

BACKGROUND PAPER

**Climate Change Impacts
on the Progress towards and the Sustainability of
MDG Achievement across Africa**

**Prepared by the International Institute for Environment and Development
for the 10th Meeting of the African Partnership Forum**

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Executive summary

The overview table below shows some of the more striking findings of this paper.

The main conclusions of the paper are:

- *No empirically based studies of how climate change will impact on the achievement and sustainability of the MDGs across Africa were found.* Both the UNDP and the UNFCCC have made assertive statements as to how and what is the likelihood that climate change will affect the MDGs;
- *Evidence does exist as to the ways that current climate variability is, and climate change will, affect the livelihoods of the poor and the sectors important to MDG achievement.* This evidence includes documented observation and projections developed from climate models. Available evidence of both direct and indirect impacts of climate change on the achievement and the sustainability of the achievement of the Millennium Development Goals across Africa is presented in the overview table below and the summary of evidence table in section 3;
- *The MDGs most susceptible to direct climate change impacts are - MDG 7 particularly increased access to potable water, MDG 1 - progress on food security, and MDG 6 in respect of prevalence and death rates associated with malaria.* The available information on progress towards MDG achievement across African countries demonstrates the complicated picture of development across the continent (a summary of evidence is available in Table 1, section 3).
- *A series of indirect impacts of climate change on MDGs can also be identified. These include how extreme weather events (droughts, floods, storm surges etc) have highly differentiated impacts that disadvantage the poor and vulnerable groups such as women, children and the elderly. Such hazards impact MDG 2 – universal primary education, MDG 3 – gender equality, MDG 4 – reduce child mortality and MDG 5 – improved maternal health.*
- *The prognosis of how exactly how climate change will affect Africa is extremely complex and as yet poorly understood. The consensus of evidence shows that due to several reasons Africa will be affected earlier and more severely than other parts of the world.* A summary of what is known about the ways climate variability and climate change is and will affect Africa is presented in section 2.
- *Intersections of projected severe climate change effects and socio-economic vulnerability can be identified across African countries. Parts of Africa where MDG achievement is most challenged are also most susceptible to climate change effects.* This review of evidence reveals a complex mosaic of checkered progress towards the MDGs overlaid with a series of likely climate change impacts.

Overview Table – Climate change impacts on MDG achievement and sustainability across Africa

1. Eradicate extreme poverty and hunger - <i>Agricultural production and food security, access to clean and abundant water resources and adequate incomes underpin eradication of poverty and hunger – all are vulnerable to climate change</i>		
Climate effects	Sector	Impacts
Warming More/ less & erratic rainfall Sea level rise Increase in extreme weather events Warming – seas Storm surges	Agriculture – crops	<ul style="list-style-type: none"> •Dryland crop productivity likely to decline by 25% per hectare by 2060 giving an overall revenue loss of US\$26 billion - a figure in excess of bilateral aid to the region in 2005 •Decreases in productivity of rain-fed and semi-arid systems due to decreased length of growing period. Deficiencies in yields from rain-fed agriculture of up to 50% during the 2000-2020 period, and reductions in crop growth period •Southern Africa likely to experience notable reductions in maize production under possible increased ENSO conditions. Wheat production likely to disappear from Africa by the 2080s. Danger that extreme food insecurity episodes, such as those that have frequently affected countries like Malawi, will become more common
	Agriculture – livestock	<ul style="list-style-type: none"> •Increases and spread of both livestock disease pathogens and vectors through changes in moisture and temperature e.g. Rift Valley Fever epidemics associated with flooding could increase with a higher frequency of El Nino events. Spread of trypanosomiasis through modification of habitats suitable for tsetse fly will exacerbated by climate variability and climate change •Increased draught incidence will reduce viability of pastoralist production systems in some areas •Heat stress will impact on animal health and production particularly of dairy and intensive pig & poultry systems
	Fisheries	<ul style="list-style-type: none"> •Temperature rises of 1.5 to 2.0°C enough to reduce fisheries in North West Africa and the East African lakes •Changes in freshwater flows and greater intrusion of salt water into lagoons will affect the species that are the basis of inland fisheries or aquaculture •Extreme wind and turbulence could decrease coastal fisheries productivity by 50-60%, while turbulence will bring a 10% decline in productivity in the spawning grounds
	Livelihoods of the poor	<ul style="list-style-type: none"> •Climate shocks - drought and floods - cause grave setbacks in nutritional status as food availability declines, prices rise and employment opportunities shrink •By 2080, the number of additional people at risk of hunger could reach 600 million - twice the number of people living in poverty in sub-Saharan Africa today •Impacts on agriculture by 2050 mean 25% of the population in Namibia will need to find new livelihoods. Displaced rural people likely to move to the cities causing fall in wages of up to 24% for unskilled labourers

2. Ensure that all children remain in school and receive a high-quality education - *Climate change stresses pose additional burdens on agricultural production and other subsistence activities like water collection, which may burden families enough to remove children from school. Climate change also threatens to destroy infrastructure (e.g. schools) and increase the displacement and migration of families thus disrupting and limiting education opportunities*

Climate effects	Sector	Impacts
Warming More/ less and erratic rainfall Sea level rise Increase in extreme weather events	Education	<ul style="list-style-type: none"> •In Zimbabwe - the longevity of human development impacts linked to climate shocks – found that drought delays the start of school and resulted in a loss of 0.4 years of schooling. The education losses translated into a 14 percent loss of lifetime earnings •The forced trade-offs that follow climate shocks can rapidly erode human capabilities, setting in train cycles of deprivation. Children suffer as families decide to reduce the number of meals they eat, cut spending on health, or withdraw their children from school to increase labour supply •In Ethiopia, children aged five or less are 36 percent more likely to be malnourished and 41 percent more likely to be stunted if they were born during a drought year and affected by it. •Kenya, being born in a drought year increases the likelihood of children being malnourished by 50 percent •In Ghana, half of children in the drought prone north are malnourished, compared with 13 percent in Accra •Research has found that girls' nutrition suffers most during periods of low consumption and rising food prices, and that rainfall shortages are more strongly associated with deaths among girls than boys

3. Promote gender equality and empower - *Poverty has a woman's face. Of the world's 1.3 billion people living in poverty, 70% are women; women do about 66% of the world's work in return for less than 5% of its income. Because two-thirds of children who are denied primary education are girls, women make up 75% of the world's illiterate adults*

Climate effects	Sector	Impacts
Warming More/ less and erratic rainfall Sea level rise Increase in extreme weather events	Various	<ul style="list-style-type: none"> •Women contribute much of the labour that will go into coping with climate risks through soil and water conservation, the building of anti-flood embankments and increased off-farm employment •Rural women in developing countries are the primary producers of staple food, a sector that is highly exposed to the risks that come with drought and uncertain rainfall. •In many countries, climate change means that women and young girls have to walk further to collect water, especially in the dry season •Gender bias in the impact of disasters is also under-reported. When disasters strike, they hurt whole communities - but women often bear the brunt. Floods frequently claim far more female victims because their mobility is restricted and they have not been taught to swim. When Bangladesh was hit by a devastating cyclone and flood in 1991, the death rate was reportedly five times higher among women. •In the aftermath of a disaster, restrictions on the legal rights and entitlements of women to land and property can limit access to credit needed for recovery •Indian women born during a drought or a flood in the 1970s were 19 percent less likely to ever attend primary

4. Reduce child mortality, 5. Improve Maternal Health, 6. Combat HIV/AIDS, malaria and other diseases - *Climate change will worsen health through: reduced food security and water security; water-borne diseases associated with floods and drought; the spread of vector-borne and air-borne diseases; and the direct link between temperatures and heat stress*

Climate effects	Sector	Impacts
Warming More/ less and erratic rainfall Sea level rise Increase in extreme weather events	Health	<ul style="list-style-type: none"> •Children and pregnant women particularly susceptible to vector- and water-borne diseases. Severe malaria is already more common in areas of low to moderate transmission, such as the highlands of East Africa and other areas of seasonal transmission. A recent epidemic in Rwanda, led to a four-fold increase in malaria admissions among pregnant women and a five-fold increase in maternal deaths •In eastern Africa, flooding in 2007 created new breeding sites for disease vectors such as mosquitoes, triggering epidemics of Rift Valley Fever and increasing levels of malaria. •Climate variability will interact with other background stresses and additional vulnerabilities such as immuno-compromised populations (HIV/AIDS) and conflict and war, resulting in increased susceptibility and risk of other infectious diseases (e.g. cholera) and malnutrition •Previously malaria-free highland areas in Ethiopia, Kenya, Rwanda and Burundi likely to experience modest incursions of malaria by the 2050s, with conditions for transmission becoming highly suitable by the 2080s. By this period, areas currently with low rates of malaria transmission in central Somalia and the Angolan highlands could also become highly suitable

7. Ensure environmental sustainability - *Climate change threatens environmental sustainability because it will cause fundamental alterations in ecosystem relationships, change the quality and quantity of available natural resources, & reduce ecosystem productivity. The poor depend on these resources for their day-to-day survival and livelihoods in many parts of the developing world*

Climate effects	Sector	Impacts
Warming Less and erratic rainfall Extreme weather events	Water resources	<ul style="list-style-type: none"> •The east-west band from Senegal to Sudan is identified as 'critical & unstable' in terms of water resources. Parts of southern Africa are projected to experience significant losses of runoff. Regional assessments report emerging declines in the hydrology of major water systems e.g. Okavango River basin, which will be negatively impacted by changes in climate •Increased water stress and decrease runoff in parts of North Africa by 2050. The Ouergha watershed in Morocco is likely to undergo changes during 2000-2020 - a 1°C temperature rise could reduce runoff by 10%.

8. Develop a global partnership for development - *Climate change threatens to exacerbate current challenges to the achievement of the MDGs. Funding for development and adaptation must be greatly increased to meet the needs of the poor*

Climate effects	Sector	Impacts
	Diplomacy and policy	<ul style="list-style-type: none"> •Developed countries have fallen short of targets they have set for themselves to achieve wide-reaching development objectives •Increased aid and debt relief, as well as effectiveness, must be accompanied by further opening of trade, accelerated transfer of technology

1. Introduction

Africa is the continent most vulnerable to the negative effects of climate change and faces the greatest challenges to adapt. Poverty, conflict, disease, governance problems, an unjust international trading system, and the debt burden hinder the ability of communities and nations to handle environmental shocks and climate change impacts.

