10	12	12	9	14	8	10	6	7	7	8
Total Continental Risk	35			35			24			22		

KEY
EXTREME
HIGH
MEDIUM
LOW-MEDIUM
LOW

¹³ Figures for energy in 2007 found at www.iea.org/stats/index.asp (Accessed 4 August 2010). As a comparison the US' rates are 2,339.94 TPES (Mtoe) and 1,665.18 Energy Production (Mtoe). The lower the number the higher energy insecurity becomes.

¹⁴ TPES stands for Total Primary Energy Supply *ibid*.

¹⁵ See: <http://databank.worldbank.org/ddp/home.do?Step=1&id=4> (Accessed 4 August 2010)

¹⁶ Figures for 2007. See: <http://databank.worldbank.org/ddp/home.do?Step=2&id=4> (Accessed 5 August, 2010)

¹⁷ Figures for 2007. See: <http://databank.worldbank.org/ddp/home.do?Step=2&id=4> (Accessed 5 August, 2010). *(No.) symbolises number of zeros

¹⁸ Figures for 2007. See: <http://databank.worldbank.org/ddp/home.do?Step=2&id=4> (Accessed 5 August, 2010)

¹⁹ See: www.grid.unep.ch/activities/earlywarning/preview/ (Accessed 5 August 2010) - 0 equals most risk 1 equals least risk

²⁰ See: www.grid.unep.ch/activities/earlywarning/preview/ (Accessed 5 August 2010)

²¹ See: www.cia.gov/library/publications/the-world-factbook/fields/2147.html (Accessed 4 August 2010)

²² See: <http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTWAT/0,contentMDK:21733296~menuPK:4818343~pagePK:148956~piPK:216618~theSitePK:4602123,00.html> (Accessed 6 August 2010)

²³ Figures are rounded and for 2010 estimated. See: <http://esa.un.org/unpp/index.asp> (Accessed 4 August 2010)

²⁴ Figures for 2008. See: <http://data.worldbank.org/indicator/SP.POP.GROW> (Accessed 5 August 2010)

²⁵ Figures are rounded and for 2010 estimated. See: <http://esa.un.org/unpp/index.asp> (Accessed 5 August 2010)

²⁶ See: <http://apps.who.int/globalatlas/dataQuery/default.asp> (Accessed 5 August 2010)

²⁷ P. Taneja (ed.), State of the World's Minorities and Indigenous Peoples 2010: Events of 2009, (London: Minority Rights Group International, 2010), pp. 201-206.

²⁸ See: http://info.worldbank.org/governance/wgi/mc_chart.asp (Accessed 4 August, 2010).

²⁹ 0% equals high political instability and 100% low political stability.

³⁰ See: <http://data.worldbank.org/country> (Accessed 5 August 2010)

³¹ See: <http://hdr.undp.org/en/statistics/> (Accessed 5 August 2010)

ANNEX II - The Sahel Case Study

The study focuses on four interconnected climate-related drivers that likely will affect the prevalence of conflicts and/or migration. The climate-related drivers are addressed as follows:

- Changing availability of natural resources (temperature and rainfall);
- Droughts & desertification;
- Heavy rains and flood disasters; and
- Sea level rise and associated permanent losses in state territory.

The speed of the onsets (sudden or slow/gradual), the geographical targets (coastal, inland, rural, or urban) of the climate stressors, as well as the average duration (hours, months, years) of the climate event will very much predefine conflict and migration patterns as well as the way to formulate appropriate policies.

Although existing action towards integrated development and conflict prevention exist in the region, the need and challenges for improvement are, however, large and far reaching. The participation of the international community in the region should bring support to governance and development activities. Food security should be a main priority, and should be inseparable from the issues of climate change, migration, and conflict that are covered in this study. In order to be able to address the three issues comprehensively, national capacities to improve living conditions are crucial. Regional action is a key to propose relevant migration policies, and conflict prevention since both are regional issues. The different topics covered throughout the study highlight how intertwined local, national, and regional issues are in the Sahel, and the need to set up integrated solutions to address them.

