
Key Vulnerabilities to Climate Change in Africa

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Global Warming: Looking Beyond Kyoto

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Outline

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“Africa is the most vulnerable region to climate change, due to the extreme poverty of many Africans, frequent natural disasters such as droughts and floods, and agricultural systems heavily dependent on rainfall”
(IPCC, 2001)

“The Least Developed Countries (LDCs) (65% of whom are in Africa) represent the poorest and the weakest segment of the international community. As a result, these are also amongst the most vulnerable to the adverse impacts of human induced climate change in future. It is, therefore, essential for these countries to prepare themselves for coping with or, one can say, ‘adapting’ to such adverse impacts and to ensure that such adaptation measures and policies are built-in to their existing national and sectoral development activities.”

Anwarul Karim Chowdhury, Under-Secretary-General
United Nations, New York, 2003

“The challenges of climate change and development in Africa are closely linked. But we urgently need to improve our understanding of how climate change will affect Africa”

Margaret Beckett (2004).

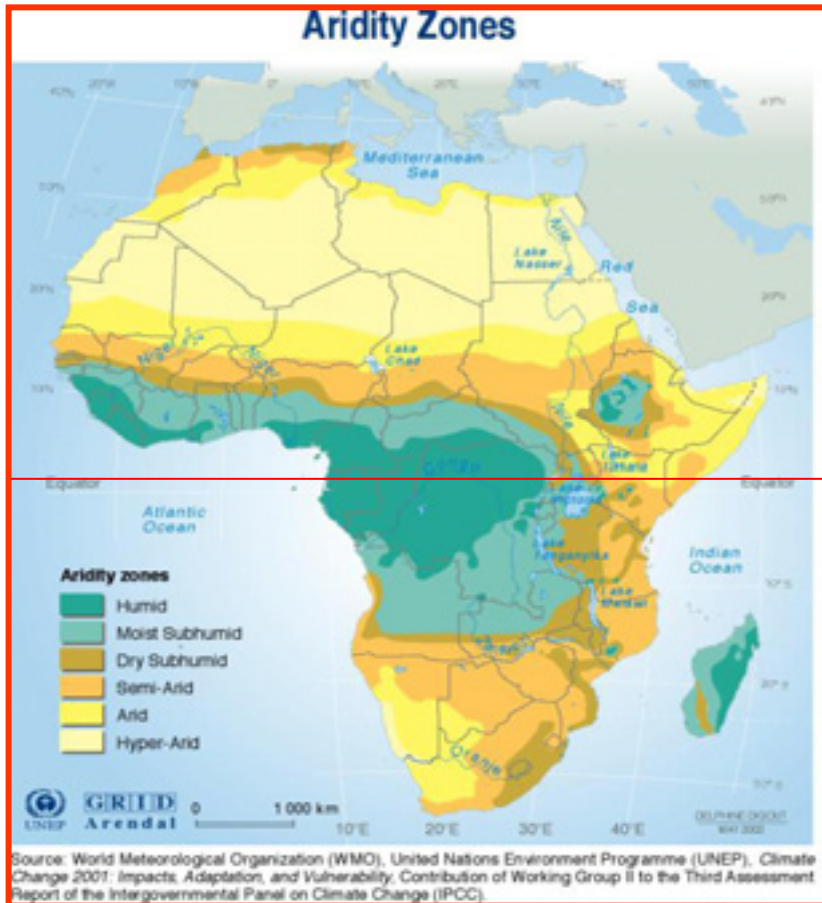
Introduction

- Several research reports have consistently noted the vulnerability of the African continent to the impacts of climate change.
- Africa's vulnerability's arises from a combination of physical and social processes and represents the interface between exposure to climatic threats interacting with other non-climatic threats, and the capacity of the threatened systems to cope with those threats.
- Africa is grappling with all aspects of under-development that require urgent attention. Achieving sustained economic growth and poverty reduction remains the key challenge facing the African region.
- Although climate change seems marginal compared to the pressing issues of poverty alleviation, hunger, health, and economic development in Africa, it is becoming increasingly clear that the realisation of the development goals can be seriously hampered by climate change.