In Africa natural resources form the foundation of the economy of most countries, from which the majority of the population derives their livelihood. Biodiversity in Africa, which principally occurs outside formally conserved areas, is under threat from climate change and other stresses. Savannahs, tropical forests, coral reef marine and freshwater habitats, wetlands and East Africa montane ecosystems are all at risk.

The poor in Africa, especially those living in marginal environments and in areas with low agricultural productivity depend directly on genetic, species and ecosystem diversity to support their way of life. As a result of this dependency, any impact that climate change has on natural systems will threaten the livelihoods, food intake and health of the population.

In 2001 the International Panel on Climate Change explained six situations that make Africa particularly vulnerable to climate change, these are:

- Water resources, especially in international shared basins where there is a potential for conflict and a need for regional co-ordination in water management
- Food security at risk from declines in agricultural production
- Natural resources productivity and biodiversity at risk
- Vector- and water-borne diseases, especially in areas with inadequate health infrastructure
- Coastal zones vulnerable to sea-level rise, particularly roads, bridges, buildings, and other infrastructure that is exposed to flooding
- Exacerbation of desertification by changes in rainfall and intensified land use

1.1 Objective

“Sustainable development and adaptive capacity for coping with climate change have common determinants ... climate change has the potential to affect the progress of nations and societies towards sustainability” (Yohe et al 2007, 4AR).

The overall objective of this document is to provide a literature survey regarding the impact of climate change on progress towards the MDGs in Africa, including on the sustainability of this progress.

A search of the literature revealed no systematic assessment of the effects of climate change on the achievement and sustainability of the MDGs in Africa. However, there are many assertions made in different publications as to the likelihood of climate change impacting

upon the timing of the achievement of different MDGs and the way climate change will challenge the processes required to maintain the levels of MDG indicators.

Different agencies concur that climate change has the potential for substantial effects on aspects of sustainability important for the achievement of the MDGs over the medium term (e.g. UNDP 2002, IIED 2005, Hellmuth et al 2007, Yohe et al 2007, UNDP 2007). The recent IPCC Fourth Assessment Report (AR4) and the 2007/8 UN Human Development Report (UNHDR 2007/2008) provide evidence both of current and projected climate effects on MDGs.

In the AR4 Yohe et al (2007) conclude - with a *very high confidence* level - that climate change will impede nations' abilities to achieve sustainable development pathways as measured, for example, by long-term progress towards the Millennium Development Goals (MDGs). The authors assert that climate change will make it more difficult for nations to achieve the MDGs for the middle of the current century.

Following an innovative set of analyses on climate change impacts the UNHDR 2007/2008 found that "the incremental risks associated with climate change are pushing up the costs of achieving human development goals, especially the MDGs. That is why increased adaptation financing should be seen in part as a response to the increased financing requirements for delivering on the MDG targets, in 2015 and thereafter" (UNHDR 2007/2008).

However, this area is not without contested interpretations of evidence. Yohe et al (2007) also state that climate change – attributable to anthropogenic sources - will not be a significant extra impediment to nations reaching their 2015 Millennium Development Targets since there are many other obstacles with more immediate impacts. The literature is inconclusive on how sensitive the metrics used to measure MDG achievement will be to either the effects of climate change or to progress on managing its drivers, especially in the near term. As the short-term targets of the MDGs (2015 to 2020) are unassailable for many countries in Africa and elsewhere, the possibility of separating out the climate change impacts is slight in most cases in the short to medium term.

This document reviews the reliable evidence on how climate change will impact upon the processes important in maintaining MDG achievements.

1.2 Main sources of information and the gaps

Section 2 - **Climate change across Africa** – draws on the work of the IPCC Working Group I and the AR4 Africa Chapter. The section also pulls together a set of climate modelling work by African and other scientists. Sir Gordon Conway (Chief Scientific Adviser, DFID, UK) kindly provided permission to use information from a paper he wrote recently on Science of climate change in Africa.

Section 3 - **The MDGs and climate change** – presents a compilation of evidence from the most recent reports by the IPCC, UNDP, World Bank, IFPRI, FAO, Red Cross and Crescent, UNECA, the Stern Review, WRI, and different international NGOs including the Up in Smoke coalition in the UK.

The evidence is provided in tabular form relating MDG, climate effects, sector and evidence of impacts (actual and projected). The climate effects are drawn from the compilation of climate effects collated by the UNFCCC from the developing countries National Communications.

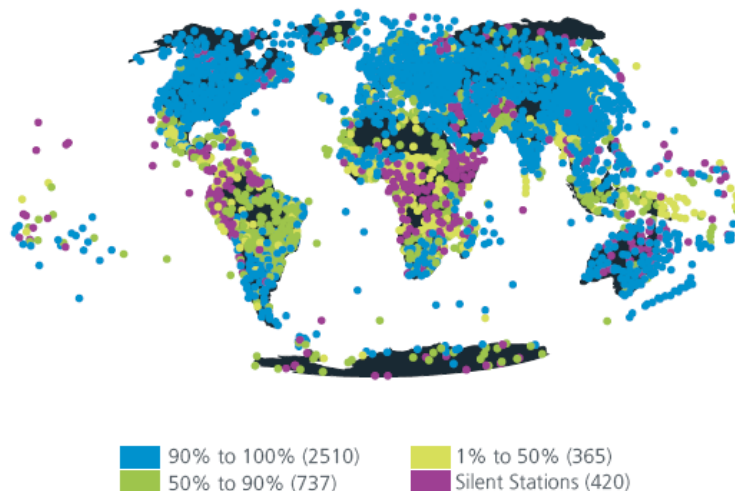
Most evidence of direct impacts was found for MDG1, MDG 6 and MDG 7. Evidence and strong inferences can be made about indirect climate impacts on MDG 2, MDG 3, MDG 4 & MDG 5. Where possible evidence is presented at a sector and country level. Where this is not possible evidence is presented by region and sector.

2. Climate change across Africa¹

Far too little is known about the African climate, its drivers and their links to global warming. There is also a paucity of continuous and detailed information on the African weather. The global network of World Watch Weather Stations which provides real time weather data is very poorly represented across Africa. There are only 1152 stations in Africa, a density of about 1 per 26,000 km² which is eight times lower than the level recommended by the World Meteorological Organisation. Moreover, the location of the stations is very uneven. Vast areas of central Africa are unmonitored, including Central Africa and the Horn of Africa (see Figure 1).

This lack of knowledge makes it very difficult to predict with any degree of accuracy what will happen as a result of climate change at a country, or even sub-regional level in Africa.

Figure 1 Reports received by the World Meteorological Office from World Weather Watch Stations 1998 – 2002



¹ The section draws with kind permission on a draft paper written by the Chief Science Adviser – Sir Gordon Conway – of the UKs Department for International Development.

Difficulties persist with modeling climate projections for Africa. Christensen et al (2007, p866) summarized these difficulties as:

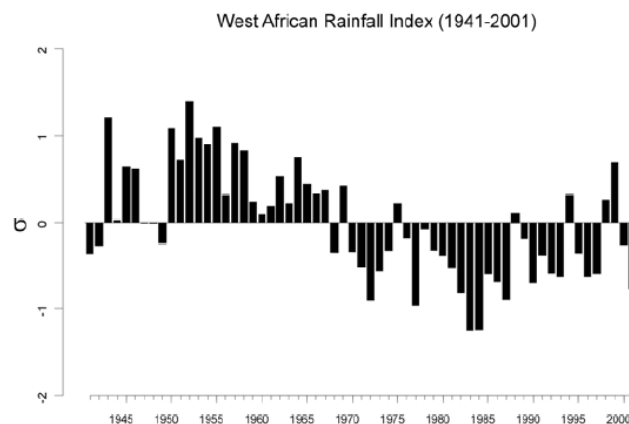
- Significant systematic errors in and around Africa. These include excessive rainfall in the south, southward displacement of the Atlantic Inter-Tropical Convergence Zone (ITCZ), and insufficient upwelling off the West Coast. This makes it difficult to assess the consequences for climate projections.
- The absence of realistic variability in the Sahel in most 20th-century simulations casts some doubt on the reliability of coupled models in this region. Vegetation feedbacks and feedbacks from dust aerosol production are not included in the global models.
- Possible future land surface modification is also not taken into account in the projections. The extent to which current regional models can successfully downscale precipitation over Africa is unclear, and limitations of empirical downscaling results for Africa are not fully understood.
- There is insufficient information on which to assess possible changes in the spatial distribution and frequency of tropical cyclones affecting Africa.

2.1 Observed effects

Africa's climate is highly diverse and variable encompassing the extreme aridity of the Saharan deserts and the extreme humidity of the Congo rainforest. Overlying these patterns are the effects of global warming.

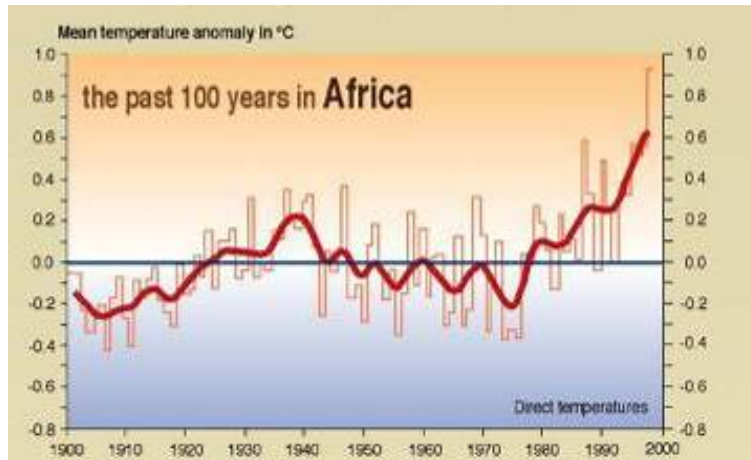
For example, the countries of the Sahel experience multi-decadal periods of drought such the current period (see Figure 2). There have been several since the last glaciation. Whether or not the current period is such a natural episode or is a product of global warming is unknown. A plausible explanation is that the current drought is a product of a combination of factors including the effects of climate change, land degradation, water pollution and biomass burning. Whatever the cause, global warming will exacerbate such droughts and other natural extremes.

Figure 2



There is already evidence that Africa is warming faster than the global average and this is likely to continue (see Figure 3). Although the overall trend is widespread, there are variations. For example, the tropical forests have warmed by 0.29°C per decade, southern and western Africa have seen an increase in the number of warm spells and a decrease in the number of extremely cold days, but in eastern Africa temperatures have fallen close to the coasts and major inland lakes.