The study has four interlinked objectives:

- Identify how climate change exacerbates existing vulnerabilities in the Sahel and its links to conflict and/or migration;
- Assess the current policy gaps to comprehensively address the climate, conflict, and migration nexus;
- Suggest options for national, regional, and international partners in the Sahel;
- Raise awareness, catalyze support, and inform investments to meet emerging climate change adaptation needs.

ANNEX III - Early-Warning Systems in Africa to Predict Climate Change/Disasters

- African Centre of Meteorological Application for Development (ACMAD) is the Weather and Climate Centre with African continental competence. ACMAD is composed of 53 member states, the 53 countries of the “Africa” continent. <http://www.acmad.ne>
- AGRHYMET Regional Centre, Niamey, Niger. AGRHYMET is a specialised hydro-meteorological Institute of the Permanent Interstate Committee for Drought Control in the Sahel (CILSS). <http://www.agrhymet.ne>;
- Inter-governmental Authority on Climate Prediction and Applications Centre (ICPAC). Mission is to improve the technical capacity of producers and users of climate information; develop an improved, proactive, timely, broad-based system of information and product dissemination and information; and to expand the knowledge-base system within the sub-region. <http://www.icpac.net>;
- Southern African Development Community (SADC) Drought Monitoring Centre (DMC). The main objective of the SADC DMC is to carry out climate monitoring and prediction for early warning and mitigation of adverse impacts of extreme climatic events on agricultural production, food security, water resources, energy, and health, among other socioeconomic sectors. <http://www.dmc.co.zw>;
- Sahara and Sahelian Observatory (OSS);
- World Meteorological Association;
- UNISDR Platform for the Promotion of Early Warning;
- Famine Early Warning System (FEWS-NET) <http://www.fews.net>;
- The FAO Global Information and Early Warning System on Food and Agriculture (FAO/GIEWS) <http://www.fao.org/giews>;
- FAO Desert Locust Information Centre (DLIS);
- United Nations Environment Programme (UNEP) Division of Early Warning and Assessment (DEWA). <http://www.unep.org/dewa/index.asp>;
- DevInfo – UNICEF. <http://www.devinfo.org/>;
- World Food Programme (WFP) Vulnerability Assessment and Mapping—food security analysis. Is concerned with food security and food aid, has its own early warning and assessment capacity. <http://www.wfp.org/food-security>;
- Office for the Co-ordination for Humanitarian Affairs (OCHA)—OCHA Online. <http://ochaonline.un.org/rosa/EmergencyPreparedness/>;
- Botswana Drought Early Warning System, Government of Botswana;
- Climate Data Library of the International Research Institute for Climate and Society of Columbia University, IRI. Also Climate and Malaria Resource Room <http://portal.iri.columbia.edu/portal/server.pt>;
- World Health Organization (WHO) Early warning of epidemics and disaster-related information on nutrition and post-disaster situation reports. <http://www.who.int/en/>.

The Climate for Development in Africa (ClimDev-Africa) initiative, aimed at mainstreaming climate information into decision-making for African development, has been launched, as has a donor fund to support it, while the AfDB has approved strategies on climate risk management and adaptation and on clean energy. The challenge lies in turning words into reality, with limited resources and capacity.

Progress is also being made in improving the information available on climate change through support for the activities of the Global Climate Observation system and through ClimDev-Africa. The AfDB is, for example, financing a \$30 million institutional support project designed to strengthen the institutional capacities of four African regional climate centres: the African Centre of Meteorological Applications for Development (ACMAD), the Agro-Meteorology and Hydrology Regional Centre (AGRHYMET), the IGAD Climate Prediction and Application Centre (ICPAC), and the Drought Monitoring Centre (DMC). This support will enhance the technical ability and expertise of African climate scientists to generate the information needed to assess climate risk and quantify climatic trends. However, Africa's ability to monitor climate change remains much lower than that of any other region in the world.