Social Vulnerability

- Many non-climatic factors contribute to vulnerability in Africa. Such factors include:
 - ❑ fragile and hazardous location
 - ❑ rapid population growth and migration
 - ❑ poverty and hunger
 - ❑ poor health
 - ❑ low levels of education
 - ❑ gender inequality
 - ❑ lack of access to resources and services
 - ❑ limited technological means
 - ❑ Lack of efficient governance.

Physical Location

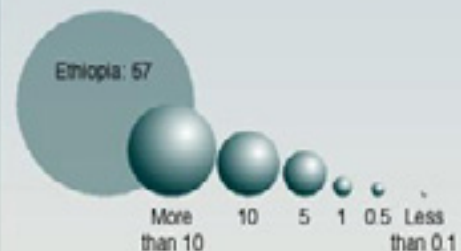


- Arid/Semi-arid regions cover 13 million km² or 43% of the continent's land area, where 270 million people, or 40% of the continent's population, live (UNDP, 1997).
- Droughts and floods are already common occurrences, with some countries experiencing both in one year.
- Increasing probability of ENSO events, which have become more frequent, persistent and intense since the mid-1970s (IPCC, 2001).
- About 23% of all reported natural and technological disasters between 1973 and 2002 were in Africa, with climatic events constituting 53%.
- Reported number of people killed and affected by climate –related disasters in Africa between 1993-2002 is 136,590,000.

People Affected by Natural Disasters between 1971-2000



Millions of People affected



Source: The Office of U.S. Foreign Disaster Assistance (OFDA), The Centre for Research on the Epidemiology of Disasters (CRED), International Disaster Database, www.cred.be/emdat, Université Catholique de Louvain, Brussel, Belgium.

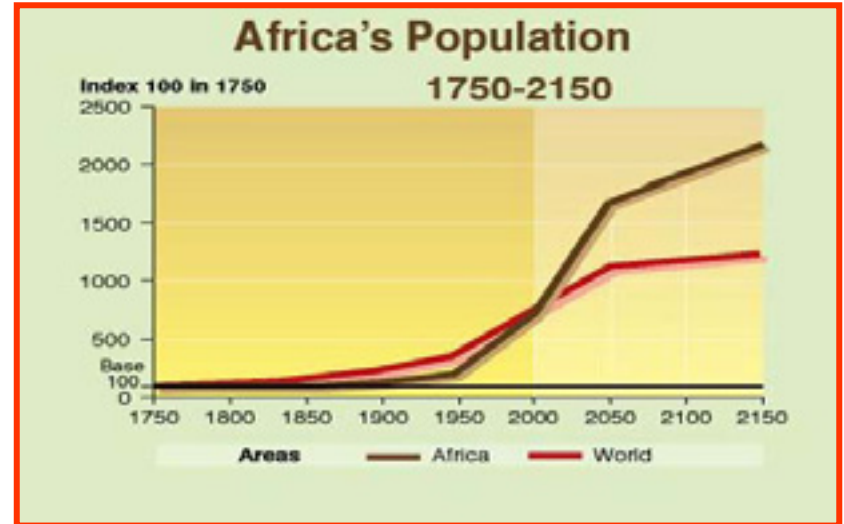


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JUNE 2002

Demography

- Africa's high population growth, rural-rural migration and high urbanization rates interact with climate change to exacerbate her vulnerability to climate change.
- Sustained rural-rural and rural-urban migration particularly from the drier regions to the wetter sub-humid regions puts undue pressure on land resources both for farming and pasture, often resulting in communal conflicts between pastoralists and sedentary farmers, further weakening the economy of the already impoverished rural areas.
- Africa's population of 851 million (2003) is growing at an annual rate of 2.4%, almost twice the world average of 1.2 percent



- Africa's population, doubling in 22 years, and with the high proportion of young people, the population momentum will probably continue for decades to come, even with AIDS reversing decades of gains in life expectancy.
- This growing population will exert pressure on the provision of safe water, education and health services, as well as threaten food security.

Low Human Development

- 60% of the people over the age of 15 are illiterate.
- High under-5 mortality rate of 140 per 1000, and life expectancy at birth of only 54 years.
- There is a growing gap between developing and developed countries in scientific and technological capacity. For example, the United States has about 70 scientists per 10,000 population, while China has six and sub-Saharan Africa just one.
- Environmental disasters and armed conflicts have become so frequent in Africa threatening livelihoods and contributing to rural-urban migration and creating environmental refugees as populations move away from vulnerable regions.