Figure 3 African average temperatures for the past 100 years



2.2 Expected effects

Despite the various complications in modelling and prediction and the unknowns what is likely to happen in the near term is that Africa will get warmer (colder in some places), generally drier but also more floods in some regions. There will be more intense tropical cyclones, higher sea levels, more storm surges and, in general, there will be more variation and extreme events.

Many regions of Africa are going to suffer from droughts and floods with greater frequency and intensity. The south east coast of Africa is subject to periodic tropical cyclones that originate over the Seychelles from October to June due to the southward displacement of the ITCZ. Rising sea surface temperatures are likely to increase cyclone intensity and there are some estimates of greater cyclone frequency, but cyclones are affected by many factors.

The AR4 provides a summary assessment of climate change projections for Africa. The key elements are (information below is adapted from Christensen et al, 2007 p866):

Warming:

- All of Africa is very likely to warm during this century more than the global average. Annual mean warming will be throughout the continent and in all seasons, with drier subtropical regions warming more than the moister tropics.

Rainfall:

- Annual rainfall is likely to decrease in much of Mediterranean Africa and northern Sahara, with the likelihood of a decrease in rainfall increasing as the Mediterranean coast is approached. Rainfall in southern Africa is likely to decrease in much of the winter rainfall region and on western margins. There is likely to be an increase in annual mean rainfall in East Africa. It is uncertain how rainfall in the Sahel, the Guinean Coast and the southern Sahara will evolve in this century.

The differences in land surface temperatures between the years 2080 to 2099 and the years 1980 to 1999 from climate model projections are shown in Figure 4 below. The temperatures are averaged over the West African (WAF), East African (EAF), South African (SAF) and Saharan (SAH) subregions and are displayed with the temporal evolution.

The general tendency is for the drier subtropical regions to warm more than the moister tropics. Northern and southern Africa will become much hotter (as much as 4-6°C) and drier in the summer, with a much greater risk of drought. The exceptions are in East Africa, including the Horn of Africa, and parts of Central and West Africa where average rainfall will increase (see Figure 5).

The increasing rainfall variability is already apparent. Inter-annual rainfall variability is large over most of Africa and, for some regions, multi-decadal variability is also substantial.

In Zimbabwe, for example, there are more cooler and hotter days, and the length and depth of the drier periods is increasing (see Figure 6). In southern Africa as a whole, the frequency of extremely dry winters and springs increases to roughly 20%, while the frequency of extremely wet summers doubles. As in other parts of the world, we can expect a general increase in the intensity of high-rainfall events associated, in part, with the increase in atmospheric water vapour. In regions of mean drying, there is likely to be a proportionally larger decrease in the number of rain days, together with greater intensity of rainfall.

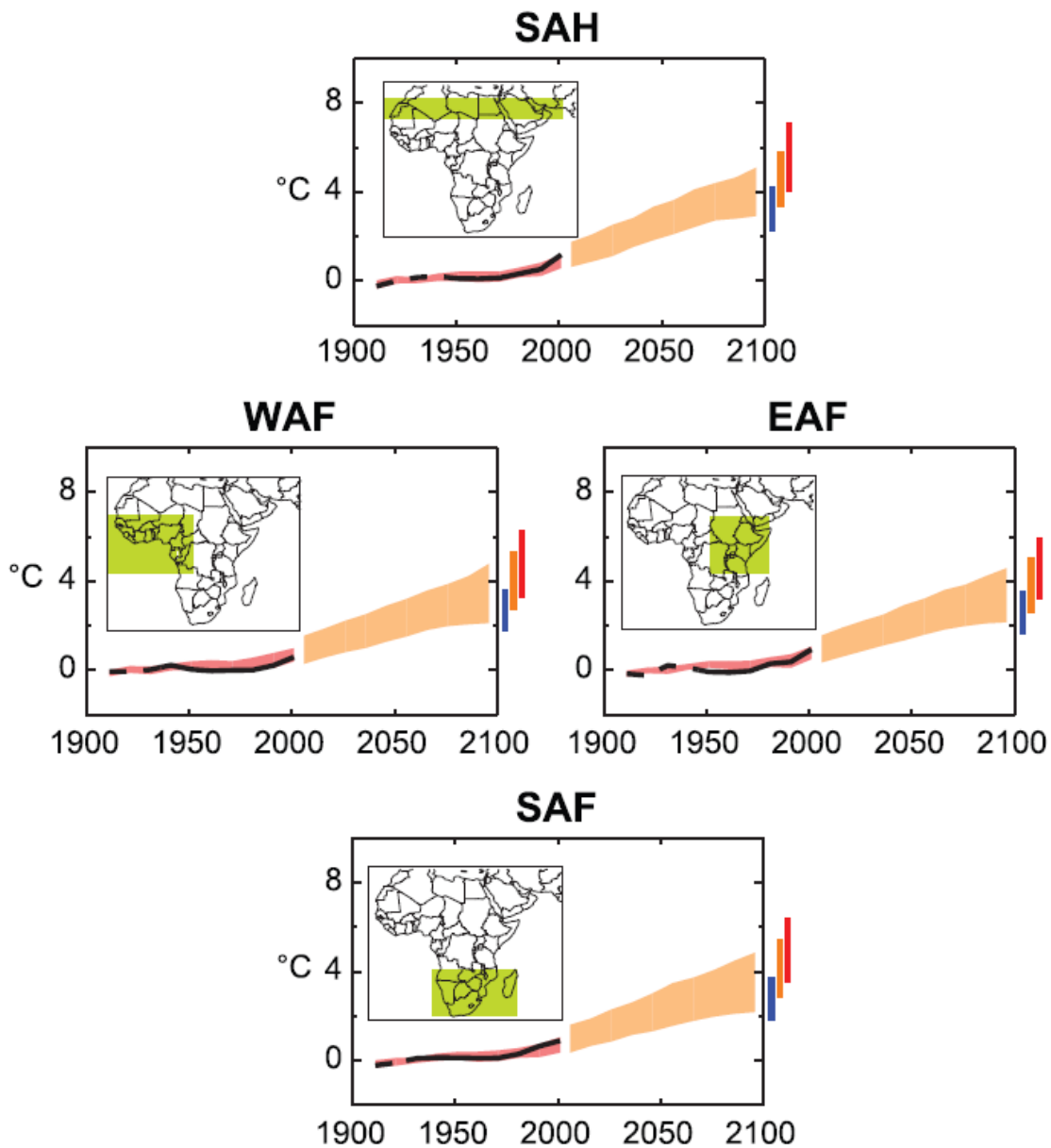


Figure 4. Temperature anomalies with respect to 1901 to 1950 for four African land regions for 1906 to 2005 (black line) and as simulated (red envelope) by models; and as projected for 2001 to 2100 by models for the A1B scenario (orange envelope). The bars at the end of the orange envelope represent the range of projected changes for 2091 to 2100 for the B1 scenario (blue), the A1B scenario (orange) and the A2 scenario (red). The black line is dashed where observations are present for less than 50% of the area in the decade concerned. [Taken from Christensen et al, 2007]

Figure 5. Temperature and rainfall projections for Africa, 1980 to 1999 versus 2080 to 2099 for scenario A1B

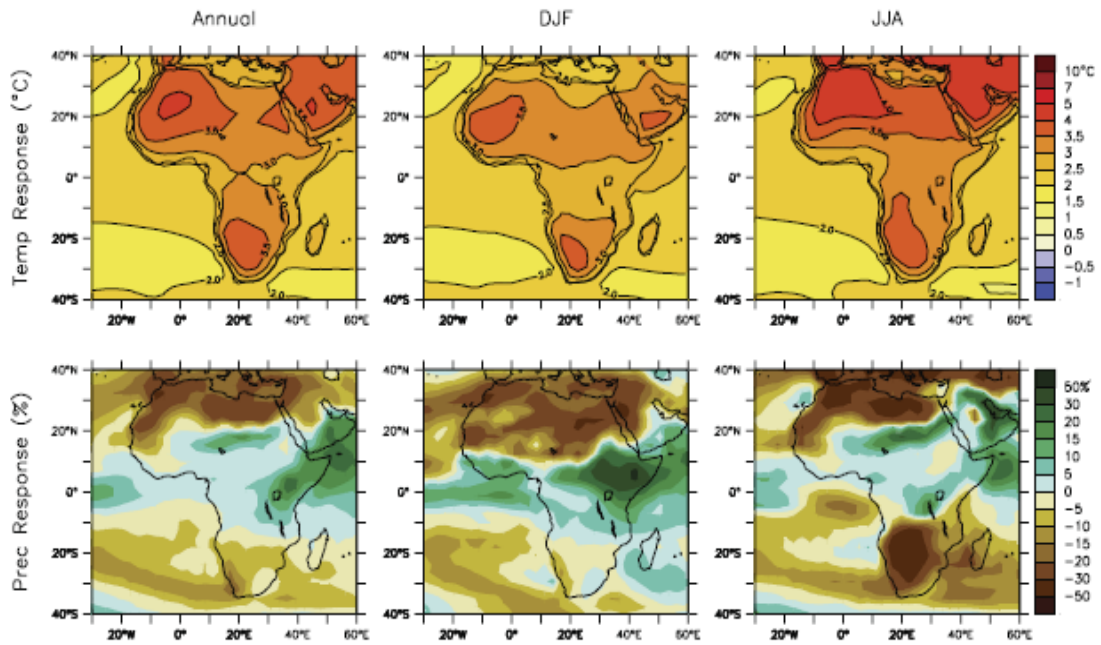
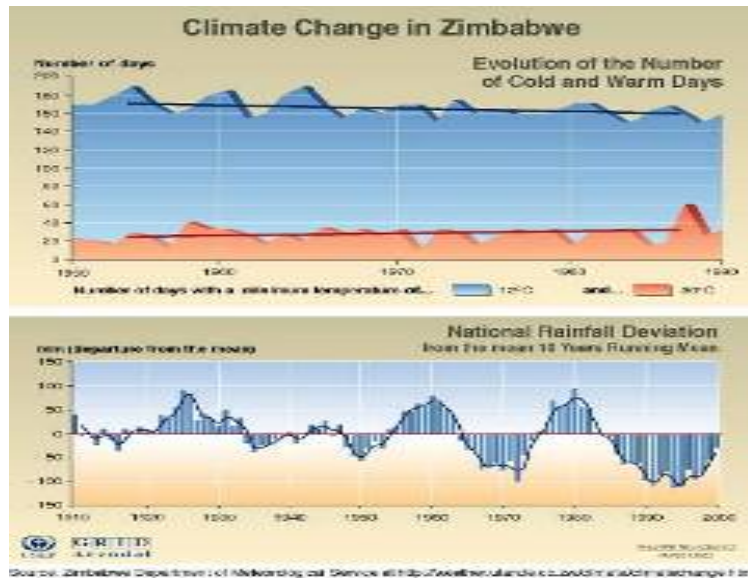


