

Climate Change and Security in Africa

A Study for the Nordic-African Foreign Ministers Meeting

Oli Brown and Alec Crawford | March 2009

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Warmer temperatures are likely to increase the risk of flooding in areas like the Niger Delta. Source: iStockphoto



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Sandstorm in Darfur. Source: UNEP

Summary

The security challenge of climate change

As science has revealed the speed and scope of climate change, we have begun to realize that it holds potentially serious implications for international security. Climate change—by redrawing the maps of water availability, food security, disease prevalence and coastal boundaries—could increase forced migration, raise tensions and trigger new conflicts. The security threat posed by climate change has caught the world's political imagination, generating a perceptible shift in the way that a growing number of decision-makers in the North and the South are talking about the subject.

The imperative to reduce greenhouse gas emissions and manage the impacts of climate change illustrates, in the starkest manner possible, our global interdependence. Recent years have seen the steady improvement of Africa's economic prospects, in the reduction of levels of conflict, in the quality of governance, and the number and nature of democracies. The African Union and its constituent regional economic communities, through their security architecture, have developed into key players in the reduction of conflict in the region.

Nevertheless, Africa, though the continent the least responsible for greenhouse gas emissions, is almost universally seen as the continent most at risk of climate-induced conflict—a function of the continent's reliance on climate-dependent sectors (such as rain-fed agriculture) and its history of resource, ethnic and political conflict. At the turn of the 21st century, more people were being killed in wars in this region than in the rest of the world combined. With tremendous natural resources and remarkable social and ecological diversity, the continent reflects a close dependency of people on natural resources. It is this dependency and its fragile governance capacities that may present Africa with potentially severe problems in adapting to the challenges of climate change.

Whether human-induced climate change is already playing a role in current conflicts, such as Darfur, is highly controversial. This desk-based report takes stock of the rapidly increasing literature on the security impacts of climate change. It tries to highlight the areas of agreement among analysts, and note where opinions diverge. The overall aim of the report is to assess, as objectively as possible, the existing evidence on the 'security threat' of climate change in Africa, and to determine which sectors and regions are most likely to suffer from the conflict impacts of climate change.

Conflict is multi-dimensional

In this report we argue that climate change presents very real development challenges which, under certain circumstances, may contribute to the emergence and longevity of conflict. Recent research broadly agrees that

four main climate links to conflict in Africa may emerge. First, reduced water supply and growing demand will, in some places, lead to increasing competition between different sectors of society, different communities and different countries. Under certain conditions, such as poor governance and existing ethnic division, these stresses may turn violent. Second, reductions in crop yields and increasingly unpredictable weather patterns around the world may lead to higher prices for food and greater food insecurity, and increase the stakes for control over productive agricultural land. Third, changes in sea level, increased natural disasters and the reduced viability of agricultural land may cause large-scale and destabilizing population movements. Finally, the cumulative impact of all these challenges on the prevalence of poverty and the ability of governments to provide services to their citizens could be a factor that tips fragile states towards socio-economic and political collapse.

Many factors impact on the probability of armed conflict. Poverty levels, natural resource endowments, population characteristics, ethnic and religious fractionalization, education levels, geography, as well as previous conflicts, are all factors that constrain or facilitate conflict. Climate change is only one of the many security, environmental and developmental challenges facing Africa. Climate change is, in effect, a 'threat multiplier' that makes existing concerns, such as water scarcity and food insecurity, more complex and intractable. However, it is non-climate factors (such as poverty, governance, conflict management, regional diplomacy and so on) that will largely determine whether and how climate change moves from being a development challenge to presenting a security threat.

Adaptation policies and programs, if implemented effectively and at multiple scales, could help avert the impacts of climate change becoming triggers for conflict. But, adaptation must take into account existing social, political and economic tensions and avoid exacerbating them. The often thin line between security and insecurity, and between stability and instability, will be determined by three broad factors: first, the extent and speed of climate change (structural conditions); second, the ability of countries and communities to adapt to those changes (institutional capacity); and third, how individuals, communities and governments react to the challenges that arise (responsiveness).

Clearly the challenge of climate change is one that is beyond the capacity of any one country to tackle. Ultimately, its shared developmental and security implications will be best resolved through cooperation at a myriad of levels: cooperation to develop comprehensive international strategies to manage migration, to share the most innovative approaches for adaptation, to administer shared resources and to cope with insecurity.

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Acronyms and abbreviations

GCM	general circulation model
IPCC	Intergovernmental Panel on Climate Change
LDC	least developed country
NAPA	National Adaptation Programme of Action
SRES	Special Report on Emissions Scenarios
UNFCCC	United Nations Framework Convention on Climate Change
UNRWA	United Nations Relief and Works Agency for Palestinian Refugees in the Near East



Section 1: Introduction

Easy access to small arms across the continent could combine with poor governance, poverty, environmental degradation and competition over natural resources to drive violent conflict. Source: iStockphoto

As science has revealed the speed and scope of climate change we have begun to realize that it holds potentially serious implications for international security.¹ Analysts argue that climate change—by redrawing the maps of water availability, food security, disease prevalence and coastal boundaries—could ultimately increase forced migration, raise tensions and trigger new conflicts.

A new foreign policy priority

The security threat posed by climate change has caught the world's political imagination, generating a perceptible shift in the way that a growing number of decision-makers in the North and the South are talking about the subject. The African Union, in a January 2007 decision, expressed grave concern about the vulnerability of Africa's "socio-economic and productive systems to climate change and variability and to the continent's low mitigation and response capacities" (African Union, 2007). The European Security Strategy notes that climate change will aggravate competition for natural resources, and likely increase conflict and migratory movements in various regions (EU, 2003). Meanwhile, climate change has become a core foreign policy priority of many governments,² including the new administration's program in the U.S., a move that is rationalized, at least in part, by the security threat it presents.³

The security challenge of climate change

There are three main dimensions to the security threat posed by climate change. First, climate change could intensify land-use conflicts and trigger environmental migration by exacerbating existing environmental crises, such as drought, water scarcity and soil degradation. In addition, rising global temperatures may undermine the basis of many people's livelihoods, especially in developing regions. Climate change is likely to overwhelm local capacities to adapt to changing environmental conditions and reinforce the trend towards general instability that already exists in many societies and regions, particularly in weak and fragile states with poorly performing institutions and systems of government.

Second, entirely new causal relationships between environmental conditions and the emergence of conflict may appear as a result of climate change in the form of sea-level rise, flooding disasters and melting glaciers that threaten downstream water supplies.

Third, there is concern that if left unabated, global warming could pass certain tipping points where climate change takes on a momentum of its own and we see the emergence of large-scale changes, (or 'non-linear events'), in the Earth's systems, such as the collapse of the Amazon rainforest or the loss of the Asian monsoon, which could have, "incalculable consequences for the societies concerned" (WBGU, 2007).

A succession of new wars across Africa?

Africa, though the continent the least responsible for greenhouse gas emissions,⁴ is almost universally seen as the continent most at risk of climate-induced conflict—a function of the continent's reliance on climate-dependent sectors (such as rain-fed agriculture) and its history of resource, ethnic and political conflict (Brown and Crawford, 2008).

The March 2005 Report of the Commission for Africa, which was chaired by the former Prime Minister of Britain, Tony Blair, argued that “Africa has experienced more violent conflict than any other continent in the last four decades” (Commission for Africa, 2005). Most of the world's armed conflicts now take place in sub-Saharan Africa and at the turn of the 21st century more people were being killed in wars in this region than in the rest of the world combined. Most of the 24 major armed conflicts recorded worldwide in 2001 were on the African continent, with 11 of those conflicts lasting eight years or more (Human Security Centre, 2005).

Violent conflict is not only devastating in human terms, but also undermines the long-term prospects of entire regions; it is, in effect, “development in reverse” (Collier, 2003). Estimates show that wars stripped about US\$ 18 billion a year from African economies between 1990 and 2005 (IANSA et al., 2007). Violent conflict is both a cause and a consequence of poverty. The Human Security Report found that the overwhelming majority of armed conflicts (95 per cent between 1995 and 2005) are fought within, and not between, states and that the most take place in the poorest parts of the world, in particular in sub-Saharan Africa (Human Security Centre, 2005).

Much has been written about the causes and nature of instability in Africa. For example, the 2005 Report of the Office of the Special Advisor on Africa on Human Security in Africa noted that, “Several factors account for conflict in Africa: remote sources, immediate causes, and factors that exacerbate conflict. The remote sources include the colonial heritage of authoritarian governance and artificial boundaries; conditions of widespread extreme poverty, and scarcity of basic necessities of life. Immediate causes include competition for land, oil or other natural resources; support for internal conflicts by outside actors, government policy and resource misallocations. Factors that exacerbate conflict can include arms imports, pressures of refugees or internally displaced persons and food insecurity” (OSSA, 2005).

That said, a number of analysts have pointed to positive longer-term trends in conflict in Africa—referring to both a reduction in armed conflict well as the contribution being made by the new wave of engagement by Africans and the international community (Human Security Centre, 2005 & 2007). However, there is concern that climate change will reverse some of the recent progress made in Africa.

In fact, some argue climate change is already playing a role in existing conflicts. A June 2007 report by the United Nations Environment Programme (UNEP) suggested that the conflict in Darfur has been in part driven by climate change and environmental degradation. The UNEP report warned of “a succession of new wars across Africa” unless more is done to contain the danger of climate change. The report concluded that “Darfur... holds grim lessons for other countries at risk.” In a 2007 Washington Post editorial UN Secretary General Ban Ki-moon argued:

“Almost invariably, we discuss Darfur in a convenient military and political short-hand—an ethnic conflict pitting Arab militias against black rebels and farmers. Look to its roots, though, and you discover a more complex dynamic. Amid the diverse social and political causes, the Darfur conflict began as an ecological crisis, arising at least in part from climate change” (KI-MOON, 2007).