Social Vulnerability

- A significant proportion of the population contends with the devastating consequences of diseases such as malaria, HIV/AIDS, typhoid and meningitis. HIV/AIDS, for instance, affects nearly 13 million resource poor African women, who constitute a disproportionate 53% of the 24.5 million living with the virus.
- Since women are major food producers in Africa, the impact of the virus is compounded because it jeopardizes food security by debilitating the agricultural labour force. For example, in Southern Africa, drought and HIV/AIDS pandemic have diminished physical, economic and social capital.

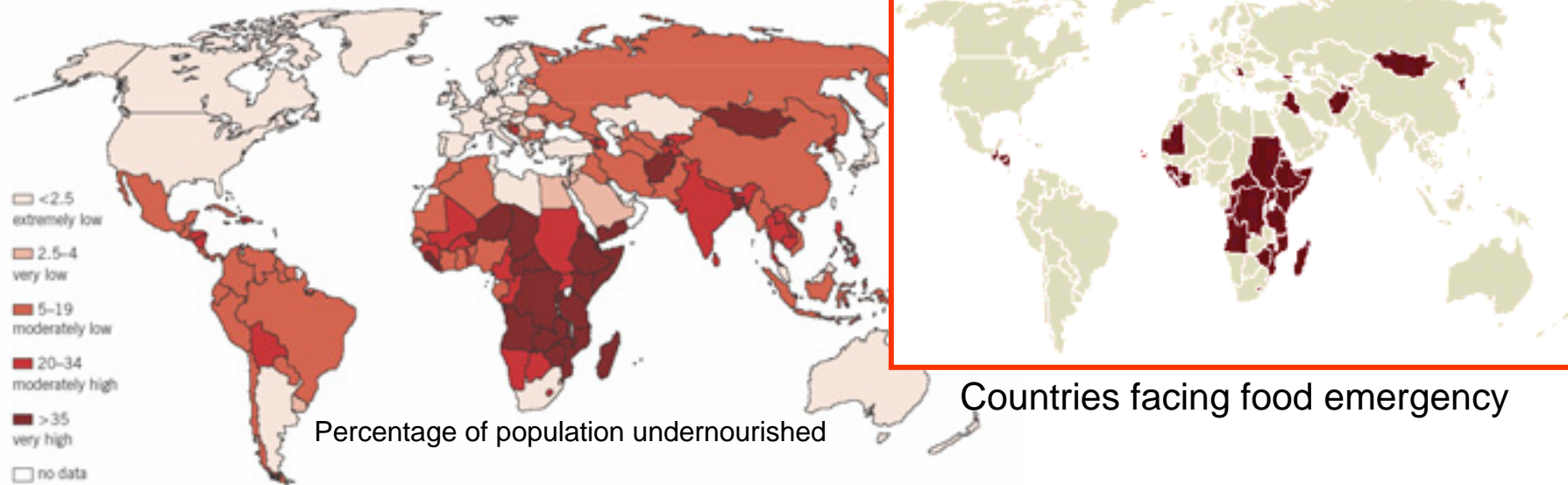


War and Hunger



Malaria

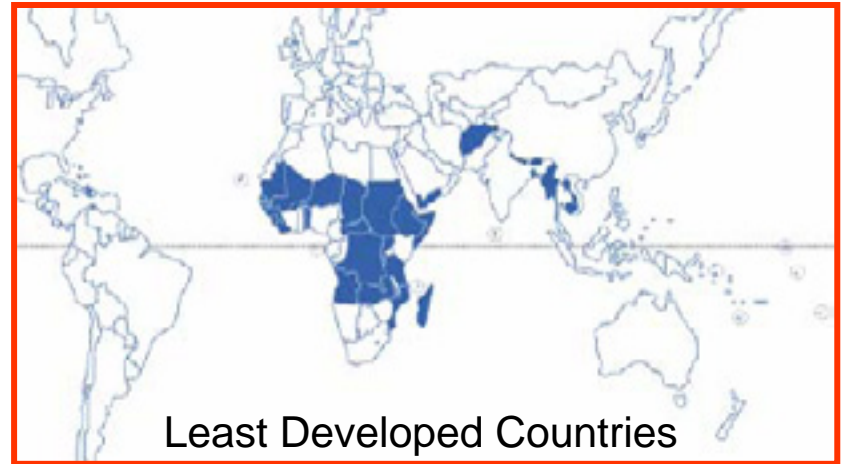
Hunger



- Sub-Saharan Africa has the highest percentage of undernourished – 40% of the total population – and there has been little progress in reducing the hunger in the last three decades.
- Hunger and poverty are closely related and are the main causes of human vulnerability in Africa. While the lack of sufficient income to purchase food is a major factor causing food insecurity, hunger itself contributes to poverty by lowering labour productivity, reducing tolerance to disease, and constraining educational achievements.