Figure 6. Increasing temperatures and rainfall variability in Zimbabwe



2.3 Expected impacts

The authors of the Africa study for the Stern Review concluded the following (Nkomo et al, 2006):

Sub-Saharan Africa

- Many vulnerable regions, embracing millions of people, are likely to be adversely affected by climate change, including the mixed arid-semiarid systems in the Sahel, arid-semiarid rangeland systems in parts of eastern Africa, the systems in the Great Lakes region of eastern Africa, the coastal regions of eastern Africa, and many of the drier zones of southern Africa (see Thornton et al 2006)
- Between 250–550 million additional people may be at risk of hunger with a temperature increase of 3°C, with more than half of these people concentrated in Africa and Western Asia. Climate change will decrease - and/or shift - the areas of suitable climate for more than 80% of Africa's plant species and by 2085, a third of plant species could find they no longer have any suitable habitat
- Tens of millions of additional people could be at risk of malaria by the 2080s
- Previously unsuitable areas for malaria in Zimbabwe could become suitable for transmission with slight temperature and precipitations variations, whilst in South Africa the area suitable for malaria may double with 7.8 million people at risk by 2100
- Water scarcities will intensify as rainfall becomes more erratic, glaciers retreat and rivers dry up. While there is much uncertainty about flow of the Nile, several models suggest a decrease in river flow, with nine recent climate scenario impacts ranging from no change to more than 75% reduction in flows by 2100. This will have a significant impact on the millions of people that have competing claims on its supplies
- Many large cities in Africa that lie on or very close to the coast could suffer severe damages from sea level rise. According to national communications to the UNFCCC, a 1 meter sea-level rise (a possibility by the end of the century) could result in the complete submergence of the capital city of Gambia, and losses of more than \$470 million in Kenya for damage to three crops (mangoes, cashew nuts and coconuts)

North Africa

- The region is already very short of fresh water and faces difficulty meeting the needs of fast-growing populations. Most if not all the region may be adversely affected by changing rainfall patterns as a result of climate change. An additional 155 to 600 million people may be suffering an increase in water stress in North Africa with a 3°C rise in temperature
- Reduced water availability combined with even modestly higher temperatures will reduce agricultural productivity and in some areas may make crops unsustainable. Maize yields in North Africa, for example, could fall by between 15-25% with a 3°C rise in temperature according to one recent report
- Some parts of the region – notably the Nile Delta and the Gulf coast of the Arabian peninsula - are in addition vulnerable to flooding from rising sea levels which could lead to loss of agricultural land and/or threats to coastal cities. Others are vulnerable to increased desertification

3. The MDGs and climate change

3.1 Goals, targets & current status

Table 1 below sets out the Millennium Development Goals, some targets associated with Goals and the current status of North Africa, Sub-Saharan Africa and selected African countries for the targets. Where possible an assessment has been made of how likely the achievement of the MDG target is by 2015.

Table 1. Progress on Millennium Development Goals targets across Africa

MDG 1 - Eradicate extreme poverty and hunger			
People living on 1\$ (PPP) as % of population	1994	2004	2015 target
North Africa	2.2	2.4	1.1
Sub Saharan Africa	44.6	44	22
Senegal		17	
Egypt		45	
Ethiopia		23	
Burundi		55	
Tanzania		58	
Malawi		21	
% children under weight for age at 5yrs			
Senegal		17	
Egypt		6	
Ethiopia		38	
Burundi		45	
Tanzania		22	
Malawi		22	
MDG 2 - Ensure that all children remain in school and receive a high-quality education			
Net primary enrolments rate % of	1994	2004	2015 target
North Africa	81	94	100
Sub Saharan Africa	53	64	100
MDG 3 - Promote gender equality and empower women			
Ratio of illiterate women to men of 15 – 24 age group	1994	2004	2015 target
North Africa	0.73	0.91	1.00
Sub Saharan Africa	0.80	0.88	1.00

Table 1. cont.

MDG 4 - Reduce child mortality			
Under 5 mortality per 1000 births	1994	2004	2015 target
North Africa	88	37	29
Sub Saharan Africa	185	168	62
Senegal	279	235	Off track
Egypt	235	33	On track
Ethiopia	239	164	Off track
Burundi	233	190	Off track
Tanzania	218	122	On track
Malawi	341	125	On track
MDG 5 - Improve Maternal Health			
Proportion of deliveries attended by skilled health workers	1994	2004	2015 target
North Africa	40	71	100
Sub Saharan Africa	42	46	100
Senegal		58	
Egypt		74	
Ethiopia		6	
Burundi		25	
Tanzania		43	
Malawi		56	
MDG 6 – Combat malaria, tuberculosis, HIV/AIDS and other diseases			
Adult HIV/AIDS prevalence	1994	2004	2015 target
North Africa	<0.1	0.1	Stop increase
Sub Saharan Africa	2.7	5.8	Stop increase
Tuberculosis prevalence (cases per 100,000 excluding HIV infected)	1994	2004	2015 target
North Africa	64	52	Stop increase
Sub Saharan Africa	337	492	Stop increase
% children under 5 that sleep under insecticide treated bednets			
Senegal		14	
Egypt		-	
Ethiopia		1	
Burundi		1	
Tanzania		16	
Malawi		15	

Table 1. cont.

MDG 7 - Ensure environmental sustainability			
Proportion of land area covered by forest	1994	2004	2015 target
North Africa	1.3	1.5	
Sub Saharan Africa	29.2	26.5	
Access to improved water source (% of population)	1994	2004	2015 target
North Africa	89	91	94
Sub Saharan Africa	49	56	75
Senegal	65	76	Achieved
Egypt	94	98	Achieved
Ethiopia	23	22	Off track
Burundi	69	79	Achieved
Tanzania	46	62	On track
Malawi	40	73	On track
Access to improved sanitation (% of population)	1994	2004	2015 target
North Africa	65	77	83
Sub Saharan Africa	32	37	66
Senegal	33	57	On track
Egypt	54	70	On track
Ethiopia	3	13	Off track
Burundi	44	36	Off track
Tanzania	47	47	Off track
Malawi	47	61	On track
MDG 8 - Develop a global partnership for Development			
Share of ODA flows (% of donor GNI)	1994	2004	2015 target
OECD	0.33	0.22	0.7

3.2 Evidence of climate change effects

The evidence collated here covers the different ways that climate (current climate variability – as a precursor - and climate change) is and will continue to impact on the sectors that are central to achieving and sustaining the MDGs across Africa. The evidence is presented in the tables below. It is important to note that no studies were encountered in the review of literature that assessed how climate change will impact on the MDGs across Africa. Some general assertions have been made by authoritative bodies such as the UNDP and the UNFCCC as to what are the likely impacts of climate change on the MDGs but these have not been followed up with empirical studies.

Climate change impacts are expected on the timing, flow and amount of available freshwater resources. These will affect the ability of developing countries to increase access to potable water – MDG 7. In addition it is though likely that climate change will

have discernible consequences, in Africa, on the indicators of progress on food security – MDG 1. Added to this, evidence exists that climate change impacts will affect the prevalence and death rates associated with malaria over the medium term – MDG 6.

Evidence of both direct and indirect impacts of climate change on the MDGs are presented in Table 2 below. The table provides information on the MDG, some of associated targets, the current status of North Africa and Sub Saharan Africa with regard to progress on the targets, and the likely climate impacts on the MDG (these are taken from the UNFCCC National communications by non Annex 1 Parties and UNFCC sixth compilation and synthesis of initial national communications from Parties not included in Annex 1 to the Convention. Addendum 5 – Climate change impacts, adaptation measures and response strategies). For each MDG and for each relevant sector evidence from the reputable literature is presented on observed and projected impacts.

Table 2. Evidence of the ways that climate change will affect the achievement and sustainability of the MDGs across Africa

Please note that:

a) The climate impacts listed are taken from the UNFCCC National communications by non Annex 1 Parties and UNFCCC sixth compilation and synthesis of initial national communications from Parties not included in Annex 1 to the Convention. Addendum 5 – Climate change impacts, adaptation measures and response strategies;

b) The evidence listed is taken directly from the sources as numbered and listed at the end of the table.

MDG 1 - Eradicate extreme poverty and hunger				
People living on 1\$ (PPP) as % of population		1994	2004	2015
North Africa		2.2	2.4	1.1
Sub Saharan Africa		44.6	44	22
Climate impacts	Sector	Evidence [source]		
Productivity declines - in terms of crop yields, animal products offtake, & fish catches - reduce household incomes and/or worsen food security	Crops	<p>Information from climate projection research work</p> <ul style="list-style-type: none"> • Climate change will decrease the productivity of mixed rain-fed and semi-arid systems, particularly the length of the growing period on the margins of the Sahel [1] • Agricultural GDP losses range from 2% to 4% with some model estimations [1] • Food security, already a humanitarian crisis in southern Africa, is likely to be further aggravated by climate variability and change, aggravated by HIV/AIDs, poor governance and poor adaptation [1] • By 2100, parts of the Sahara are likely to emerge as the most vulnerable, showing likely agricultural losses of between 2 and 7% of GDP[1] • Wheat production is likely to disappear from Africa by the 2080s [1] • Southern Africa likely to experience notable reductions in maize production under possible increased ENSO conditions [1] • Deficiencies in yields from rain-fed agriculture of up to 50% during the 2000-2020 period, and reductions in crop growth period [1] • Agricultural activities could also be affected by climate change and variability, including changes in the onset of rain days and the variability of dry spells [1] • Growing seasons in certain areas (e.g. parts of the Ethiopian highlands and Mozambique), may lengthen under climate change, due to a combination of increased temperature and rainfall changes [2] 		
	Livestock	<p>Evidence of impacts from current increased climate variability</p> <ul style="list-style-type: none"> • Drought hit Niger hard in 2004/2005. It can take decades for livestock herds to recover previous numbers and health. Many pastoralist communities have never fully recovered from the disasters of the early 1970s and mid-1980s. By December 2005 over 326,000 malnourished children were being given special feeding in Niger, and thousands more in neighbouring countries [3] • In 2005/06 some 25 million people faced a serious food crisis across sub-Saharan Africa due to drought, 11 million of them in East Africa. Cows and goats, even camels, died in vast numbers. In East Africa, Oxfam 		