However, others caution that we should not over-emphasize the role of climate change in Darfur. Kevane and Gray (2008) doubt that a reduction in rainfall is correlated to the conflict. De Waal (2005) argues that responsibility for the conflict lies primarily with power and governance rather than water and pasture: “Climate change causes livelihood change, which in turn causes disputes. Social institutions can handle these conflicts and settle them in a non-violent manner—it is mismanagement and militarization that cause war and massacre.”

Background to the report

This desk-based report attempts to assess the extent to which climate change may affect violent conflict in African states. It takes stock of the rapidly increasing literature on the security impacts of climate change. It tries to highlight the areas of agreement among analysts, and note where opinions diverge. The overall aim of the report is to assess, as objectively as possible, the existing evidence on the security threat of climate change in Africa, and to determine which sectors and regions are most likely to suffer from the conflict impacts of climate change.

The problem of prediction

The scientific basis for climate change is well established (Boko et al., 2007). However, there is still little empirical proof for a directly *causal* link between climate change and violent conflict. To an extent this is unsurprising. The science of climate change is complex enough, even before considering its impact on societies with widely differing resources and varied capacities to adapt to external shocks. The projected impact of climate change on societies is, of course, even *more uncertain* than the projected climate change itself, being a projection based on a projection.

There have been some attempts to construct scenarios of the security implications of climate change at a regional and global scale (CSIS, 2007). There are also increasingly detailed studies on the interaction between climate stresses and conflict at a community level (Nyong, 2005; Meier and Bond, 2007). Finally, work is beginning on the ways that international community can use adaptation funding as a way of achieving the twin aims of preventing conflict and reducing climate risk (International Alert, 2008).

However, this emerging literature has been criticized on a number of grounds. First, it is accused of having its roots in neo-Malthusian notions of the ‘carrying capacity’ of a country where population growth or shrinking resources will eventually lead to conflict, an approach that many Africans find unnecessarily deterministic and negative (Obi, 2000). This tends to assume the worst of people; that they will fight rather than cooperate over scarce resources, and underestimates African populations’ capacities to adapt to different conditions and to manage conflicts (Batterbury and Warren, 2001). It also fails to account for different levels of development on resource consumption, resource scarcity and conflict. Highly developed economies, for example, may experience less conflict over resources even as demand increases (Hendrix and Glaser, 2007).

Second, it can downplay some significant regional variations in climate predictions for Africa. Although regional climate models are still basic (reflecting, in large part, patchy capacity to collect primary meteorological data), nuances in the data are emerging (for instance, in some areas rainfall is predicted to increase) that frustrate broad generalizations.

Third, like much research about the links between environmental change and security, the literature on climate change and conflict tends to focus on the structural conditions in which conflict emerges (such as resource scarcity or abundance, poverty, etc.) rather than the role of individuals in initiating, sustaining, resisting or resolving

conflict. It tends to downplay the short-term causes (or triggers) of conflict and the importance of human decisions—the choices made by individual ‘actors’ in a conflict (Barnett and Adger, 2005).

What do we mean by security and conflict?

The terms ‘security’ and ‘conflict’ are, of course, loaded and loose concepts, open to misinterpretation. In this report we understand security not as stasis or the absence of change but rather as a condition where the changes and internal pressures that all countries experience can be managed in a non-violent way.

Likewise, ‘conflict’ itself is a dispute or incompatibility between two opposing sides. It is normal and not inherently negative. Indeed we all encounter, negotiate and manage conflicts every day of our lives. Mediating differing interests in a peaceful manner is at the heart of the democratic process. It becomes a destructive force where the capacity to mediate incompatible interests breaks down and those interests are pursued through violence, either at a community, national or international level. Throughout the report the word ‘conflict’ is used as convenient shorthand for ‘violent conflict’.

The structure of this report

In this report we argue that climate change presents very real challenges to development. Projected climatic changes for Africa suggest a future of increasingly scarce water, collapsing agricultural yields, encroaching desert and damaged coastal infrastructure. Such impacts, should they occur, could cause destabilizing population movements and raise tensions over dwindling strategic resources. In such a case, climate change could be a factor that tips fragile states towards socio-economic and political collapse. As such it can be seen as a ‘threat multiplier’ that makes existing concerns, such as water scarcity and food insecurity, more complex and intractable (CNA, 2007).

It is self-evident that in an increasingly interdependent world a rise in violent conflict in Africa will have implications beyond the continent itself and repercussions beyond the immediate humanitarian and developmental costs. The need for international engagement in terms of development aid and peacekeeping interventions would grow, as would flows of international migrants.

But climate change is only one of the many security, environmental and developmental challenges facing Africa. Its impacts will be magnified or moderated by underlying conditions of governance, poverty and resource management, as well as the nature of climate change impacts at local and regional levels. Adaptation policies and programs, if implemented effectively and at multiple scales, could help avert climate change and other environmental stresses becoming triggers for conflict. But adaptation must take into account existing social, political and economic tensions, and avoid exacerbating them. The often thin line between security and insecurity, and between stability and instability will be determined by three broad factors: first, the extent and speed of climate change (structural conditions); second, the ability of countries and communities to adapt to those changes (institutional capacity); and third, how individuals, communities and governments react to the challenges that arise (responses).

The report is grounded in a variety of scenarios of future emissions, of population growth and so on. The aim is not to deliver a precise prediction of where future conflicts or disasters will take place (after all, scenarios are not forecasts) but rather to identify some of the

mechanisms that may encourage conflict in a world affected by climate change. The report aims to establish, where possible, what we know about the causal links in two important dimensions; first between climate change and its environmental, economic and social impacts and second, how those impacts may lead to an increased risk of violent conflict.

Section 2 looks to the future. It attempts to summarize the extent of our knowledge (and ignorance) on the way that regional climates in Africa are expected to change under different emissions and warming scenarios. In Section 3 we present the four areas of concern that arise most often in the literature: (a) growing water scarcity; (b) rising food insecurity; (c) increases in climate-induced migration; and (d) the impact of climate change on state fragility. For each area we attempt to establish whether and how these problems may be exacerbated by climate change and what causal links there are to the emergence or longevity of conflict. Section 4 concludes with an analysis of possible responses from within and outside Africa, investigating whether tackling climate change might give rise to better cooperation and discussing what the international community and African nations might do to help prevent climate-induced conflicts.



Annual rainfall along the Mediterranean coast, including Tunisia (pictured above), is predicted to fall by as much as 20 percent, threatening the viability of both agriculture and livestock in the region. Source: iStockphoto

Temperatures will increase significantly in Libya; some models predict warming of up to 9°C during the summer across North Africa. Source: iStockphoto



Section 2:

Climate Change in Africa

The world's climate has been changing for many thousands of years. Seven thousand years ago, for example, the Sahara was a landscape of lakes and forests. Pastoralism as a way of life emerged as a response to its gradual desertification (Brooks, 2006). However, it's now widely accepted that the burning of fossil fuels and deforestation are changing our atmosphere with a speed and scope that is unprecedented in the historical record (Boko et al., 2007).

Box 1: Predicting climate change

General circulation models (GCMs) are computer-driven weather forecasting tools, used to understand current climate conditions and project future climate change. GCMs are frequently based on the emissions scenarios laid out by the IPCC's Special Report on Emissions Scenarios (SRES). The six basic 'storylines' of the SRES are each based on different rates of population and economic growth, as well as the future 'energy mix'.

Using these future emissions scenarios, GCMs model the expected climate based on the physical, chemical and biological properties of the climate system, along with its interactions and feedback processes (IPCC, 2007). GCMs are improving, but remain particularly problematic for Africa, due in large part to the lack of primary data on which to base the models. The climate observing system in Africa is in a far worse state than that of any other continent, and is deteriorating (Washington et al., 2004). There are eight times fewer weather stations on the continent than the minimum recommended level (Elasha et al., 2006) and vast parts of central Africa remain unmonitored.

In addition, many unknowns remain in the science of complex climate systems. Feedback loops, both positive and negative, add a level of uncertainty. For example, meteorologists do not yet fully understand the extent to which higher atmospheric CO₂ levels will increase vegetative cover through a process known as carbon fertilization, which might in turn affect the hydrological cycle.

2.1 The current and future climate in Africa

Climate change and climate variability (or unpredictability) are challenges that already face many African countries. The UN estimates nine out of every 10 disasters are climate-related (Holmes, 2008). Garcia (2008) argues that climate change has already started to disrupt states' capacity to generate wealth, to decrease gross national product and to affect human, and ultimately national, security in Africa. According to John Holmes, the Under-Secretary General for Humanitarian Affairs, "What we are witnessing is not an aberration but rather a 'curtain raiser' on the future." These events, he suggests, are the "new normal" (Holmes, 2008).

The continent's climate is made up of seven distinct zones.⁵ Widely different ecosystems from the Sahara to the rainforests of central Africa to the (disappearing) snows of Kilimanjaro mean that the impact of climate change will vary between and within countries. However, determining the sub-regional impacts of climate change with any confidence is difficult (see Box 1). In this section, we will examine five aspects of the climate system: temperature; rainfall; extreme weather events; sea-level rise; and non-linear ('surprise') events.