Poverty

- Poverty is endemic in many areas of Africa and the number of Africans living below the poverty line has increased by 50% over the last 14 years.
- About 65% of the least developed countries are in Africa, and these represent the poorest and the weakest segment of the international community.
- The economies of most African countries are largely based on primary products or extraction of natural resources, both exported unprocessed.



- Almost all the African countries are classified as being in the low human development category
- As a result, these are also amongst the most vulnerable to the adverse impacts of human induced climate change in future.

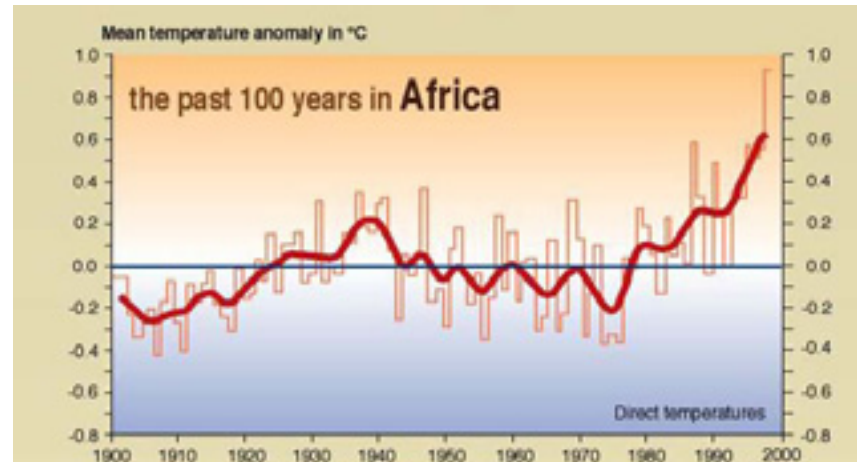


Vulnerability to Climate Change

Africa's Importance in Global Climate Change

- Africa exhibits large contrasts in its surface terrain and vegetation, which may be important in modulating the global climate.
- The only continent to straddle the equator with roughly equal landmasses within both hemispheres and its climate is controlled by the Hadley cell which is symmetrically located, not like most other continents.
- One of the few areas whose climate is influenced by the three tropical oceanic basins. Her unique geographical position leads to an equally substantial role in determining the characteristics of the general circulation of the atmosphere both regionally and globally.
- The Sahara desert generates the largest mineral aerosol output globally, which is potentially implicated in tropical cyclone formation over the Atlantic as well as the transport of aerosols to Amazon, Western Atlantic and the Caribbean.
- Africa experiences strong shifts in climate from the climatic optimum, from the much wetter conditions of the humid tropics to the hyper-arid Sahara.

Africa's Changing Climate



- Observational records show Africa has been warming through the 20th century at the rate of about 0.05°C per decade with slightly larger warming in the June-November seasons than in December-May (Hulme et al., 2001).
- Since the mid-1970s, precipitation has declined by about $2.4 \pm 1.3\%$ per decade in tropical rainforest Africa, this rate being stronger in West Africa ($-4.2 \pm 1.2\%$ per decade) and in north Congo ($-3.2 \pm 2.2\%$ per decade) (Nicholson et al. 2000).

Key Vulnerabilities to Climate Change: Water Resources

- Between 1970 and 1995, Africa has experienced a 2.8 times decrease in water availability (Shiklomanov, 1996).
- The average discharge of West African rivers has dropped by 40-60% since 1970.
- By the year 2025 it is projected under SRES scenarios that about 370 million African people will experience increases in water stress, while about 100 million people are likely to experience a decrease in water stress by 2055, as a result of a likely increase in precipitation (Arnell, 2004).
- In the Nile region, most scenarios of water availability estimate a decrease in river flow up to more than 75% by the year 2100, with implications for agriculture and conflict.
- A drop in the water level in reservoirs and rivers could adversely affect the quality of water by concentrating sewage and industrial effluents, thereby exacerbating water-borne diseases and reducing the quality and quantity of fresh water available for domestic use (Dixon et al, 2003).