		<p>alone provided food and water to over 700,000 people in one of its biggest humanitarian operations [3]</p> <ul style="list-style-type: none"> • The demographic impacts on trypanosomiasis, for example, can arise through modification of the habitats suitable for the tsetse fly. These modifications can be further exacerbated by climate variability and climate change. Climate change is also expected to affect both pathogen and vector habitat suitability through changes in moisture and temperature [1] • Changes in disease distribution, range, prevalence, incidence and seasonality can all be expected. However, there is low certainty about the degree of change. Rift Valley Fever epidemics, evident during the 1997/98 El Nino event in East Africa and associated with flooding, could increase with a higher frequency of El Nino events. [1] • Finally, heat stress and drought are likely to have further negative impacts on animal health and production of dairy products, as already observed in the USA [1]
	Fisheries	<p>Information from climate projection research work</p> <ul style="list-style-type: none"> • With a rise in annual global temperature (e.g. of the order of 1.5 to 2.0°C) fisheries in North West Africa and the East African lakes are shown to be impacted [4] • In coastal regions that have major lagoons or lake systems, changes in freshwater flows and a greater intrusion of salt water into lagoons will affect the species that are the basis of inland fisheries or aquaculture [1] • In South Africa, fisheries could be affected by changes in estuaries, coral reefs and upwelling. Extreme wind and turbulence could decrease productivity by 50-60%, while turbulence will probably bring about a 10% decline in productivity in the spawning grounds and an increase of 3% in the main feeding grounds [5]
	Food security	<ul style="list-style-type: none"> • Climate shocks such as drought and floods can cause grave setbacks in nutritional status as food availability declines, prices rise and employment opportunities shrink. Deteriorating nutrition provides the most telling evidence that coping strategies are failing. The drought that swept across large areas of eastern Africa in 2005 illustrates the point. In Kenya, it put the lives of an estimated 3.3 million people in 26 districts at risk of starvation [6] • By 2080, the number of additional people at risk of hunger could reach 600 million — twice the number of people living in poverty in sub-Saharan Africa today [6] • Dryland agricultural systems will register some of the most damaging impacts from climate change. One study has looked at the potential implications for dryland areas in sub-Saharan Africa of a 2.9°C increase in temperature, coupled with a 4 percent reduction in rainfall by 2060. The result: a reduction in revenue per hectare of about 25 percent by 2060. In 2003 prices, overall revenue losses would represent around US\$26 billion in 2060 — a figure in excess of bilateral aid to the region in 2005. More broadly, the danger is that extreme food insecurity episodes, such as those that have frequently affected countries like Malawi, will become more common [6]

<p>Damage to livelihood assets, including homes, water supply, health, and infrastructure, can undermine peoples' ability to earn a living</p>	<p>Extreme weather events and disasters</p>	<p>Evidence of impacts from current increased climate variability</p> <ul style="list-style-type: none"> • The biggest threats to localized population concentrations posed by climate variability and change are often expected to be from little-characterised and unpredictable rapid-onset disasters such as storm surges, flash floods and tropical cyclones [1] • For the period 2000–2004, on an average annual basis one in 19 people living in the developing world was affected by a climate disaster (the comparable figure for OECD countries was one in 1,500 affected). In sub-Saharan Africa 10 million were affected by drought and 2 million by flooding, in many cases with near simultaneous episodes [6] • Droughts in the Horn of Africa and southern Africa during 2005 threatened the lives of over 14 million people across a swathe of countries from Ethiopia and Kenya to Malawi and Zimbabwe. In the following year, drought gave way to extensive flooding across many of the same countries [6] • While individual droughts in sub-Saharan Africa cannot be directly attributed to climate change, climate models predict systemic decreases in rainfall in sub-tropical areas—over 20 percent in some regions [6] • The record shows that droughts in sub-Saharan Africa have become more frequent and protracted. Tropical storms have increased in intensity. Climate change may not provide a full explanation, but it is heavily implicated [6]
<p>Changes in natural systems and resources, infrastructure and labour productivity may reduce income opportunities and affect economic growth</p>	<p>Ecosystems and natural resources</p>	<p>Information from climate projection research work</p> <ul style="list-style-type: none"> • Negative impacts of climate change could create a new set of refugees, who may migrate into new settlements, seek new livelihoods and place additional demands on infrastructure [1] • Populations of West Africa living in coastal settlements could be affected by projected rise in sea levels and flooding [1] • Ecosystem impacts, including impacts on mountain biodiversity, could occur. Declines in fisheries in some major East African lakes could occur [1] • In sub-Saharan Africa in particular, economic growth rates are closely tied to rainfall. Moreover, every US\$1 generated in agriculture in sub-Saharan Africa is estimated to generate up to US\$3 in the non-agricultural sector [6] • Due to impacts on agriculture by 2050 25% of the population in Namibia will need to find new livelihoods. Displaced rural people likely to move to the cities and this will cause a fall in real wages of up to 24% for unskilled labourers [8] • In sub-Saharan Africa, the areas suitable for agriculture, the length of growing seasons and the yield potential of food staples are all projected to decline. By 2020, between 75 million and 250 million more people in sub-Saharan Africa could have their livelihoods and human development prospects compromised by a combination of drought, rising temperature and increased water stress [6]

<p>Social tensions over resource use can lead to conflict, destabilising lives and livelihoods and forcing communities to migrate</p>	<p>Human security</p>	<p>Evidence of impacts from current increased climate variability</p> <ul style="list-style-type: none"> • The Turkana have names for the increasingly frequent droughts. The latest has been called <i>Atiaktiak ng'awiyei</i> or 'the one that divided homes' because so many families split up to survive, migrating in all directions to the borders, towns and relief camps [3] • Drought hit Niger hard in 2004/2005. It can take decades for livestock herds to recover previous numbers and health. Many pastoralist communities have never fully recovered from the disasters of the early 1970s and mid-1980s. By December 2005 over 326,000 malnourished children were being given special feeding in Niger, and thousands more in neighbouring countries [3] <p>Information from climate projection research work</p> <ul style="list-style-type: none"> • Climate models for Northern Kordofan in Sudan indicate that temperatures will rise by 1.5°C between 2030 and 2060, with rainfall declining by 5 percent. Possible impacts on agriculture include a 70 percent drop in yields of sorghum. This is against the backdrop of a long-term decline in rainfall that, coupled with overgrazing, has seen deserts encroach in some regions of Sudan by 100 km over the past 40 years. The interaction of climate change with ongoing environmental degradation has the potential to exacerbate a wide range of conflicts, undermining efforts to build a basis for long-term peace and human security [6]
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Table 2 cont

MDG 2 - Ensure that all children remain in school and receive a high-quality education				
Net primary enrolments rate % of		1994	2004	2015 target
North Africa		81	94	100
Sub Saharan Africa		53	64	100
Climate impacts	Sector	Evidence		
Loss of livelihood assets (natural, health, financial and physical capital) may reduce opportunities for full time education in numerous ways	Food security	<p>Evidence of impacts from current increased climate variability</p> <ul style="list-style-type: none"> • In Ghana, half of children in the drought prone northern region are malnourished, compared with 13 percent in Accra [6] • Research has found that girls' nutrition suffers most during periods of low consumption and rising food prices, and that rainfall shortages are more strongly associated with deaths among girls than boys [6] • Kenyan research shows that declines in the production of rainfed crops such as maize and beans harmed both people's diet and their purchasing power. In drought years health centres have reported an increase in malnutrition, with 30 percent of children seeking medical assistance found to be underweight compared to 6 percent in normal years [6] • Detailed household survey analysis in Zimbabwe demonstrates the longevity of human development impacts linked to climate shocks. Taking a group of children that were aged 1–2 years during a series of droughts between 1982 and 1984, researchers interviewed the same children 13–16 years later. They found that the drought had reduced average stature by 2.3 centimetres, delayed the start of school and resulted in a loss of 0.4 years of schooling. The education losses translated into a 14 percent loss of lifetime earnings [6] • In Ethiopia, children aged five or less are 36 percent more likely to be malnourished and 41 percent more likely to be stunted if they were born during a drought year and affected by it. This translates into some 2 million 'additional' malnourished children [6] • Kenya, being born in a drought year increases the likelihood of children being malnourished by 50 percent [6] • In Niger, children aged two or under who were born during a drought year and were affected by it are 72 percent more likely to be stunted, pointing to the rapid conversion of droughts into severe nutritional deficits [6] 		
Natural disasters and drought reduce children's available time (which may be diverted to household tasks), while displacement and migration can reduce access to education opportunities		<p>Evidence of impacts from current increased climate variability</p> <ul style="list-style-type: none"> • The forced trade-off s that follow climate shocks can rapidly erode human capabilities, setting in train cycles of deprivation. Children suffer as families decide to reduce the number of meals they eat, cut spending on health, or withdraw their children from school to increase labour supply [6] • Droughts and floods are often catalysts for wide-ranging health problems, including an increase in diarrhoea among children, cholera, skin problems and acute under-nutrition [6] 		

Table 2 cont

MDG 3 – Promote gender equality and empower women				
Ratio of illiterate women to men of 15 – 24 age group		1994	2004	2015 target
North Africa		0.73	0.91	1.00
Sub Saharan Africa		0.80	0.88	1.00
Climate impacts	Sector	Evidence		
Depletion of natural environment, including agriculture, affects women more than men (they depend more upon it for their livelihoods) leading to poor health and less time to engage in decision making and earning additional income exacerbating gender inequalities	Natural resources e.g. forest	<ul style="list-style-type: none"> Women contribute much of the labour that will go into coping with climate risks through soil and water conservation, the building of anti-flood embankments and increased off-farm employment [6] 		
	Agriculture	<ul style="list-style-type: none"> Rural women in developing countries are the primary producers of staple food, a sector that is highly exposed to the risks that come with drought and uncertain rainfall. One corollary of gender vulnerability is the importance of women's participation in any planning process for adaptation to climate change [6] 		
Women and girls typically care for the home and fetch water, fodder, firewood, and often food. During climate stress, they cope with fewer resources and a greater workload	Water	<ul style="list-style-type: none"> In many countries, climate change means that women and young girls have to walk further to collect water, especially in the dry season [6] 		
Female headed households with few assets are particularly affected by climate related disasters	Extreme events and disasters	<ul style="list-style-type: none"> Gender bias in the impact of disasters is also under-reported. When disasters strike, they hurt whole communities—but women often bear the brunt. Floods frequently claim far more female victims because their mobility is restricted and they have not been taught to swim. When Bangladesh was hit by a devastating cyclone and flood in 1991, the death rate was reportedly five times higher among women. In the aftermath of a disaster, restrictions on the legal rights and entitlements of women to land and property can limit access to credit needed for recovery [6] Indian women born during a drought or a flood in the 1970s were 19% less likely to ever attend primary school, when compared with women the same age who were not affected by natural disasters. The incremental risks associated with climate change have the potential to reinforce cycles of disadvantage [6] 		

Table 2 cont.