Temperature

Average annual temperatures in Africa rose approximately 0.5°C over the course of the 20th century, with some areas warming faster than others. The countries of the Nile Basin, for example, saw an increase in temperature of between 0.2°C and 0.3°C per decade in the second half of the century, while Rwanda saw temperatures increase by 0.7°C to 0.9°C over the same 50-year period (Eriksen et al., 2008). This gradual heating meant more warm spells and fewer cold days across the continent (Boko et al., 2007).

Africa is likely to warm across all seasons during this century (Boko et al., 2007). For a medium warming scenario, annual mean surface air temperatures are expected to increase between 3°C and 4°C by 2099, roughly 1.5 times average global temperatures (as land masses warm more than water bodies) (Boko et al., 2007). Across all emissions scenarios, temperatures in Africa are expected to increase by between 2°C and 6°C by 2100 (Hulme, 2001).

There are significant regional variations within these projections. The drier sub-tropical regions are expected to warm more than the moist tropics, with warming likely to be greatest over the interior of the semi-arid margins of the Sahara and central southern Africa (Eriksen et al., 2008). Using a medium warming scenario, Hudson and Jones (2002) find that temperatures in southern Africa would increase by 3.7°C in the summer and 4°C in the winter. Under a high warming scenario, temperature increases are expected to be more dramatic: according to

one model developed by Ruosteenoja et al. (2003), temperatures could increase by up to 9°C for North Africa in June to August, and by up to 7°C for southern Africa in September to November by the end of the century.

Rainfall

Rainfall currently varies considerably across Africa, both spatially and temporally (Boko et al., 2007). In recent decades, the continent's sub-tropical zones have become more arid, particularly the Saharan and Mediterranean regions and southern Africa (WBGU, 2007). In southern Africa, there has been an increase in interannual variability over the past 40 years, with more intense and widespread droughts. Heavy rainfall events have increased for many of the countries in the region (Angola, Namibia, Mozambique, Malawi and Zambia), along with changes in seasonality and weather extremes (Boko et al., 2007). East Africa has seen an increase in annual rainfall, with some regional variations. In West Africa, rainfall has actually increased in the last 10 years when compared from the extended drought years from the 1960s to the 1990s, which saw annual mean rainfall drop by as much as 30 per cent (Hulme, 2001).

On a global scale, the IPCC projects a 1–2 per cent increase in rainfall for every degree of temperature warming (Boko et al., 2007). But for Africa, regional differences abound. According to the IPCC, under a medium warming scenario mean annual rainfall is predicted to decrease along the Mediterranean coast by 20 per cent, extending into the northern Sahara (Boko et al., 2007). Rainfall is likely to increase in tropical and eastern Africa by around seven per cent, though changes will not be uniform throughout the year, and will likely occur in unpredictable events (Case, 2006). In southern Africa, winter rains will decrease, by up to 40 per cent in the extreme west. Climate models for West Africa vary considerably, and are still inadequate for predicting the impact of warming temperatures on rainfall with any accuracy. In short, there is no consensus on whether the region will become wetter or drier (Hulme, 2001). Recently, models have started pointing towards rainfall increases, as increased temperatures and CO₂ concentrations lead to both a northward shift in the West African Monsoon and an increase in vegetative cover, with a positive feedback loop on precipitation (Brooks, 2004).

These long-term precipitation rates are important, however their extended timescale means that populations may have more time to adapt. This is not the case with short-term variability; both long-term trends and short-term (year-to-year) variability in rainfall must be considered. For farmers in Africa, predictions of the total quantity rainfall do not always capture the impact of climate variability. Factors such as the *timing* of the onset of the first rains (which affects when crops are planted),

the *distribution* of rains within the growing season and the *effectiveness* of the rains are all criteria that affect the success of farming (Simms, 2005).

In terms of rainfall variability, Hendrix and Glaser (2007) find that annual precipitation flux is projected to increase in western Africa and decrease in southern Africa over the century. In addition, few trends emerge when measuring interannual variability across sub-Saharan Africa. In other words, rainfall variability will not be uniform across the continent, and will remain unpredictable across seasons.

Extreme weather events

For many African countries, natural disasters involve too much or too little rain: the Sahel witnessed a series of devastating drought years between the 1960s and 1990s, while more recently, Mozambique (2000 and 2001), Ethiopia (2006) and Ghana (2007) have experienced severe flooding, to name only a few examples.

Warmer temperatures are projected to increase both the frequency and intensity of extreme weather events for the continent: heavy rain storms, flooding, forest fires and El Niño events (Case, 2006). Climate models predict an increasing share of annual rains falling during intense precipitation events; they also point towards a lengthening of drought periods (WBGU, 2007).

Regions of particular concern include the Mediterranean coast and southern Africa, which are both expected to see an increased risk of drought (Boko et al., 2007). More rain in East Africa could increase the risk of flooding. Contradictory models for the Sahel do not point towards a definitive trend in floods or drought, though Huntingford et al. (2005) argue that the number of extremely dry and wet years in the region is likely to increase over the century. Finally, by century's end more frequent and intense storms are projected in the southern Indian Ocean; a 2–4°C rise in sea surface temperature could very probably

lead to a 10 to 20 per cent increase in cyclone activity on Africa's eastern coast, with implications for populations in both island and coastal communities (Boko et al., 2007).

Sea-level rise

The sea-level rise witnessed in the twentieth century was for the first time observed to be driven primarily by human-induced warming. An increase of meltwater into the world's oceans and a thermal expansion caused by warming sea temperatures both contributed to the rise, which since 1993 has averaged three millimetres per year (WBGU, 2007). Without action on greenhouse gas emissions, and barring any non-linear events (see below), a global rise of between 0.2m and 0.6m can be expected by 2100 across all IPCC scenarios (Boko et al., 2007).

Rising sea levels will carry with them significant implications for coastal settlements and populations, and are likely to increase the socio-economic and physical vulnerability of many of Africa's coastal cities. Those most susceptible to sea level rise are poor populations living along the coast in areas potentially vulnerable to flooding (Boko et al., 2007).

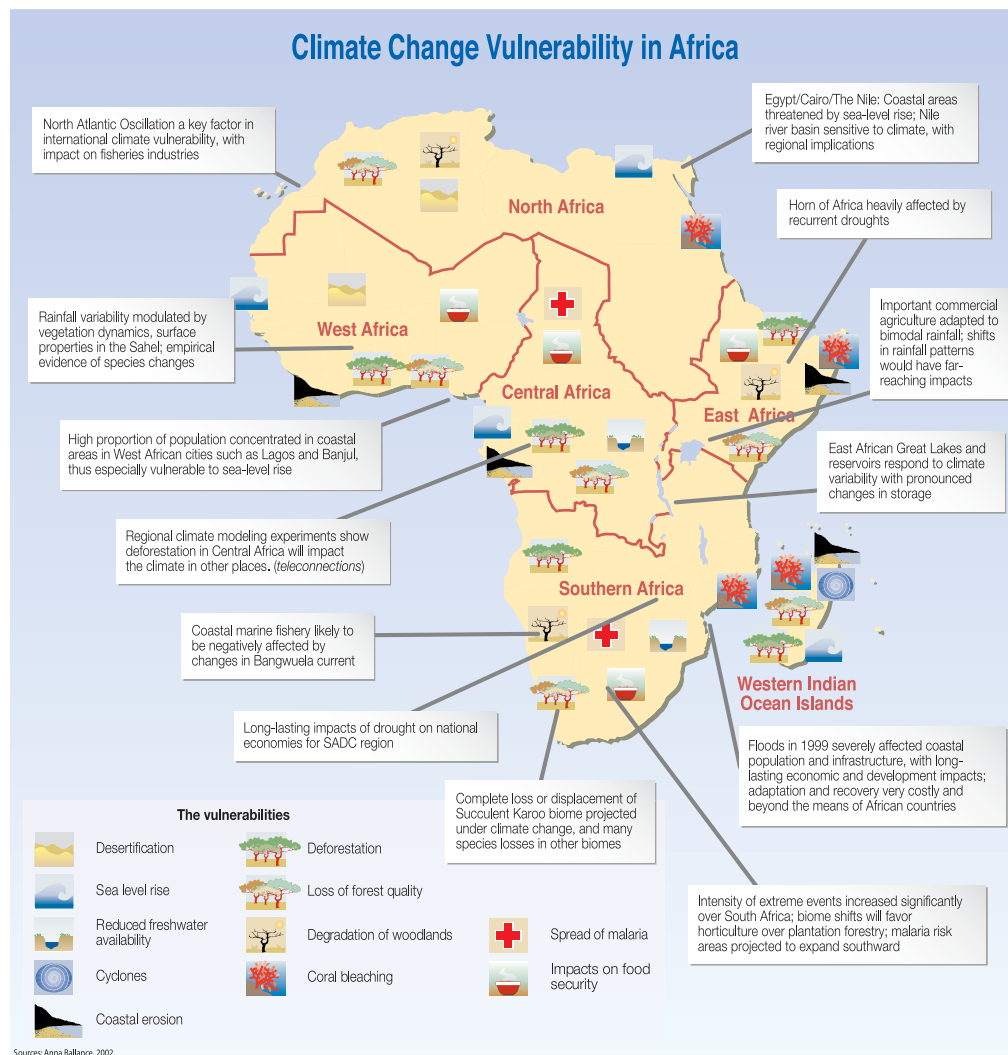
Non-linear events

Projections of future climate change have tended to focus on the most *probable* outcome based on mathematical modelling of what we already know about the world's climate. Climate change is typically discussed in terms of a linear progression of rising temperatures, falling rainfall and so on. However, as temperatures warm beyond 2–3°C, critical thresholds in the climate system risk being crossed, and positive feedback loops in the climate system may set in train dramatic changes to our climate—so called 'non-linear' events. At this point analysts warn that our ability to influence the resulting effects is likely to be lost (WBGU, 2007).