Water Resources

- Several African countries share more than 50 major watersheds, river basins and lakes in Africa. For instance, the 17 countries in West Africa share 25 trans-boundary rivers and majority of the West African countries have a water interdependency ratio as high as 90%. The absence of institutional management of water resources may be the reason of many current conflicts between African countries, and more conflicts are expected to happen under climate change impacts on water resources and water scarcity in Africa.
- Poor water quality, projected to intensify under climate change, would increase water related diseases, reduce agricultural production, and limit economic development options.
- Poor water supply systems and low infrastructure also will add extra pressures on water availability in African countries.
- This projected future water stress and scarcity will have serious impacts on the socio-economic development of the countries affected and will likely adversely affect their food production levels and development plans.

Agriculture

- Model results (Hadley Centre, CSIRO, Canadian Climate Centre, and NCAR) indicate that only 80,000 km² of agricultural land in Sub-Saharan Africa with currently severe environmental constraints, out of more than 15.1 million km², are expected to improve with climate change, whereas more than 600,000 km² currently classified as moderately constrained would migrate to the class of severe environmental limitations (Fischer et al, 2002).
- Projected losses in cereal production potentials in sub-Saharan Africa up to about 33 percent by 2060.
- Climate change could have a negative impact on pastoral livelihoods through a reduction in water availability and biomass
- Up to 40% of sub-Saharan countries will lose a rather substantial share of their agricultural resources (implying a loss at 1990 prices of US\$10-60 billion).
- Global warming and sea level rise could threaten fisheries and shrimp production in Africa.

Food Security

- Africa has a strong dependence on agriculture (in 2050, agriculture is predicted to represent 38.1% of the GDP).
- The food security threat posed by climate change is greatest for Africa, where agricultural yields and per capita food production have been steadily declining, and where population growth will double the demand for food, water and forage in the next 30 years (Davidson et al. 2003).
- Parry et al. (1999) estimated that climate change will place an additional 80-125 million people (± 10 million) at risk of hunger by the 2080s, 70-80 percent of whom will be in Africa.