MDG 4 - Reduce child mortality & MDG 5 - Improve Maternal Health				
Under 5 mortality		1994	2004	2015 target
North Africa		88	37	29
Sub Saharan Africa		185	168	62
Proportion of deliveries attended by skilled health workers		1994	2004	2015 target
North Africa		40	71	100
Sub Saharan Africa		42	46	100
Climate impacts	Sector	Evidence		
Deaths and illness due to heat-waves, floods, droughts and hurricanes	Extreme weather events & disasters	Evidence of impacts from current increased climate variability <ul style="list-style-type: none"> During the 2002 food crisis in southern Africa, over half of households in Lesotho and Swaziland reported reduced health spending [6] 		
Children and pregnant women are particularly susceptible to vector-borne diseases (e.g. malaria and dengue fever) and water-borne diseases (e.g. cholera and dysentery) which may increase and/or spread to new areas – e.g. anaemia resulting from malaria is currently responsible for one quarter of maternal mortality	Health	Evidence of impacts from current increased climate variability <ul style="list-style-type: none"> Severe malaria-associated disease is more common in areas of low to moderate transmission, such as the highlands of East Africa and other areas of seasonal transmission. An epidemic in Rwanda, for example, led to a four-fold increase in malaria admissions among pregnant women and a five-fold increase in maternal deaths due to malaria [1] Some 800,000 children under the age of 5 in sub-Saharan Africa die as a result of malaria each year, making it the third largest killer of children worldwide. Malaria causes immense suffering, robs people of opportunities in education, employment and production, and forces people to spend their limited resources on palliative treatment. Rainfall, temperature and humidity are three variables that most influence transmission of malaria — and climate change will affect all three [6] In eastern Africa, flooding in 2007 created new breeding sites for disease vectors such as mosquitoes, triggering epidemics of Rift Valley Fever and increasing levels of malaria. In Ethiopia, an epidemic of cholera following the extreme floods in 2006 led to widespread loss of life and illness. Unusually dry and warm conditions in eastern Africa have been linked to the spread of <i>chikungunya</i> fever, a viral disease that has proliferated across the region [6] 		

Table 2 cont

MDG 6 – Combat malaria, tuberculosis, HIV/AIDS and other diseases				
Adult HIV/AIDS prevalence		1994	2004	2015 target
North Africa		<0.1	0.1	Stop increase
Sub Saharan Africa		2.7	5.8	Stop increase
Tuberculosis prevalence (cases per 100,000 excluding HIV infected)		1994	2004	2015 target
North Africa		64	52	Stop increase
Sub Saharan Africa		337	492	Stop increase
Climate impacts	Sector	Evidence		
Water stress and warmer conditions encourage disease	Environment	<p>Information from climate projection research work</p> <ul style="list-style-type: none"> • Results from the “Mapping Malaria Risk in Africa” project show possible expansions and contractions, depending on location, of climatically suitable areas for malaria by 2020, 2050 and 2080 [1] • By 2050 and continuing into 2080, for example, a large part of the western Sahel and much of southern central Africa is shown to be likely to become unsuitable for malaria transmission [1] • Assessments show that by 2100 changes in temperature and precipitation could alter the geographical distribution of malaria in Zimbabwe, with previously unsuitable areas of dense human population becoming suitable for transmission. Strong southward expansion of the transmission zone will probably continue into South Africa. [1] • Projected scenarios estimate a 5-7% potential increase - mainly altitudinal - in malaria distribution, with little increase in the latitudinal extent of the disease by 2100 [1] • Previously malaria-free highland areas in Ethiopia, Kenya, Rwanda and Burundi likely to experience modest incursions of malaria by the 2050s, with conditions for transmission becoming highly suitable by the 2080s • By this period, areas currently with low rates of malaria transmission in central Somalia and the Angolan highlands could also become highly suitable [1] • The highlands of eastern Africa and areas of southern Africa are likely to become more suitable for malaria transmission [1] • The potential for climate change to intensify or alter flood patterns may become a major additional driver of future health risks from flooding [1] • The probability that sea-level rise could increase flooding, particularly on the coasts of eastern Africa, may also have implications for health [1] 		

Households affected by AIDS have lower livelihood assets, and malnutrition accelerates the negative effects of the disease	Health	<p>Information from climate projection research work</p> <ul style="list-style-type: none"> • Climate variability will interact with other background stresses and additional vulnerabilities such as immuno-compromised populations (HIV/AIDS) and conflict and war in the future, resulting in increased susceptibility and risk of other infectious diseases (e.g., cholera) and malnutrition [1] • Apart from its immediate consequences for health, HIV/AIDS has created new categories of vulnerable groups. These include households lacking adult labour or headed by elderly people or children, and households with sick family members unable to maintain production. Women are faced with the triple burden of agricultural production, caring for HIV/AIDS victims and orphans, and collecting water and firewood. [6]
	Food security	<ul style="list-style-type: none"> • Almost all HIV/AIDS-affected households covered in a survey of the Malawi's central region reported reduced agricultural production. HIV/AIDS-affected groups will be in the front line facing incremental climate change risks [6]
		<ul style="list-style-type: none"> • The social and economic costs of malaria are huge and include considerable costs to individuals and households as well as high costs at community and national levels [1]
	Animal health & zoonotic disease	<p>Information from climate projection research work</p> <ul style="list-style-type: none"> • The demographic impacts on trypanosomiasis, for example, can arise through modification of the habitats suitable for the tsetse fly. These modifications can be further exacerbated by climate variability and climate change. Climate change is also expected to affect both pathogen and vector habitat suitability through changes in moisture and temperature [1] • Changes in disease distribution, range, prevalence, incidence and seasonality can all be expected. However, there is low certainty about the degree of change. Rift Valley Fever epidemics, evident during the 1997/98 El Nino event in East Africa and associated with flooding, could increase with a higher frequency of El Nino events. [1] • Climate change will impact on the migratory bird species, their breeding and non-breeding areas, migration routes, and stopover sites. This will influence and change the spread of highly pathogenic influenza H5N1 [7]

Table 2 cont

MDG 7 - Ensure environmental sustainability				
Proportion of land area covered by forest		1994	2004	2015 target
North Africa		1.3	1.5	
Sub Saharan Africa		29.2	26.5	
Access to improved water source (% of population)		1994	2004	2015 target
North Africa		89	91	94
Sub Saharan Africa		49	56	75
Access to improved sanitation (% of population)		1994	2004	2015 target
North Africa		65	77	83
Sub Saharan Africa		32	37	66
Climate impacts	Sector	Evidence		
Alterations and possible irreversible damage in the quality and productivity of ecosystems and natural resources	Water & sanitation	<p>Information from climate projection research work</p> <ul style="list-style-type: none"> • In North Africa even modest temperature increases could dramatically change water availability. For example, a 1°C increase could reduce water runoff in Morocco's Ouergha watershed by 10 percent by 2020. If the same results hold for other watersheds, the result would be equivalent to losing the water contained by one large dam each year [6] • Increase in numbers of people who could experience water stress by 2055 in northern and southern Africa. In contrast, more people in eastern and western Africa will be likely to experience a reduction rather than an increase in water stress [1] • The possible range of Africa-wide climate-change impacts on streamflow increases significantly between 2050 and 2100. The range in 2050 is from a decrease of 15% in streamflow to an increase of 5% above the 1961-1990 baseline. For 2100, the range is from a decrease of 19% to an increase of 14%. Second, for southern Africa, almost all countries except South Africa will probably experience a significant reduction in streamflow. Even for South Africa, the increases under the high emissions scenarios are modest at under 10% [1] • A critical 'unstable' area is identified for some parts, for example, the east-west band from Senegal to Sudan, separating the dry Sahara from wet Central Africa. Parts of southern Africa are projected to experience significant losses of runoff, with some areas being particularly impacted (e.g., parts of South Africa) [1] • Other regional assessments report emerging changes in the hydrology of some of the major water systems (e.g., the Okavango River basin) which could be negatively impacted by changes in climate; impacts that could possibly be greater than those associated with human activity [1] • There is no clear indication of how Nile flow will be affected by climate change because of the uncertainty about rainfall patterns in the basin and the influence of complex water management and water governance structures [1] 		

Decrease in biodiversity and worsening of existing environmental degradation	Ecosystems	<ul style="list-style-type: none"> Ecosystem impacts, including impacts on mountain biodiversity, could occur. Declines in fisheries in some major East African lakes could occur [1]
Alterations in ecosystem-human interfaces and interactions lead to loss of biodiversity and loss of basic support systems for the livelihood of many people	Ecosystems	<p>Information from climate projection research work</p> <ul style="list-style-type: none"> Changes in coastal environments (e.g. mangroves and coastal degradation) could have negative impacts on fisheries and tourism [1] Dune fields may become highly dynamic, from northern South Africa to Angola and Zambia [1] Fynbos and Succulent Karoo biomes in southern Africa, are likely to be the most vulnerable ecosystems to projected climate changes [1]
	Water & sanitation	<p>Information from climate projection research work</p> <ul style="list-style-type: none"> Detailed assessments in northern Africa based on temperature increases of 1-4°C and reductions in precipitation of between 0 and 10% show that the Ouergha watershed in Morocco is likely to undergo changes for the period 2000-2020. A 1°C increase in temperature could change runoff by of the order of 10%, assuming that the precipitation levels remain constant. If such an annual decrease in runoff were to occur in other watersheds, the impacts in such areas could be equivalent to the loss of one large dam per year [1] Assessments show the climate change will increase water stress and decrease runoff in parts of North Africa by 2050. Southern Africa is highly vulnerable to water stress and water drainage due to climate variability and change [1] Assessments of impacts on water resources across Africa currently do not fully capture multiple future water uses and water stress and must be approached with caution [1]

MDG 8. Develop a global partnership for development		
Climate effects	Sector	Impacts
Climate change threatens to exacerbate current challenges to the achievement of the MDGs. Funding for development and adaptation must be greatly increased to meet the needs of the poor	Diplomacy and policy	<ul style="list-style-type: none"> Developed countries have fallen short of targets they have set for themselves to achieve wide-reaching development objectives Increased aid and debt relief, as well as effectiveness, must be accompanied by further opening of trade, accelerated transfer of technology

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4. Conclusions

4.1 What does the available evidence tell us?

A search of the literature revealed no systematic assessment of the impacts of climate change on the sectors (social and economic) that are central to the achievement and sustainability of the MDGs across African countries. However, there are many assertions made in different publications as to the likelihood and how climate change will impact upon the timing of the achievement of different MDGs and the way climate change will challenge the processes required to maintain the levels of MDG indicators. The evidence, reviewed here, that supports these assertions includes assessments of progress towards MDG achievement, observations of how climate impacts upon social and economic sectors and the projections of likely change generated by climate modeling.