Rainfall in the Sahel typically falls in short torrential bursts, resulting in extensive (but short-lived) flooding. Source: UNEP, 2007

Figure 1: Climate change vulnerability in Africa



Source: Delphine Digout, Revised by Hugo Ahlenius, UNEP/GRID-Arendal

Many of these non-linear events may at first seem outside of the immediate concern of African states: the melting of the Greenland ice sheet, for instance, or large-scale die-back of the Amazon rainforest. However, all carry significant global consequences. Should the Greenland ice sheet melt, global sea levels are likely to rise seven metres. This would amplify the coastal impacts listed above. In addition, the infusion of cold freshwater would affect the Atlantic's ecosystem and West African fisheries, could alter Africa's tropical rain belt and could also weaken oceanic circulation in the North Atlantic (WBGU, 2007).

2.2 Africa's vulnerability to climate change

In their 2007 Fourth Assessment Report, the UN's Intergovernmental Panel on Climate Change (IPCC) noted that Africa is one of the most vulnerable continents to climate change (future weather patterns) and climate variability (how predictable those patterns are). This vulnerability is both a function of continent's complex climate system and that system's interaction with socio-economic challenges like endemic poverty; poor governance; limited access to capital and global markets; ecosystem degradation; complex disasters and conflicts; and urbanization—all of which may undermine communities' ability to adapt to climate change (Boko et al., 2007).

There are three factors that make Africa particularly vulnerable to the impacts of climate change (Garcia, 2008). The first is Africa's position on the globe; Africa already has a warm climate and is exposed to inconsistent rains with large areas characterized by poor soils or floodplains. Already the Sahelian climate is described as "perhaps the most dramatic example of climatic variability that we have quantitatively measured anywhere in the world" (Batterbury and Warren, 2001). Second is the fact that many of Africa's economies are dependent on sectors that are susceptible to climate fluctuations, such as agriculture, fisheries, forestry and tourism. Agriculture represents on average between 20 to 30 per cent of GDP in sub-Saharan Africa and makes up 55 per cent of the total value of African exports. Meanwhile, depending on the country, between 60 and 90 per cent of the total labour force in sub-Saharan Africa is employed in agriculture. Third is the socio-economic context: the lack of good governance; persistent and widespread poverty; poor economic and social infrastructure; conflicts; and limited human, institutional and financial capacities means that as a continent, Africa is least able to adapt to the effects of climate change.

Vulnerability to climate varies from country to country, and from village to village

Not all parts of Africa are equally vulnerable to climate change. Within any country vulnerability to climate change can vary from village to village and from person to person. Women, in their roles as principal care-givers, but often with fewer rights and freedom of action, may be more affected. But it is not always the poorest who are most exposed to climate change. In the Limpopo

Province of South Africa a recent study demonstrated how irrigation farmers may be at greater risks from drought because they are less diversified, and they face a combination of both climate and market risk (Eriksen, O'Brien and Losentrater, 2008).

Adaptation to climate change

'Adaptation' is a broad concept usually implying a process of adjustment to survive and, ideally, thrive in the face of change. In the context of climate change, adaptation takes place through adjustments to reduce vulnerability or enhance resilience to observed or expected changes in climate, and involves changes in processes, perceptions, practices and functions (Brown, Hammill and McLeman, 2007). Adaptation can take place at a number of different scales, from institutionally-driven, 'top-down' policies at a national level to adjustments and decisions at the level of individual households (McLeman and Smit, 2006).

African populations have demonstrated for centuries a tremendous ability to adapt to climate variability, often employing sophisticated, evolving tactics to respond to risks and take advantage of new opportunities. Various researchers have documented how this can take many forms; strategic migration decisions (Hampshire and Randall, 2007); shrewd management and conflict resolution strategies for water resources (Nyong and Fiki, 2005); rapidly changing agrarian and pastoral practices (Crowley and Carter, 2000; Hesse and Cotula, 2006); and complex socio-economic linkages between rural and urban areas (Smit, 1998). The present concern, however, is that the even extraordinary 'adaptive capacity' of African populations may not be able to keep pace with the scale and speed of climate change (Boko et al., 2007).



Urban slums like Kibera, in central Nairobi, continue to grow as more and more migrants arrive from the surrounding countryside. Source: iStockphoto

Displaced populations settle on the outskirts of El Fasher, Northern Darfur. These new arrivals add to the existing environmental burden on the surrounding desert environment. Source: UNEP, 2007



Section 3:

African Security in a Changing Climate: Areas of Concern

Africa is changing in a variety of profound ways, not just in terms of its climate. Its population is growing and moving, its economy is evolving and the health of its environmental resources is declining. Future climate change will take place against a backdrop of these powerful socio-economic challenges. How these are managed will determine the ability of African countries and communities to adapt to climate change.

The scale of resource use and environmental stress in Africa will be sharply accentuated by population growth. Africa's population is predicted to double by the middle of the century from 987 million people, or 15 per cent of the global population, to just under two billion (or 22 per cent of the global total) by 2050 (UNFPA, 2008). Meanwhile, an increasing number of Africans are moving to urban areas—at a rate of three per cent per annum. Currently still predominantly rural, 50 per cent of Africans will live in urban areas by 2030, doubling Africa's urban population from 373.4 million to 759.4 million. By 2050 there will be more than 1.2 billion African city dwellers (UN-HABITAT, 2008).

Africa is likely to experience a continuing trend of land degradation. Already approximately 3,500 square kilometres of Nigerian land turns to desert each year, forcing both farms and herdsmen to abandon their lands (Campbell et al., 2007). The UN estimates that over 70 per cent of Africa's agricultural drylands are degraded as a result of over-cultivation, mismanagement of irrigated croplands, overgrazing and deforestation (ISDR, 2004).

Together with climate change these trends will affect the availability of and demand for water, food and agricultural land. These challenges will interact with external factors such as the health of international economy and the level of aid flows and internal factors such as the quality of governance to shape Africa's prospects. This section picks out the four pressing issues most commonly identified by analysts: (a) increasing water scarcity; (b) decreasing food security; (c) increasing climate-induced migration; and (d) the impact of climate change on poverty and state fragility. Each section assesses the degree of existing problem, the threat posed by climate change, and the evidence for it becoming a threat to security.

3.1 Increased water scarcity

3.1.1 Existing water stress in Africa

Access to clean water is a major problem in many African countries. One-third of all people in Africa live in drought-prone regions. One-quarter (about 200 million people) currently experience significant water stress (IPCC, 2007). Drought accounted for 31 per cent of all natural disasters in Africa between 1975 and 2002. Floods accounted for another 26 per cent (ISDR, 2004). Ethiopia, Eritrea and Somalia have suffered more deaths through drought over the last century—600,000 by one estimate—than any other part of Africa. These countries

have also experienced persistent conflict, internally and regionally. Drought and famine remain major underlying threats to security.

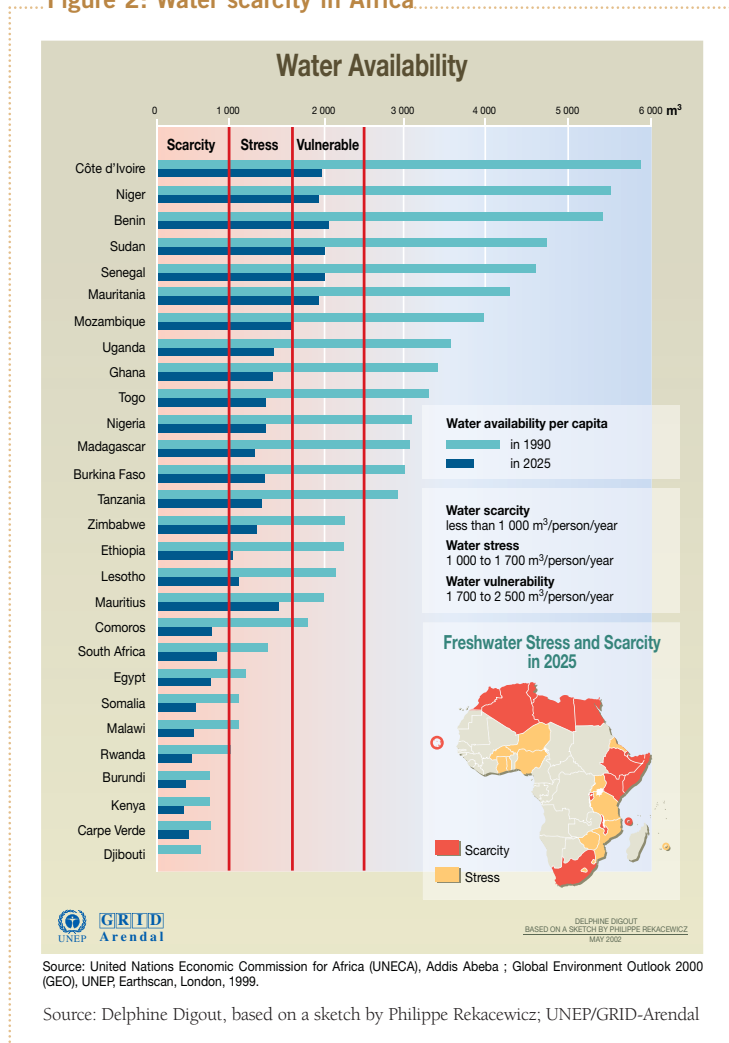
In many places, the problem of water is both one of quantity and quality. Increasingly, the problem is not one simply of overuse but also pollution. Agricultural runoff as well as industrial and household waste put lakes, rivers and coastal waters under stress, causing significant health and development problems. Two-thirds of the rural population and one-quarter of the urban population in Africa lack access to safe drinking water (Simms, 2005).