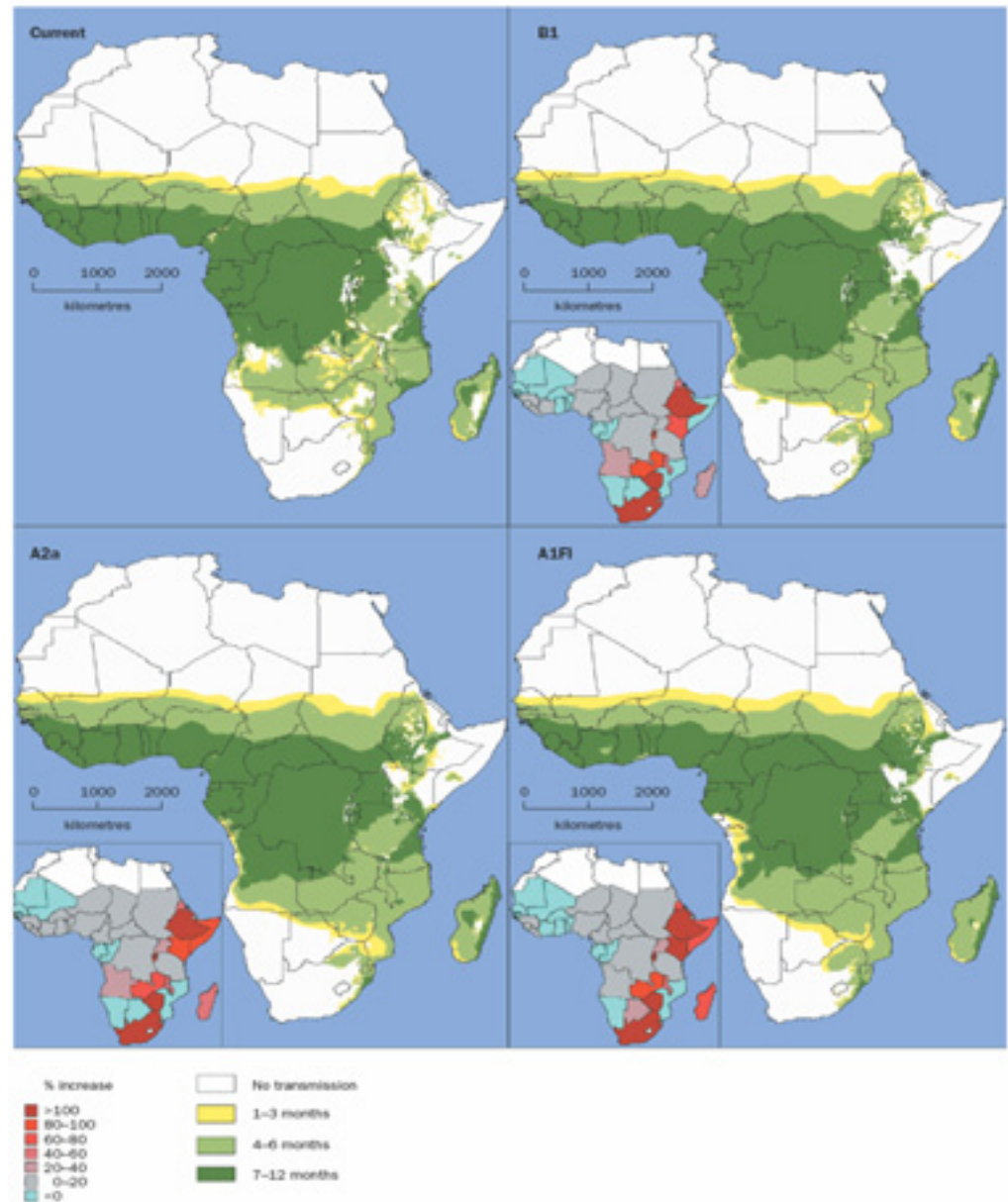
Health

- Models for suitability of malaria in Africa and GCM projections showed that there will be expansion and contraction of climate suitable areas for malaria by 2020, 2050 and 2080. According to their model by 2050 and continuing into 2080, a large part of Western Sahel and much of southern-central Africa would likely become unsuitable for malaria transmission but suitability will increase in Southern Africa and the East African highlands in areas that are currently malaria free (Christopher *et al*, 2004).
- In South Africa, it is estimated that the area suitable for malaria will double and that 7.8 million people will be at risk (5.2 million being people that never experienced malaria) (Republic of South Africa, 2000).
- Africa accounts for about 85% of all deaths and diseases associated with malaria (Van Lieshout *et al.*, 2004).
- On the basis of MIASMA model combined with HadCM3 outputs for different SRES scenarios, Van Lieshout *et al.* (2004) demonstrated that climate change could be responsible in Africa for an additional population at risk comprised between 21 million (B1) and 67 million (B2) by the years 2080s.
- Rift Valley Fever epidemics are associated with flooding and could increase with a higher frequency of El Nino events. Heat stress and drought are likely to have a negative impact on animal health, production of dairy products, meat and reproduction (St-Pierre *et al.*, 2003).

Estimated number of months suitable for *Plasmodium falciparum* malaria transmission, and change in person-months of exposure by country at present and by 2100 using three HadCM3 scenarios (B1, A2a, A1FI)

The scenarios project overall potential increases in person-months exposure by 2100 to be 16% (B1), 23% (A2a), and 28% (A1FI), respectively (constant population assumed).

Source: Tanser, F.C., B. Sharp and D. Sueur (2003). Potential effect of climate change on malaria transmission in Africa. *Lancet*, 362: 1792-98



Ecosystem

- Africa is well recognized for its rich and diverse biological resources and these natural systems form the foundation of the economy of most countries, from which the majority of the population derive their livelihood. Threatened terrestrial and marine ecosystems translate to threatened livelihoods in Africa.
- Africa contains about one-fifth of all known species of plants, mammals, and birds, as well as one-sixth of amphibians and reptiles. Biodiversity in Africa is under threat from climate change and other stresses.
- Savannas, tropical forests, coral reef marine and freshwater habitats, wetlands and East Africa montane ecosystems are all at risk. Africa's social and economic development is now even more in danger because climate change, habitat loss, over harvesting of selected species, the spread of alien species, and illegal activities such as hunting and deforestation threaten to undermine the integrity of the continent's rich but fragile ecosystems.
- In Malawi, climate change could induce a decline of nyala (*Tragelaphus*) and zebra (*Equiferus*) in the Lengwe and Nyika national parks because these species couldn't adapt to climate induced habitat changes.
- The 1998 coral bleaching resulted in an average of 30% mortality of corals in the western Indian Ocean region and for Mombasa and Zanzibar decreases in tourism value of coral reefs were estimated to be about US\$ 12-18 million.