The evidence on progress towards meeting the MDGs across Africa shows that with regard to income levels and hunger, human health and access to water and sanitation there is insufficient momentum in improvements to meet the targets by 2015 across wide areas of Africa. However, some countries are showing how measures can be put in place to accelerate progress. Table 3 summarises this.

Table 3 Status and progress on MDGs across Africa (adapted from the United Nations “Africa and the Millennium Development Goals, 2007 Update”)

MDG 1 – Incomes & hunger	Status statements <ul style="list-style-type: none"> • Proportion of people living on one dollar a day or less has declined from 46% to 41% since 1999. Halving the extent of extreme poverty by 2015 requires that the current pace is nearly doubled • Population growth rate 2.3% per year. Rising number of extreme poor has leveled off, increasing only marginally from 296 million in 1999 to 298 million in 2004 • Proportion of underweight under-5s declined only from 33% to 29%. Proportion of people living on USD1/day or less declined from 46% to 41% since 1999. Halving the extent of extreme poverty by 2015 requires doubling current pace
	Examples of progress <ul style="list-style-type: none"> • In one year Malawi’s voucher programme for fertilizers and seeds has led to a doubling of agricultural productivity during the 2006/7 growing season
MDGs 4, 5 & 6 – Health	Status statements <ul style="list-style-type: none"> • Under-5 mortality rates dropped - 185 per 1,000 live births in 1990 to 166 in 2005 • Probability that a sub-Saharan African woman will die from complications of pregnancy and childbirth is 1 in 16, compared to 1 in 3,800 in the developed world • The number of new cases, especially among women, as well as the number of people with advanced HIV infection is growing faster than treatment services • No evidence that rate of new TB cases in sub-Saharan Africa is leveling off
MDG 7 – environmental sustainability	Status statements <ul style="list-style-type: none"> • 42% of people in rural areas have access to clean water and 63% of the entire population lack access to basic sanitation facilities – little improvement from 1990 • Between 75 and 250m people will be exposed to an increase of water stress
	Examples of progress <ul style="list-style-type: none"> • Niger – many thousands of rural people have improved their livelihoods and reduced their vulnerability to droughts through large-scale reforestation • Senegal - on track to achieving the water & sanitation goals

If targets are to be met within a generation progress on MDG achievement across some parts of Africa has to be increased in various areas that are sensitive to the vagaries of climate including

rural income generation, food security, vector borne diseases and access to water and sanitation. Unfortunately, many of the countries that are falling behind in terms of MDG achievement are located in the parts of Africa where climate change impacts are projected to be worse. Table 4 summarises the climate change projections reported last year for Africa by the Inter-governmental Panel on Climate Change.

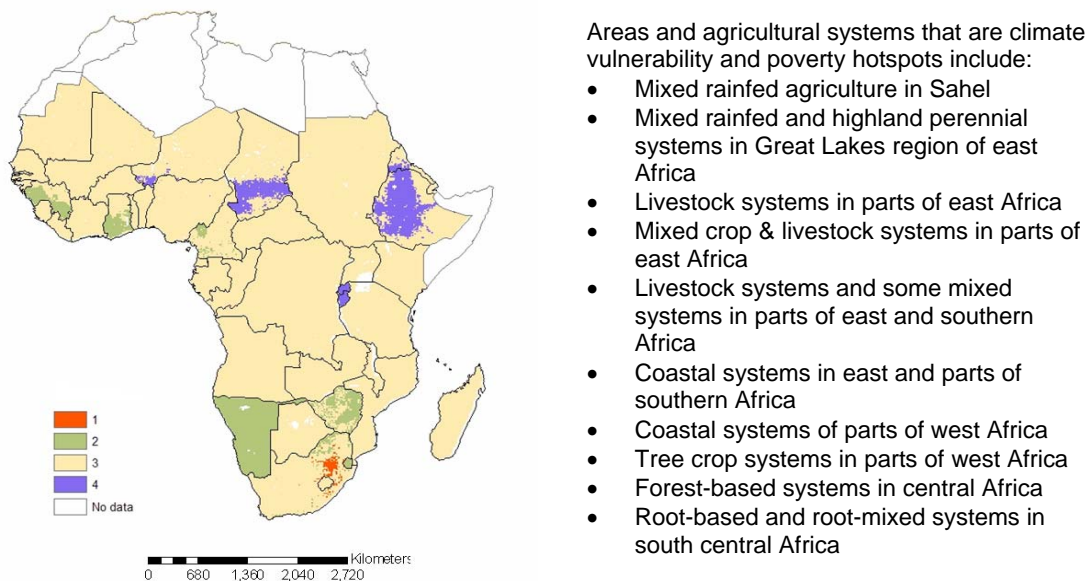
Table 4 Summary of climate change projections for Africa by the Inter-governmental Panel on Climate Change (adapted from AR4 chp 11)

IPCC reported climate change projections comparing current climate with projection for 2080-2099					
Region	Median projected temperature increase (°C)	Median projected precipitation increase (%)	Projected frequency of extreme warm years (%)	Projected frequency of extreme wet years (%)	Projected frequency of extreme dry years (%)
West Africa	3.3	+2	100	22	-
East Africa	3.2	+7	100	30	1
Southern Africa	3.4	-4	100	4	13
Sahara & North Africa	3.6	-6	100	-	-
	Temperature rise	Rainfall changes		Extreme weather events	
West Africa	All regions and all seasons median temperature increase to the 2099 lies between 3°C and 4°C, roughly 1.5 times the global mean response	Weak drying trend in the Sahel in the 20th century followed by modest moistening with little change on the Guinean coast		Increase in the number of extremely wet seasons - 1 in 5 of the seasons are extremely wet, as compared to 1 in 20 in late 20 th C	
East Africa		Increase extending into the Horn of Africa, an increase in the core of this region, east of the Great Lakes		Increase in the number of extremely wet seasons - 1 in 5 of the seasons are extremely wet, as compared to 1 in 20 in late 20th C	
Southern Africa		Drying mostly in spring leading delay in onset of rainy season and especially in the extreme southwest in winter		Increase in the rainfall intensity. Proportionally larger decrease in the number of rain days. Frequency of extremely dry winters and springs will increase to roughly 20%, while the frequency of extremely wet summers will double	
Sahara & North Africa		Drying extends into the northern Sahara, and down the West Coast as far as 15°N		Proportionally larger decrease in the number of rain days, indicating compensation between intensity and frequency of rain	

4.2 Key areas – where MDG progress is poor and climate impacts are expected

Thornton et al (2006) provided an analysis of climate vulnerability and poverty hotspots across Africa. The way the climate impacts were assessed meant that the analysis concentrated on climate vulnerability of agriculture as a proxy for rural livelihoods. The conclusion of this work showed that most of Sub Saharan Africa will have to face declines in agricultural productivity due to reduced crop and forage growing period length and increased rainy season failure. Regions where climate vulnerability and current poverty overlap are shown in the map below.

Figure 7. Climate vulnerability and poverty hotspots: agricultural systems [source Thornton et al 2006]



From the evidence reviewed here on MDG achievement and climate change impacts on key sectors a regional assessment of climate change impacts on MDG achievement and sustainability can be made. This assessment is presented in Table 5 below. In summary the assessment finds that:

- Rising temperatures and decreased rainfall will threaten agricultural productivity affecting rural incomes and food security particularly in Southern Africa
- Decreases in rainfall will add pressure on water availability and the provision of water & sanitation services particularly in North and Southern Africa
- Extreme weather events may cause increases health risks to those living in poor housing
- Increases in rainfall and temperature will lead to vector-borne diseases spreading into new areas – particularly highland areas
- Increase droughts & floods will lead to displacement and migration of families thus disrupting and limiting education opportunities
- Climate risks will increase burdens on women in poor households challenging their coping capacity

Table 5 African regional assessment of climate change impacts on MDG achievement and sustainability

Region	MDG 1 Incomes & hunger	MDGs 2 & 3 Education & gender	MDGs 4, 5 & 6 Health	MDG 7 Environment
Sahara & North Africa	Rising temperatures and decreased rainfall will threaten agricultural productivity affecting rural incomes and food security	Climate risks will increase burdens on women in poor households challenging their coping capacity	Increases in extreme weather events may cause increases health risks to those living in poor housing	Decreases in rainfall will add pressure on water availability and the provision of water & sanitation services
West Africa	Rising temperatures will threaten agricultural productivity affecting rural incomes and food security. Water temperature rises will decrease productivity of fisheries	Increasing droughts & floods will lead to displacement and migration disrupting and limiting education opportunities. Climate risks will increase burdens on women in poor households challenging their coping capacity	Extreme weather events and rising sea levels may cause increases health risks to those living in poor housing. Increases in rainfall and temperature will lead to vector-borne diseases spreading into new areas	Less predictable and more erratic rainfall will add pressure on water availability and the provision of water & sanitation services
East Africa	Rising temperatures will threaten agricultural productivity affecting rural incomes and food security. Increased rainfall in some areas will improve agricultural productivity. Water temperature rises will decrease productivity of fisheries	Increasing droughts & floods will lead to displacement and migration disrupting and limiting education opportunities. Climate risks will increase burdens on women in poor households challenging their coping capacity	Extreme weather events may cause increases health risks to those living in poor housing. Increases in rainfall and temperature will lead to vector-borne diseases spreading into new areas – particularly highlands	Less predictable and more erratic rainfall will add pressure on water availability and the provision of water & sanitation services
Sthn Africa	Rising temperatures and decreased rainfall will threaten agricultural productivity affecting rural incomes and food security. Water temperature rises will decrease productivity of fisheries	Reduced agricultural productivity and water availability etc could burden families enough to remove children from school. Climate risks will increase burdens on women in poor households challenging their coping capacity	Increases in extreme weather events may cause increases health risks to those living in poor housing	Decreases in rainfall will add pressure on water availability and the provision of water & sanitation services