Even before factoring in climate change many African countries are heading towards a crisis in terms of their economically usable, land-based freshwater resources as a result of population growth and increased demand (see Figure 2). Agricultural use of freshwater is predicted to rise by 30 per cent between 2005 and 2025 (ISDR, 2004). The IPCC estimates several countries in Africa,

particularly in North Africa, will exceed the limits of their economically usable land-based water resources by 2025 (IPCC, 2007). Since the mid-1980s Libya has been building the ‘Great Man-made River’ project. This massive system of underground pipes and wells, which will eventually cost the Libyan government US\$ 25 billion, has already begun to transport ‘fossil water’ from the Nubian sandstone aquifer system under the Sahara to the populated coast.⁶

In some regions of Africa water interdependence is very high; for example, the 17 countries in West Africa share 25 transboundary rivers (Boko et al., 2007), the Nile Basin extends over 10 countries and the Nubian sandstone aquifer is shared by four countries. This means that economic progress is intimately tied to water management elsewhere—often a rationale for better cooperation, but also a cause for tension and conflict.

Figure 2: Water scarcity in Africa



3.1.2 The challenge of climate change

The principal impacts of climate change are shifts in precipitation patterns and a rise in temperature. Meanwhile, rising temperatures increase evaporation (from soil and rivers) and evapo-transpiration (from plants) and reduce the amount of available water in lakes and rivers (known as 'blue' water) and in the soil ('green' water).

There is widespread agreement that climate change and variability are likely to impose additional pressures on water availability and accessibility in Africa (IPCC, 2007). Using a range of scenarios the IPCC estimates that by 2020 an additional 75 to 250 million people in Africa are likely to be at risk of increased water stress. By 2050 this population is projected to be between 350 and 600 million (IPCC, 2007).

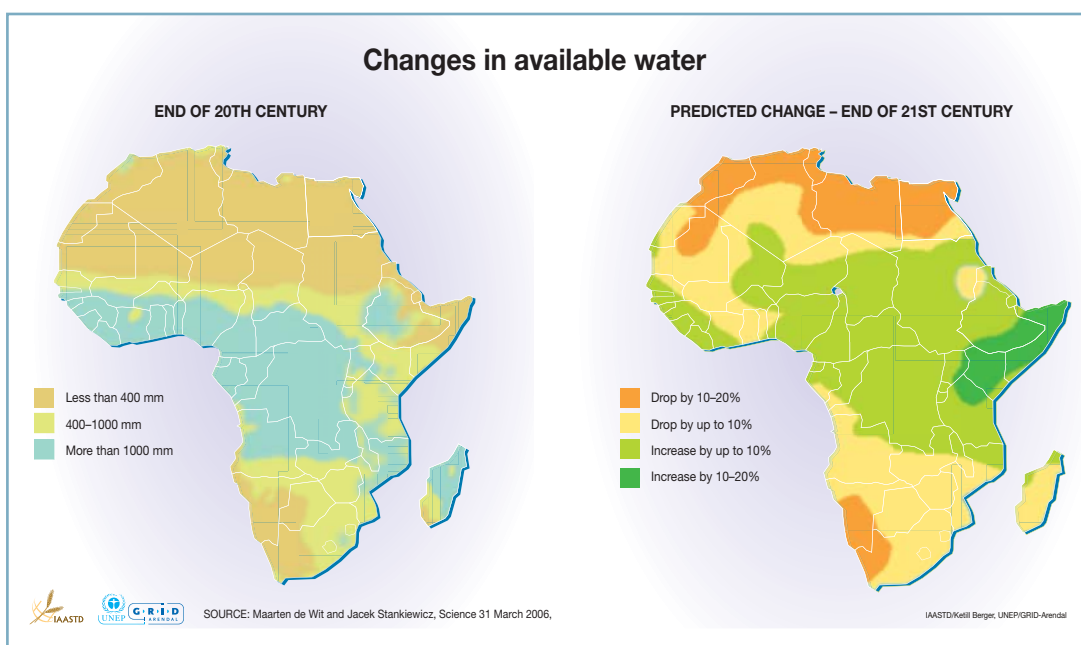
But these averages hide a great deal of regional variation. Climate change will aggravate the water stress currently felt by some countries, may relieve it in others, while still other countries that are not currently water stressed will become at risk. Increased variability of rainfall will also pose problems for the capture and storage of water between periods of heavy rainfall. Ethiopia, Senegal and Guinea, for example, are able to store less than 10 per cent of their annual requirement (Brown and Lall, 2006).

3.1.3 The link to conflict

The extent to which interstate conflict over water could occur in future is controversial. According to one study, historical data would imply that water is not a reliable cause of interstate conflict: between 1945 and 1999 the importance of water led to twice as many instances of cooperation as conflicts between countries sharing the same water (Wolf et al., 2005). Indeed there are some striking examples of cooperation over water between fundamentally hostile parties (e.g., between Israel and Palestine, and India and Pakistan).

But water is rarely an isolated problem; it can be highly politically sensitive and is closely connected with other socio-economic and foreign policy issues. The twin pressures of demand growth and climate change may put existing international management mechanisms, such as those governing the Nile, under severe strain. Gleditsch et al. (2006) found that shared river basins increase the likelihood of conflict between neighbouring countries (see Box 2). The UN has identified nine river basins in Africa that are at risk for the onset of tensions or conflict, among them the Kunene, Okvanago, Zambezi, Limpopo, Orange and Nile (ISDR, 2004). According to Garcia (2008), "the water equation in these countries is complicated by numerous inter- and intra-state conflicts, lack of cooperative regimes for water sharing, or antiquated international laws."

Figure 3: Changes in available water during the 21st century



Source: IAASTD/Ketill Berger, UNEP/GRID-Arendal

Other research points to water being a source of conflict at a community level—particularly in cases where no formal rules or agreements on the use of the water resources had been agreed (WBGU, 2007). Focusing on community-level conflict, Raleigh and Urdal (2007) found an empirical link between reduced freshwater resources and an increased likelihood of conflict. There is also tension when water resources are diverted from agricultural areas to cities and the industries located there (Brown and Crawford, 2008). Likewise Nyong and Fiki (2005) argue that recurrent droughts interacting with other social and economic factors have resulted in conflicts among rural populations in the West African Sahel. These conflicts, they argue, have increased in their frequency, intensity and the magnitude of the destruction caused by them.

3.2 Decreased food security

3.2.1 Food insecurity in Africa

In 2004, 1.1 billion people were undernourished in the world—230 million of whom were in Africa (UNDP, 2007). Although global food production more than doubled between 1961 and 2003 the growth in agricultural production in Africa has not kept pace with population growth (WBGU, 2007). Food insecurity is, of course, a more complex problem than the simple availability of food; it is a function of poverty, poor

governance and inequity within countries. Nevertheless, within the last decade food shortages have affected 25 African countries and placed as many as 200 million people “on the verge of calamity” (CNA, 2007). Since 2001 consecutive droughts in southern Africa have led to serious food shortages. According to the UN’s Office for the Coordination of Humanitarian Assistance (OCHA), the 2002–03 drought alone left an estimated 14 million people in need of food aid.

3.2.2 The challenge of climate change

Given Africa’s high dependence on rain-fed agriculture, food production on the continent is intimately tied to rainfall. African farmers have developed many different ways to cope with existing climate variability (such as contour bunding, Zai agriculture). However such innovations may not be sufficient for future climate pressures. According to a study quoted in WBGU (2007) climate change will result in an increase in drylands and areas under water stress by 2080. As a result of climate change this arid and semi-arid area could expand by five to eight per cent, equalling a loss of productivity in another 50 to 90 million hectares of arable land.

The IPCC notes that the causal contribution of climate to food insecurity in Africa is still not fully understood, particularly the role of other multiple stresses that enhance the impacts of droughts and floods and possible future climate change (IPCC, 2007). Nevertheless, they suggest that unabated climate change could, by 2080,

Box 2: International waters: The case of the Nile Basin

Serious inter-state conflict over water in the Nile Basin, shared by 10 countries, has long been predicted. Hostilities did break out between Egypt and Sudan in the 1950s over Egypt’s plan for the Aswan High Dam. Although this was settled by a treaty in 1959¹ no similar agreement exists with Ethiopia, where most of the Nile’s flow is sourced (ISDR, 2004).

Egypt is water stressed and will become increasingly so as a result of population growth and rising demand (in 2000 Egyptian total water use was estimated at 68.3 km³, already nearing the available resources of 78.2 km³ per year). Egypt is entirely reliant on the waters of the Nile, which flows through Sudan; meeting growing demand in Egypt would require taking a larger share. Meanwhile, population (and demand) pressures in upstream countries that are tributary to the Nile are growing (the population of Ethiopia, for example, is expected to increase from 85 million to 183 million by 2050 (UNFPA, 2008)).

Since the early 1990s, the Nile Basin Initiative has coordinated management between the 10 countries in the region¹ that share the watershed. But climate change, population growth and increased demand from agriculture will put this system under new pressures. At the same time sea-level rise will threaten the heavily populated Nile Delta which is vital to the Egyptian economy both in agricultural and industrial terms.