Settlement and Urbanization

- African economies are often clustered around natural resource rich zones that are very sensitive to climate variability with more than a quarter of the population residing within 100km of a sea coast.
- These economic activity nodes form the nucleus of settlements, urbanization and development in the continent and are associated with high concentrations of infrastructure systems and population.
- Africa's recent and projected rapid urban growth rising up to 54% of the population by 2030 will lead to extensive land use and land cover changes especially from largely uncontrolled urban, semi-urban and rural settlements thus altering existing surface microclimate and hydrology and exacerbate the scope and scale of climate change impacts.
- Climate change will impact infrastructure and settlements in Africa through sea level rise, shortage of water resources, extreme events, food security, health risks and temperature related morbidity in urban centres. The bigger threat of climate variability to infrastructure is expected from the little characterised and unpredictable rapid-onset disasters like storm surges, flash floods and tropical cyclones coupled with localised population concentrations

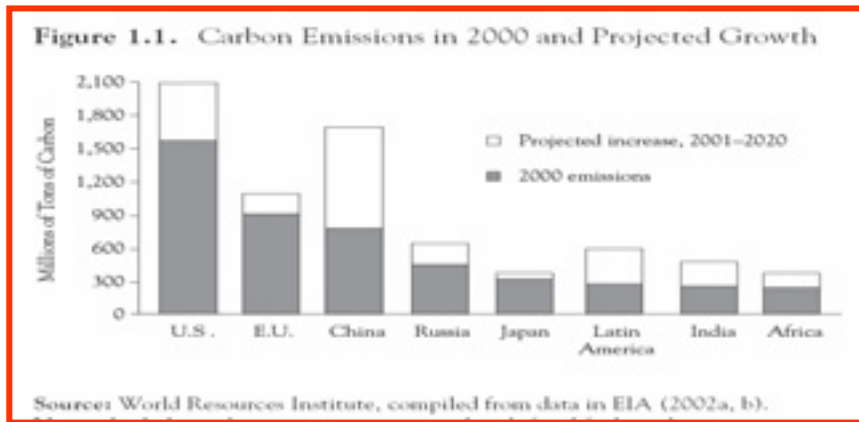
Climate Change and Africa's Development

- Impact of climate variability and change on Africa's development are two-fold:
- Directly:
 - Climate extremes (droughts, floods, heat-waves) take direct toll on lives (human and livestock), health, assets, livelihoods and infrastructure.
 - Directly impacts food and epidemiology of infectious diseases.
 - Severe and repeated climate shocks can push intensifies the vicious cycle of poverty.
 - Creates environmental refugees
 - Precipitates conflicts and wars
- Indirectly:
 - Their uncertainty makes planning difficult.

Climate Change and Achievement of the MDGs

- While Climate Change does not sit on the front burner in the development agenda of most African governments, it could hamper the goal of poverty reduction in the continent.
- Generally poor people in Africa are particularly vulnerable to individual and collective risks which are expected to be further aggravated with climate change, thus depressing the achievement of the PRSPs.
- Climate change is capable of hampering the achievement of the Millennium Development Goals (MDGs).
- Combating climate change is vital to the pursuit of sustainable development; equally the pursuit of sustainable development is integral to lasting climate change mitigation. Thus it is critical to mainstream climate change into sustainable development policies and plans in Africa.

Mitigation and Adaptation Strategies



Global Greenhouse Gas Emissions

- Responding to climate change encompasses two strategies:
 - mitigation: controlling greenhouse gases to stabilize climate change at an acceptable limit, and
 - adaptation: adjustments to the impact of climate change given existing levels of greenhouse gasses in the atmosphere.
- Africa Regional Mitigation Strategies
 - Hydropower development
 - Natural gas utilization through the West African Gas Pipeline
 - Adopting Zero-gas flaring by 2008
 - Metro-rail system for Lagos to reduce emissions from cars.
- Regional Adaptation Strategies
 - IWRM approaches that recognize the link between water, land, human development and natural environment are being adopted.
 - Regional Institutional and Multi-sectoral frameworks are being developed and implemented to enhance potential for adaptation in the water sector.