4.3 Main conclusions

- *No empirically based studies of how climate change will impact on the achievement and sustainability of the MDGs across Africa were found. Both the UNDP and the UNFCCC have made assertive statements as to how and what is the likelihood that climate change will affect the MDGs;*
- *Evidence does exist as to the ways that current climate variability is, and climate change will, affect the livelihoods of the poor and the sectors important to MDG achievement. This evidence includes documented observation and projections developed from climate models;*
- *The MDGs most susceptible to direct climate change impacts are - MDG 7 particularly increased access to potable water, MDG 1 - progress on food security, and MDG 6 in respect of prevalence and death rates associated with malaria;*
- *A series of indirect impacts of climate change on MDGs can also be identified. These include how extreme weather events (droughts, floods, storm surges etc) have highly differentiated impacts that disadvantage the poor and vulnerable groups such as women, children and the elderly. Such hazards impact MDG 2 – universal primary education, MDG 3 – gender equality, MDG 4 – reduce child mortality and MDG 5 – improved maternal health;*
- *The prognosis of how exactly how climate change will affect Africa is extremely complex and as yet poorly understood. The consensus of evidence shows that due to several reasons Africa will be affected earlier and more severely than other parts of the world;*
- *Intersections of projected severe climate change effects and socio-economic vulnerability can be identified across African countries. Parts of Africa where MDG achievement is most challenged are also most susceptible to climate change effects. This review of evidence reveals a complex mosaic of checkered progress towards the MDGs overlaid with a series of likely climate change impacts.*

ANNEX 1: Overview table: Climate change impacts on the MDGs across Africa

1. Eradicate extreme poverty and hunger - Agricultural production and food security, access to clean and abundant water resources and adequate incomes underpin eradication of poverty and hunger – all are vulnerable to climate change		
Climate effects	Sector	Impacts
Warming More/ less & erratic rainfall Sea level rise Increase in extreme weather events	Agriculture – crops	<ul style="list-style-type: none"> • Dryland crop productivity likely to decline by 25% per hectare by 2060 giving an overall revenue loss of US\$26 billion - a figure in excess of bilateral aid to the region in 2005 • Decreases in productivity of rain-fed and semi-arid systems due to decreased length of growing period. Deficiencies in yields from rain-fed agriculture of up to 50% during the 2000-2020 period, and reductions in crop growth period • Southern Africa likely to experience notable reductions in maize production under possible increased ENSO conditions. Wheat production likely to disappear from Africa by the 2080s. Danger that extreme food insecurity episodes, such as those that have frequently affected countries like Malawi, will become more common
Warming – seas Storm surges	Agriculture – livestock	<ul style="list-style-type: none"> • Increases and spread of both livestock disease pathogens and vectors through changes in moisture and temperature e.g. Rift Valley Fever epidemics associated with flooding could increase with a higher frequency of El Nino events. Spread of trypanosomiasis through modification of habitats suitable for tsetse fly will exacerbated by climate variability and climate change • Increased draught incidence will reduce viability of pastoralist production systems in some areas • Heat stress will impact on animal health and production particularly of dairy and intensive pig & poultry systems
	Fisheries	<ul style="list-style-type: none"> • Temperature rises of 1.5 to 2.0°C enough to reduce fisheries in North West Africa and the East African lakes • Changes in freshwater flows and greater intrusion of salt water into lagoons will affect the species that are the basis of inland fisheries or aquaculture • Extreme wind and turbulence could decrease coastal fisheries productivity by 50-60%, while turbulence will bring a 10% decline in productivity in the spawning grounds
	Livelihoods of the poor	<ul style="list-style-type: none"> • Climate shocks - drought and floods - cause grave setbacks in nutritional status as food availability declines, prices rise and employment opportunities shrink • By 2080, the number of additional people at risk of hunger could reach 600 million - twice the number of people living in poverty in sub-Saharan Africa today • Impacts on agriculture by 2050 mean 25% of the population in Namibia will need to find new livelihoods. Displaced rural people likely to move to the cities causing fall in wages of up to 24% for unskilled labourers

<p>2. Ensure that all children remain in school and receive a high-quality education - <i>Climate change stresses pose additional burdens on agricultural production and other subsistence activities like water collection, which may burden families enough to remove children from school. Climate change also threatens to destroy infrastructure (e.g. schools) and increase the displacement and migration of families thus disrupting and limiting education opportunities</i></p>		
Climate effects	Sector	Impacts
<p>Warming</p> <p>More/ less and erratic rainfall</p> <p>Sea level rise</p> <p>Increase in extreme weather events</p>	<p>Education</p>	<ul style="list-style-type: none"> • In Zimbabwe - the longevity of human development impacts linked to climate shocks – found that drought delays the start of school and resulted in a loss of 0.4 years of schooling. The education losses translated into a 14 percent loss of lifetime earnings • The forced trade-off s that follow climate shocks can rapidly erode human capabilities, setting in train cycles of deprivation. Children suffer as families decide to reduce the number of meals they eat, cut spending on health, or withdraw their children from school to increase labour supply • In Ethiopia, children aged five or less are 36 percent more likely to be malnourished and 41 percent more likely to be stunted if they were born during a drought year and affected by it. • Kenya, being born in a drought year increases the likelihood of children being malnourished by 50 percent • In Ghana, half of children in the drought prone north are malnourished, compared with 13 percent in Accra • Research has found that girls’ nutrition suffers most during periods of low consumption and rising food prices, and that rainfall shortages are more strongly associated with deaths among girls than boys
<p>3. Promote gender equality and empower - <i>Poverty has a woman's face. Of the world's 1.3 billion people living in poverty, 70% are women; women do about 66% of the world's work in return for less than 5% of its income. Because two-thirds of children who are denied primary education are girls, women make up 75% of the world's illiterate adults</i></p>		
Climate effects	Sector	Impacts
<p>Warming</p> <p>More/ less and erratic rainfall</p> <p>Sea level rise</p> <p>Increase in extreme weather events</p>	<p>Various</p>	<ul style="list-style-type: none"> • Women contribute much of the labour that will go into coping with climate risks through soil and water conservation, the building of anti-flood embankments and increased off -farm employment • Rural women in developing countries are the primary producers of staple food, a sector that is highly exposed to the risks that come with drought and uncertain rainfall. • In many countries, climate change means that women and young girls have to walk further to collect water, especially in the dry season • Gender bias in the impact of disasters is also under-reported. When disasters strike, they hurt whole communities - but women often bear the brunt. Floods frequently claim far more female victims because their mobility is restricted and they have not been taught to swim. When Bangladesh was hit by a devastating cyclone and flood in 1991, the death rate was reportedly five times higher among women. • In the aftermath of a disaster, restrictions on the legal rights and entitlements of women to land and property can limit access to credit needed for recovery • Indian women born during a drought or a flood in the 1970s were 19 percent less likely to ever attend primary

<p>4. Reduce child mortality, 5. Improve Maternal Health, 6. Combat HIV/AIDS, malaria and other diseases - <i>Climate change will worsen health through: reduced food security and water security; water-borne diseases associated with floods and drought; the spread of vector-borne and air-borne diseases; and the direct link between temperatures and heat stress</i></p>		
Climate effects	Sector	Impacts
<p>Warming</p> <p>More/ less and erratic rainfall</p> <p>Sea level rise</p> <p>Increase in extreme weather events</p>	Health	<ul style="list-style-type: none"> • Children and pregnant women particularly susceptible to vector- and water-borne diseases. Severe malaria is already more common in areas of low to moderate transmission, such as the highlands of East Africa and other areas of seasonal transmission. A recent epidemic in Rwanda, led to a four-fold increase in malaria admissions among pregnant women and a five-fold increase in maternal deaths • In eastern Africa, flooding in 2007 created new breeding sites for disease vectors such as mosquitoes, triggering epidemics of Rift Valley Fever and increasing levels of malaria. • Climate variability will interact with other background stresses and additional vulnerabilities such as immuno-compromised populations (HIV/AIDS) and conflict and war, resulting in increased susceptibility and risk of other infectious diseases (e.g. cholera) and malnutrition • Previously malaria-free highland areas in Ethiopia, Kenya, Rwanda and Burundi likely to experience modest incursions of malaria by the 2050s, with conditions for transmission becoming highly suitable by the 2080s. By this period, areas currently with low rates of malaria transmission in central Somalia and the Angolan highlands could also become highly suitable
<p>7. Ensure environmental sustainability - <i>Climate change threatens environmental sustainability because it will cause fundamental alterations in ecosystem relationships, change the quality and quantity of available natural resources, & reduce ecosystem productivity. The poor depend on these resources for their day-to-day survival and livelihoods in many parts of the developing world</i></p>		
Climate effects	Sector	Impacts
<p>Warming</p> <p>Less and erratic rainfall</p> <p>Extreme weather events</p>	Water resources	<ul style="list-style-type: none"> • The east-west band from Senegal to Sudan is identified as 'critical & unstable' in terms of water resources. Parts of southern Africa are projected to experience significant losses of runoff. Regional assessments report emerging declines in the hydrology of major water systems e.g. Okavango River basin, which will be negatively impacted by changes in climate • Increased water stress and decrease runoff in parts of North Africa by 2050. The Ouergha watershed in Morocco is likely to undergo changes during 2000-2020 - a 1°C temperature rise could reduce runoff by 10%.
<p>8. Develop a global partnership for development - <i>Climate change threatens to exacerbate current challenges to the achievement of the MDGs. Funding for development and adaptation must be greatly increased to meet the needs of the poor</i></p>		
Climate effects	Sector	Impacts
	Diplomacy and policy	<ul style="list-style-type: none"> • Developed countries have fallen short of targets they have set for themselves to achieve wide-reaching development objectives • Increased aid and debt relief, as well as effectiveness, must be accompanied by further opening of trade, accelerated transfer of technology