Reductions in annual flow of the Nile of just 20 per cent would interrupt normal irrigation (Simms, 2005). According to Andrew Simms (2005), “such a situation could cause conflict because the current allocation of water, negotiated during periods of higher flow, would become untenable.” Sudan is seeking to irrigate the Sahel but Ethiopia has claimed that any Sudanese attempt to divert water from the Nile would provoke a military response. Likewise Egypt has threatened to clash with Sudan or Ethiopia over any effort by either to manipulate the waters that flow into the Nile (Campbell et al., 2007).

mean an *additional* 30–170 million people suffer from malnutrition or under-nutrition, of whom three-quarters will live in sub-Saharan Africa.

In countries that rely on agriculture in coastal zones such as Kenya (mangoes, cashew nuts and coconuts); Benin (coconuts and palm oil); Guinea (rice); and Nigeria, where coastal agricultural land accounts for about 75 per cent of the total arable land, rising sea levels will impact negatively on food supplies (ECOSOC, 2008). It is predicted that Egypt, for example, will be affected both by temperature increases and sea-level rise. The first would increase evapo-transpiration from the soil and the water needs of agriculture, resulting in declining yields. The second would inundate some of the most fertile and densely populated land in Egypt. According to a report for the German government, a sea-level rise of 37cm by 2060 would cause food self-sufficiency in Egypt to decline from 60 per cent in 1990 to 10 per cent by 2060 (Brauch, 2002).

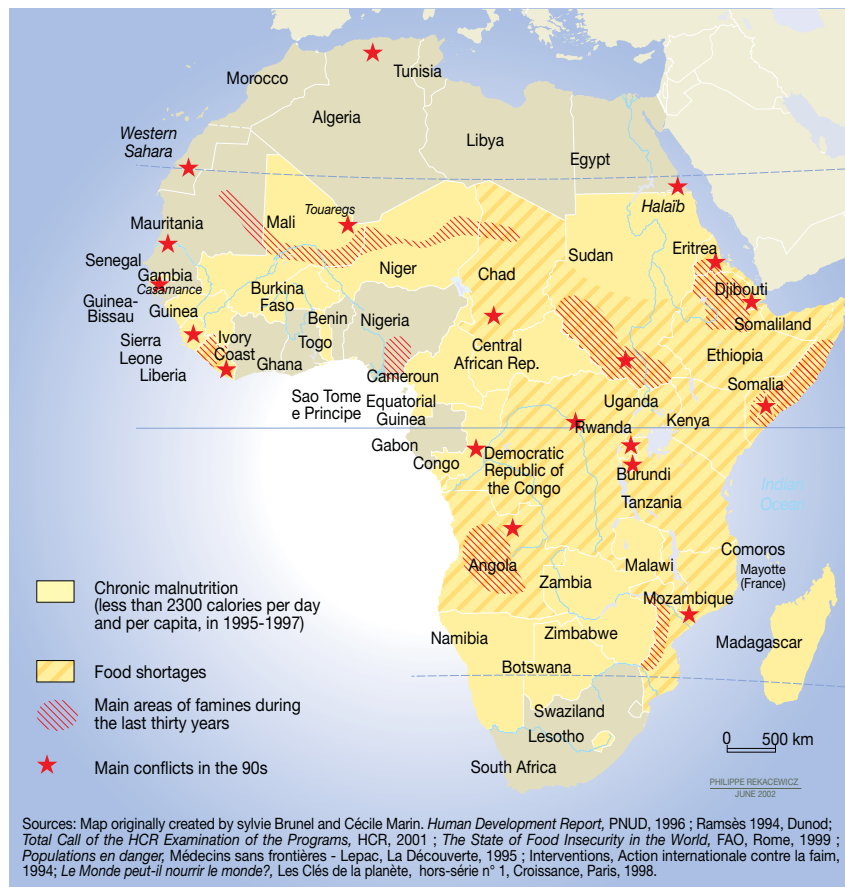
3.2.3 The link to conflict

The German Advisory Council on Global Change (WBGU, 2007) argues that drops in food production could trigger regional food crises and further undermine the economic performance of weak and unstable states. Nyong and Fiki (2005) argue that conflict in sub-Saharan African countries has been associated with per capita annual declines in food production of over 12 per cent.

If climate change leads to drops in agricultural production on a wide scale, prices of many agricultural commodities may rise, leaving individuals and countries financially overstretched. Food crises would be amplified in countries with existing inequality: if the majority of the population is hungry while a small minority is unaffected, outbreaks of violence are more likely than if the entire population is negatively affected (Kaplan, 1985).

However, whether a decline in food production leads to violent conflict will be determined by a complex range of other social, economic and demographic factors. In

Figure 4: Food insecurity in Africa



Source: Philippe Rekacewicz, UNEP/GRID-Arendal

general the greater the part played by agriculture in employment and national food security as a whole, the more vulnerable a country is to the economic effects of a decline in agricultural production. Countries with higher incomes may be able to rely on food imports to offset domestic drops in production, but this option may not be open to poorer countries.

3.3 Large-scale climate-induced migration

3.3.1 Existing refugee crises in Africa

According to figures from UNHCR (2008), at the end of 2007 around 67 million people were forcibly displaced as a result of conflict, persecution and natural disasters. Sixteen million of those fell under the UNHCR and UNRWA mandates as political refugees. The number of internally displaced persons (IDPs) was estimated at 51 million worldwide; some 26 million were displaced as a result of armed conflict and another 25 million were displaced by natural disasters.

Already more than 30 per cent of the world's refugees and internally displaced people are housed by African countries (Garcia 2008). North Africa is already a migration destination (for internal as well as cross-border migrants), and is a transit area for people from sub-Saharan Africa and Asia attempting to reach Europe. In

certain locations, this has already given rise to problems of social unrest and attacks on migrants as well as human trafficking and an increasing number of fatalities from attempted sea crossings.

3.3.2 The challenge of climate change

Climate change and its impacts will affect a growing number of people, and migration hotspots around Africa are likely to increase. Climate change will cause population movements by making certain parts of the world much less viable places to live: by causing food and water supplies to become more unreliable; undermining livelihoods; through sea-level rise and flooding that reduces available land; and by increasing the frequency and destructive power of storms (Brown, 2008b). This in turn may force large numbers of people to leave their homes and communities.

Often living on marginal land, in disaster-prone areas and with few resources in reserve, Africa populations are particularly vulnerable. One-third of the African population already live in drought-prone areas. Six of the 10 largest cities in Africa are located on the coast (Garcia, 2008). The Niger delta alone is home to 20 million people (CNA, 2007). In West Africa, 40 per cent of the population lives in coastal cities, and it is expected that by 2020 the coastline between Accra and the Niger Delta will be fully urbanized, with more than 50 million inhabitants (Hewawasam, 2002).



Africa is already home to more than 30 per cent of the world's refugees and internally displaced people; climate change could add to these numbers. iStockphoto

Estimates for the number of ‘climate migrants’ vary but perhaps the best-known was made by Norman Myers who, looking ahead to 2050, argued that “when global warming takes hold there could be as many as 200 million people [displaced] by disruptions of monsoon systems and other rainfall regimes, by drought of unprecedented severity and duration, and by sea-level rise and coastal flooding” (Myers, 2005).

This migratory pressure can be expected to increase due to heightening stress and tensions in the rest of Africa, and in the Sahel in particular: by 2020 the population of the Sahelian countries will have quadrupled since 1960. Furthermore it is estimated that between 2025 and 2050 the population of North Africa will increase by around 50 million (UN DESA, 2005).

3.3.3 The link to conflict

Migration itself is not inherently problematic, and indeed it can be an important way of adapting to the impacts of climate change. However, experience shows that migration can increase the likelihood of conflict in transit and target regions (WBGU, 2007). Barnett and Adger (2005) argue that the influx of migrants into new areas has been a significant factor in many ‘environmental conflicts’. What does seem to be the most important factor in violent conflict are the political and institutional responses to migrants.

Large population movements are already recognized by the UN Security Council as constituting a potential threat to international peace and security, particularly if there are existing social and ethnic tensions (Sindico, 2005). Large-scale population displacement will redraw the ethnic map of many countries, bringing previously separate groups into close proximity with each other and in competition for the same resources. In the context of poor governance, poverty and easy access to small arms these situations may turn violent (Brown, 2008b).

For example, in the 1970s and 1980s hundreds of thousands of Malians and Burkinabe travelled to Côte d’Ivoire to find work and food and to escape the threat of desertification caused by severe drought. Although originally welcoming, government policy changed in the 1990s when a policy of ‘Ivoryité’ was established. The resulting tension between the *indigènes* and the migrants contributed to the civil war that broke out in 2002 (Mabey, 2008).

Nyong (2007) notes that over the course of the twentieth century decreasing rainfall in the Sahel has pushed northern pastoralists southwards into land occupied by sedentary farmers, leading to conflicts and widespread destruction of farmland and cattle. Meanwhile, to meet the growing needs for food, farmers are expanding into marginal lands traditionally used by pastoralists, heightening competition between livestock and agricultural production.

However, Nyong warns that we need to understand such conflicts in their socio-economic context. In addition to marking a transition from pastoral to agricultural production, the Sahel is a zone of cultural and linguistic transition, where the Islamic culture from the north mingles with the traditional cultures of the south. The region’s large number of different ethnic groups—as well as in-migration from several new ones—creates the potential for conflict, as these groups have different interests in the resource base, possess different skills, and claim rights over different resources and areas (Nyong, 2007).