Adaptation in agriculture

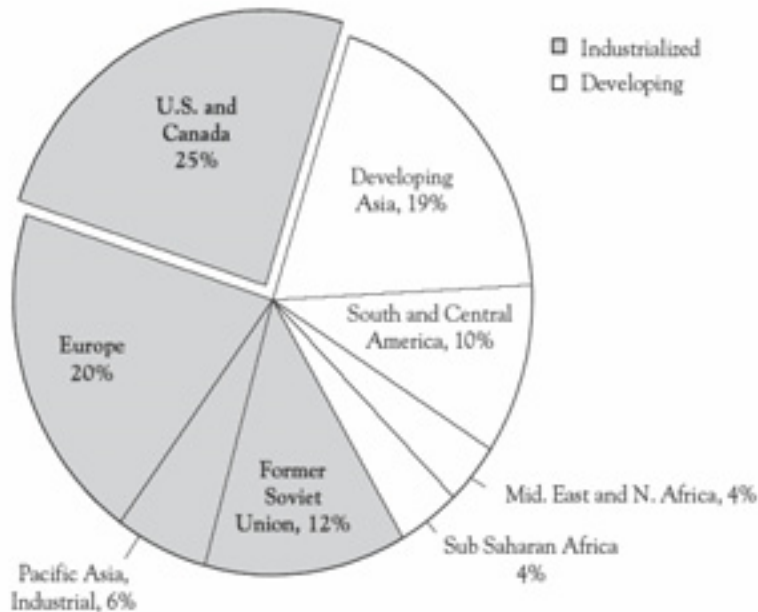
- Several of the Africa economies depend directly on agriculture, adaptation strategies adopted include:
 - adjustments to planting dates;
 - changes in fertilization; irrigation applications; cultivar traits,
 - selection of animal species,
 - recourse to indigenous knowledge
 - mixed farming and multiple cropping, and
 - reduced utilization of marginal lands.
- Agroforestry – with mitigation benefits.
- Limited Early Warning Systems
- Livelihood diversification

What can be done?

- Invest in early Warning Systems
- Strengthen adaptive capacity:
 - of African scientists to assess likely impacts and options to enhance adaptive capacity;
 - of Africa research organisations to contribute to adaptive capacity by carrying out impact assessment and examination of options for adaptation (including linkages and co-ordination between organisations);
 - of governments, civil society organisations, international bodies and donors to use research outputs and plan for and to support adaptation by African people, and to prepare for extreme events;
 - of international scientific community to support, strengthen and complement the work of African scientists and governments.
 - of local end-users to be able to use climate forecasts and other assessments results for planning their activities
- Empower vulnerable communities to better manage their risks
- Supporting adaptation by rural and urban people, particularly the most vulnerable
- Mainstream climate change into development policies and plans

The Kyoto and Africa

Percent of Total Accumulated Atmospheric CO₂ from Industrial Sources and Land Use Changes, 1900–2000



Source: World Resources Institute, compiled from data in Marland et al. (2000), EIA (2002b) and Houghton et al. (2000).

Notes: Data include net CO₂ emissions from fossil fuel combustion (1900–2000), cement manufacturing (1900–1979), and changes in land use (1900–1990), such as harvesting of forest products, clearing for agriculture, and vegetation re-growth.

- The developed countries should show a stronger commitment to actually reducing GHG, or better still stabilizing GHG emissions to avoid dangerous climate change, and not concentrate so much on emissions trading.
- Now that the Kyoto Protocol has come into force, developing countries have to start thinking about what is going to follow the Protocol. Developing countries, should get off the side-lines of the climate discussions and take both the opportunity and the responsibility to become more active in, if not become the leaders of, this discussion.
- The protocol tends to focus more on emission targets than sustainable development, due in part to the predominance of the interests of Annex 1 countries. good reason to believe that greater sustainability in development paths will “bend the curve” of emissions.
- SD is more pertinent to Africa and fits well into the MDGs, (G8 commitment).
- Availability of funds to help developing countries deal with adverse impacts of climate change.