3.4 The impact of climate change on poverty and state fragility

3.4.1 Poverty and state fragility in Africa

Africa is the world’s poorest continent. Almost half the population of sub-Saharan Africa lives on less than one dollar a day. The region has experienced only sporadic growth in the last 40 years and despite some improvements during this decade, Africa as a whole is not growing fast enough to keep up with the rest of the world, let alone to achieve eventual convergence with developed countries.

There are many complex reasons for this: inadequate governance, crippling debt, limited infrastructure, disease and inadequate healthcare, reliance on natural resources and ongoing cycles of conflict. Life expectancy remains low at 49.6 years; no other region in the world is less than 60 years (UNDP, 2007). Together these factors inhibit the ability of many countries and communities to adapt to the impacts of climate change. Poorer countries are likely to have fewer resources and less stamina to deal with climate change, even in its early, modest manifestations (Campbell et al., 2007).

Meanwhile, seventeen countries in Sub-Saharan Africa are included in lists of the world’s most fragile states: Burundi, Chad, Central African Republic, Côte d’Ivoire, Democratic Republic of Congo, Liberia, Nigeria, Sudan, Angola, Ethiopia, Guinea, Sierra Leone, Somalia, Zimbabwe, Cameroon, Guinea-Bissau and Malawi (Smith and Vivekananda, 2007).

Natural disasters already have devastating impacts; for example, the two cyclones that hit in Mozambique in 2000 displaced 500,000 people and left 950,000 people dependent on humanitarian assistance. Beyond the human toll (an estimated 500,000 dead from the Sahelian droughts spanning the 1960s to the 1990s, for example), the economic losses are significant: several hundred million U.S. dollars were lost in the African droughts of the mid-1980s, primarily in the Sahel, Horn of Africa and across the south of the continent (Boko et al., 2007).

While improvements have been made in health services (reductions in infant and under-five mortality, for instance), significant challenges remain. HIV/AIDS infection rates top 25 per cent in many southern African countries. An estimated 700,000 to 2.7 million people die of malaria each year, 75 per cent of which are African children. The economic burden is estimated to be up to 1.3 per cent of GDP in those countries with high malaria prevalence (IPCC, 2007).

3.4.2 The challenge of climate change

Climate change could undermine economic growth and inhibit poverty reduction in numerous ways. Droughts will impact hydroelectric power generation, which accounts for 80 per cent of total electricity production in 18 African countries (ISDR, 2004). Tourism will also be affected. In the western Indian Ocean region a 30 per cent loss of corals from a coral bleaching event in 1998 and 1999 during an El Niño episode resulted in reduced tourism in Mombasa and Zanzibar, and caused financial losses of US\$ 12–18 million (IPCC, 2007).

In Ghana, a quarter of the population of 22.5 million live within the coastal belt and the government estimates that a sea-level rise of one metre could put 132,000 people at risk (EPA, 2000). Agriculture accounts for 35 per cent of GDP but is heavily dependent on certain cash crops, such as cocoa, which may be affected by increasing temperatures. If rainfall decreases over the Sahel to the north reduced water flow from the Volta river would lower available water for irrigation and also put pressure on the power supply (hydroelectric generation from the Akosombo Dam accounts for 60 per cent of energy in the country).

Tensions with the population in the arid, underdeveloped northern part of the country might increase—a pattern that may be replicated in neighbouring Côte d'Ivoire, Togo and Benin, as well as Senegal (Brown and Crawford, 2008). Meanwhile, oil production and stability in the Niger delta may be threatened by sea-level rise.

The World Health Organization has argued that the spread of infectious diseases is likely to be a major consequence of climate change (Simms, 2005). Malaria represents a particular and additional threat in Africa; a high proportion of the world's 300–500 million cases of malaria are found on the continent (Simms, 2005). The Stern Review (2006) estimated that by 2100 between 165,000 to 250,000 more children may die each year from a variety of causes than would be the case in a world without climate change.

3.4.3 The link to conflict

The cumulative impacts of increasing food and water insecurity, mass population movements, more extreme natural disasters and the burden of more prevalent diseases threaten to strain or overwhelm the capacity of governments to meet the basic needs of their people. Fundamentally, climate change threatens to exacerbate these trends and undermine governments' ability to ensure security and stability.

A general link between a country's level of economic development and its propensity for conflict is widely acknowledged (Collier and Hoeffler, 2004). Miguel, Satyanath and Sergenti (2004) tried to estimate the effect of economic shocks on the likelihood of conflict in Sub-Saharan Africa. Because the region is agrarian and



Intense competition over declining natural resources is one of the underlying causes of the ongoing conflict in Sudan. Pictured above: a military escort of the African Union Mission in Sudan (AMIS). Source: UNEP, 2007

irrigation is not widely practised they argued that rainfall was a plausible instrument for economic growth. Using data on rainfall variability they found that increased rainfall tended to increase economic growth and reduce the risk of conflict.

The report of the German Advisory Council on Global Change (WBGU, 2007) argues that North Africa in particular faces the potential for political crisis and increased migratory pressure as a result of the interaction between increasing drought and water scarcity, high population growth, a drop in agricultural potential and 'poor political problem-solving capabilities' (see Box 3).

Natural disasters have also been linked to conflict. From a study of 171 storms and flood disasters since 1950, each involving at least 1,000 victims, a clear connection was established in 12 cases between the natural disaster and the intensification of conflict or a political crisis (CRED, 2006). Military analysts have also made a link between state fragility and the appearance of radical movements (CNA, 2007). Like East Africa, the Indian Ocean coast of southern Africa (Madagascar and

Mozambique) is exposed to storms and sea-level rise, and remains vulnerable to flooding. Regionally, it is clear that growing water and food insecurity, coupled with the impact of migratory flows, will put increasing pressure on the provision of basic needs and may exacerbate existing ethnic and political tensions.

3.5 The unknown factor: Non-linear climate change

So far this report has dwelt on the implications of the relatively linear and conservative scientific predictions of climate change. However, there are growing concerns that as a result of innate scientific caution, incomplete data sets and a tendency for scientists to steer away from controversy these predictions have been consistently below what has actually transpired (Campbell et al., 2007). The threat of non-linear climate change, where feedback loops set in train dramatic changes in the Earth's climate, would have consequences for economic and political stability that are hard to model or predict with any degree of accuracy.

Box 3: Algeria: Recovery is at risk¹

Between 1992 and 2002 Algeria experienced a decade of bitter and bloody civil war that cost an estimated 150,000 lives. Since 2002, when elections were held amid continuing violence, the country has embarked on a tentative transition towards democracy and peace. Meanwhile, the country is attempting the difficult transition from a state-run to a market-oriented economy. Overall unemployment is around 25 per cent; although it is double that for those under 25 years of age.

Adding to an already stressed demographic situation are migrants from the south, some of whom continue to Europe while others settle in Algeria. With nowhere else to settle, many of these people end up in the cities or surrounding slums. This rapid urbanization exacerbates the environmental stress that already exists in the cities, such as poor air and water quality.

Algeria is expected to face serious climate change in the form of increased and faster desertification, as well as increasing water and food insecurity. Only three per cent of Algeria's land is arable: not nearly enough to provide food for its population. This means that Algeria has to import 45 per cent of its local food needs and more than half of its grain. The little viable farmland that exists is at risk of desertification, a process that is expected to accelerate under climate change. Algeria's dependence on food imports is likely to increase and its food security may be extremely vulnerable to international grain shortages.

Armed insurgent groups are still active and the country is in a state of socio-economic turmoil. It has been in an official State of Emergency since 1992, with wide-ranging powers for the state and limits on freedoms for political parties. Its continuation today is justified by the government on the basis of the War on Terror. However, many of the issues that led to war in the 1990s have not been resolved and there are militant Islamist groups that are committed to violently overthrowing the state.

Smith and Vivekananda (2007) conclude, "Though there is a long way to go on the road to peace, the government has made progress and life for ordinary Algerians is much improved as a result. But in combination with other long-standing economic, social and conflict problems, the effects of climate change risk overwhelming the coping ability of both the Algerian people and the state."

A young population means that by 2050, 22 per cent of the world's people—an estimated two billion—will live in Africa. Source: iStockphoto



Section 4:

Strategies for Peace and Development in a Changing Climate

4.1 The challenge of climate change

While our climate has always been in a state of flux, scientific evidence now points to unprecedented changes in climate patterns that present African governments with a range of daunting development challenges: how to meet the water and food needs of a growing population; how to increase communities' resilience to drought and floods; how to expand economies in spite of potentially more adverse and unpredictable weather; and how to share increasingly scarce resources between different sectors of society and the economy.

If left unchecked, these challenges will inhibit the ability of governments to provide basic services, they will undermine employment and livelihoods, they will lead to unplanned and destabilizing migration, and they may inflame tensions between neighbouring communities and countries over shared resources. Cumulatively, they threaten to make developing countries more fragile and to push already-fragile states towards collapse.

Conflict is not inevitable

While it is clear that environmental stress can increase the severity, duration and collateral impacts of a conflict, environmental factors are rarely, if ever, the sole cause of violent conflict. Climate change is perhaps best seen as a 'threat multiplier' that intensifies existing problems and vulnerabilities (CNA, 2007). African governments and communities will need to manage these shifts to mediate competition for resources, and minimize tensions over climate-induced migrants. Ultimately the extent to which climate change triggers "a succession of new wars" in Africa, as UNEP's report (2007) on Sudan predicted, depends more on governments and governance than on the strength of the climate 'signal' itself.

Context is key

It is non-climate factors (such as poverty, governance, conflict management, regional diplomacy and so on) that will largely determine whether and how climate change moves from being a development challenge to presenting a security threat. It is an error to try and over-simplify the

"It is not predicting the future that matters, but being prepared for it"

Pericles, Greek Statesman, 493–429 BC

relationships—people do not experience climate change in isolation of the many other factors that affect their lives. Climate change will exacerbate existing problems and create some new ones but if there were no climate change many of those problems would still exist. Many parts of Africa are already experiencing severe problems of available land, water and food. By broadly labelling most environmental change-related security issues as being the result of climate change, we risk inadvertently limiting the range of possible responses (Paskal, 2007).

4.2 Climate change as a reason for better cooperation?

Clearly, the challenge of climate change is one that is beyond the capacity of any one country to tackle. Ultimately, its shared security implications will be best resolved through cooperation at a myriad of levels: cooperation to develop comprehensive international strategies to manage forced migration, to share the most innovative approaches for adaptation and to administer shared resources. With this sentiment in mind this report concludes with four broad strategies that, together, may address the security challenges of climate change.

Strategy 1 Improve projections and predictions

Traditionally, the international community has been poor at developing effective 'early warning' systems to predict conflict over political, ethnic or economic issues. Adding the meteorological uncertainties of climate change to the mix adds a whole new layer of uncertainty to such an exercise. It is unlikely that the international community will ever be able to generate models of sufficient complexity and nuance to forecast where climate-induced conflict may break out with accuracy. Nevertheless, there is much progress that could be made on understanding climate change and its impacts in Africa so as to generate more effective responses. In particular there is a need for:

- Better projections of climate change in Africa, and a better understanding of the interaction between climate change and conflict. This will help to delineate potential 'hotspots' and assist policy-makers in taking appropriate measures to prevent or manage conflict;
- More investment in climate data and analysis capabilities on the continent (more down-scaled, sub-national climate data and projections through investments in establishing and maintaining weather stations, in human resources and in capacity for meteorology);
- International cooperation on the provision of climate information. This is vital to enable developing countries to access current scientific data on the regional impacts of climate change; and

- Research agendas that are inclusive of determining migratory flows, 'vulnerability assessments' and conflict risks.

Strategy 2 Minimize dangerous climate change

Climate change presents a major threat to the prospects for sustained economic growth and development in Africa. The security impacts of climate change will be determined by the extent of climate change. That, in turn, is a result of the greenhouse gases that accumulate in the atmosphere. Efforts to mitigate global warming must be supported. In particular, efforts should be made to:

- Facilitate an ambitious and determined shift in the way the world produces and uses energy;
- Ensure global agreement on stronger commitments to reduce greenhouse gas emissions at the COP-15 meeting in Copenhagen while fully recognizing Africa's legitimate development needs;
- Invest in clean energy projects, and provide support for avoided deforestation; and
- Support the widespread provision of clean energy in Africa, through the transfer of renewable energy technology.

Strategy 3 Adapt to the impacts of climate change

Regardless of whether the international community manages to strike an ambitious deal to succeed the Kyoto Protocol, the inherent inertia of the climate systems (in that past emissions will cause future warming) means that a certain amount of climate change is 'locked in'. This means that African countries will need to adapt to the changes that a warming climate will force on them (Boko et al., 2007).

Vulnerabilities to conflict and climate change are often shared. It follows that adaptation to climate change, if managed carefully, can also tackle some of the core causes of conflict. There have been a number of excellent initiatives that have recommended specific action on climate change adaptation—the report of the Africa Commission (2008) on the Challenge of Climate Change is but one example.⁷ In terms of the conflict implications of climate change particular efforts should be made to:

- Build the capacity of national governments to address climate risks, by *inter alia*, ensuring better water management, promoting agricultural development and developing more effective disaster management and early warning systems;
- Provide substantial and predictable financial support from development partners to help meet the additional costs of adaptation, including the development of climate-related information and early warning systems;

- Undertake climate sensitive urban planning and the construction of climate-resilient infrastructure (drainage, housing, transport systems, etc.);
- Generate a better understanding of successful adaptive strategies occurring at the local level, share strategies for 'best practice' adaptation and integrate the impact of climate change into national development strategies and existing policies including security risk assessments;
- Educate women on adaptive strategies, as they are primarily those involved in agricultural production; and
- Ensure that adaptation strategies are conflict sensitive: they should neither undermine adaptive strategies elsewhere nor crowd out other important development concerns.

Strategy 4 Integrate climate change into all relevant levels of governance

The available predications, projections and perspectives need to be integrated at every relevant level of government, regional and international policy. At the international level, efforts should be made to sustain attention of the international community on the security risks of climate

change and enhance international cooperation on the detection and monitoring of security threats. The international community needs to follow through on its aid and peacekeeping commitments to Africa, and sustain attention and support for failing and fragile states. African countries must improve their governance if they are to avoid the debilitating effects of climate change. In particular:

- African governments must strengthen their conflict prevention and peacebuilding mechanisms and ensure that an understanding of foreseeable climate change is integrated into their strategies;
- Regional mechanisms for the management of shared resources such as transboundary rivers need to be supported and strengthened, and must be adaptable to changing situations;
- National Adaptation Programmes of Action must be put in place. Care needs to be taken that these plans are conflict sensitive and that they take into account the socio-political and economic context and differing conflict dynamics; and
- Negotiations in other areas such as trade and investment need to be developed in a way that compliments mechanisms to deal with climate change.

“Batta li a ifi ise agoura li arin egun”

[“With shoes, one can walk on thorns”]

Yoruba proverb, West Africa

Endnotes

¹ Climate change represents potentially the most serious of a range of environmental drivers of conflict that have been identified in recent decades. This research has followed several different paths. Authors like Westing (1986), Mathews (1989) and Homer-Dixon (1991) argued there is a direct link between environmental conditions, resource scarcity and the outbreak of violent intra- and inter-state conflict, particularly in developing regions. Myers (1989, 1993) was among the first to predict that climate change would cause broad-based population displacements. Bohle et al. (1994) made the connection between climate change and food security and Döös (1994) predicted that climate change would exacerbate food shortages caused by land degradation. Molvaer (1991) warned that land degradation was becoming a source of conflict between agriculturalists and pastoralists in the Horn of Africa. Hekstra (1990) and Lewis (1990) noted that increases in sea-level posed significant risks to the populations of small-island states and low-lying coastal areas. Meanwhile, McGregor (1994) suggested that care needed to be taken that population displacements did not, in turn, affect access to food in the places where 'climate refugees' might try to find shelter or resettle.

² <http://www.number10.gov.uk/Page13736>

³ http://change.gov/agenda/energy_and_environment_agenda/

⁴ African nations, in both absolute and per capita terms, emit CO₂ at a level that's insignificant on the global scale. On average, each resident of sub-Saharan Africa produces less than a tonne of CO₂ per year, as compared with an average European's output of 8.2 tonnes of CO₂ and the average North American's of 19.9 tonnes (Brown et al., 2007).

⁵ The seven different climatic zones are: tropical rainforest; tropical wet and dry; tropical dry; mountain; Mediterranean; middle latitude dry; and humid subtropical (Eriksen et al., 2008).

⁶ http://en.wikipedia.org/wiki/Great_Manmade_River

⁷ <http://www.africacommission.um.dk/en/menu/Consultations/Conferences/TheChallengeOfClimateChange>

Annex 1:

Summary of the Impacts of Climate Change in Africa by 2099

By 2099	Low warming scenario	Mid warming scenario	High warming scenario
CO ² concentrations	600ppm	850ppm	1,550ppm
Global temperature	1.8°C	2.8°C	4.0°C
Global sea-level rise	0.18–0.38m	0.21–0.48m	0.26–0.59m
Water	<ul style="list-style-type: none"> • 20–30% decrease in water availability in vulnerable areas 	<ul style="list-style-type: none"> • Precipitation in sub-tropical areas falls by up to 20% • Annual mean rainfall increases by 7% in East Africa • Precipitation decrease of 20% along Mediterranean coast 	<ul style="list-style-type: none"> • 30–50% decline in water availability in southern Africa
Agriculture and food	<ul style="list-style-type: none"> • 5–10% decline in African crop yields 	<ul style="list-style-type: none"> • 550 million additional people at risk of hunger 	<ul style="list-style-type: none"> • Decrease of 15–35% in agricultural yields across continent
Extreme events	<ul style="list-style-type: none"> • Up to 10 million more people affected by coastal flooding globally 	<ul style="list-style-type: none"> • Coastal flooding affects between 11 and 170 million additional people per year globally • 10–20% increase in cyclone activity, southern Indian Ocean 	<ul style="list-style-type: none"> • 420 million people exposed to flooding globally • Tens of millions displaced by extreme weather events and climate processes

Source: IPCC, 2007

Annex 2:
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Annex 3:

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Climate change—by redrawing global maps of water availability, food security, disease prevalence and coastal boundaries—could potentially increase forced migration, raise tensions and trigger new conflicts.

Africa, though the continent the least responsible for greenhouse gas emissions, is almost universally seen as the continent most at risk of climate-induced conflict—a function of the continent's reliance on climate-dependent sectors (such as rain-fed agriculture) and its history of resource, ethnic and political conflict.

In this report, prepared for the Nordic-African Foreign Ministers Meeting in Copenhagen in March 2009, IISD examines the implications of climate change for African security, and lays out strategies for peace and development in a changing climate.

The International Institute for Sustainable Development contributes to sustainable development by advancing policy recommendations on international trade and investment, economic policy, climate change, measurement and assessment, and natural resources management. Through the Internet, we report on international negotiations and share knowledge gained through collaborative projects with global partners, resulting in more rigorous research, capacity building in developing countries and better dialogue between North and South.

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