

Impacts of Climate Change in the Tropics:

The African Experience

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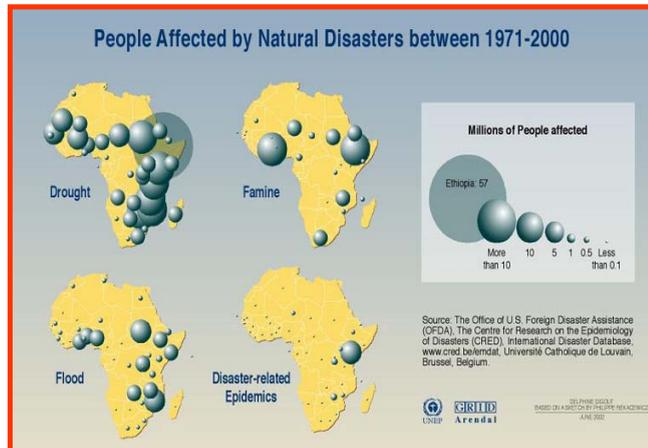
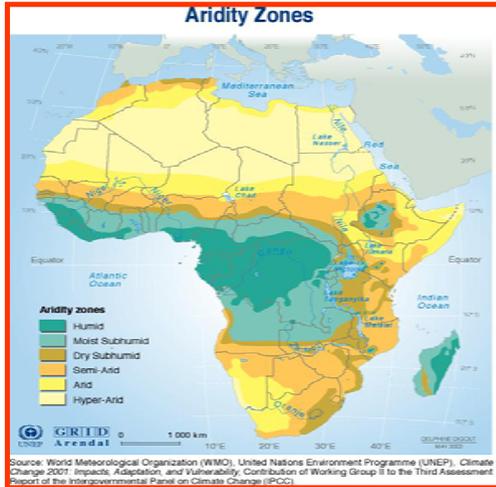
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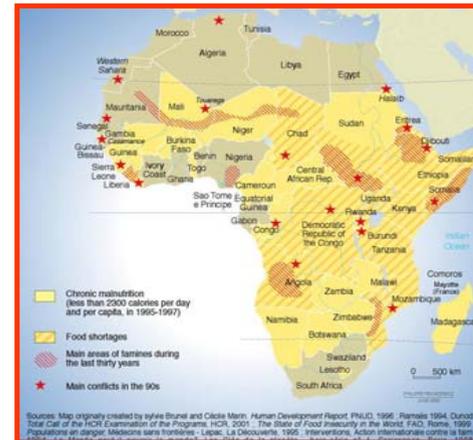
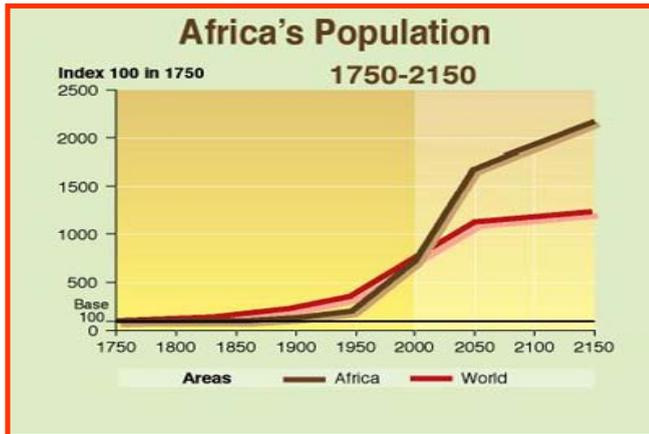
“Africa is the most vulnerable region to climate change, due to the extreme poverty of many Africans, frequent natural disasters such as droughts and floods, and agricultural systems heavily dependent on rainfall”
(IPCC, 2001)

Africa in Context - 1



- 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).
- Almost all weather related famines in the Horn of Africa in 200 years correlate with ENSO events (Davis, 2001)

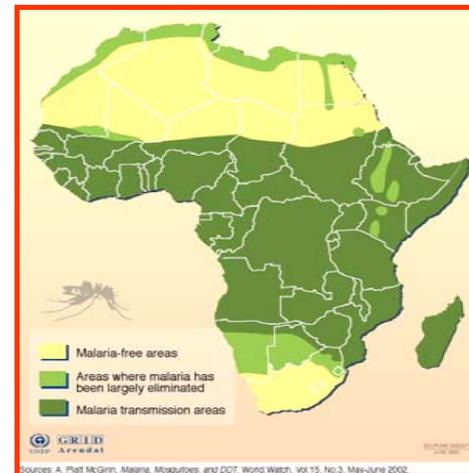
Africa in Context - 2



War and Hunger

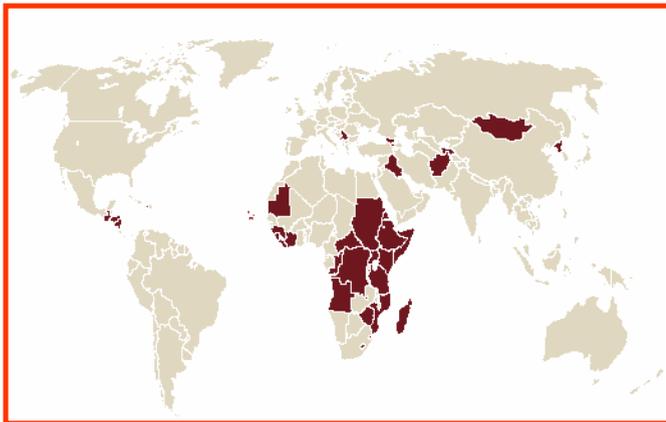


Declining food production



Malaria

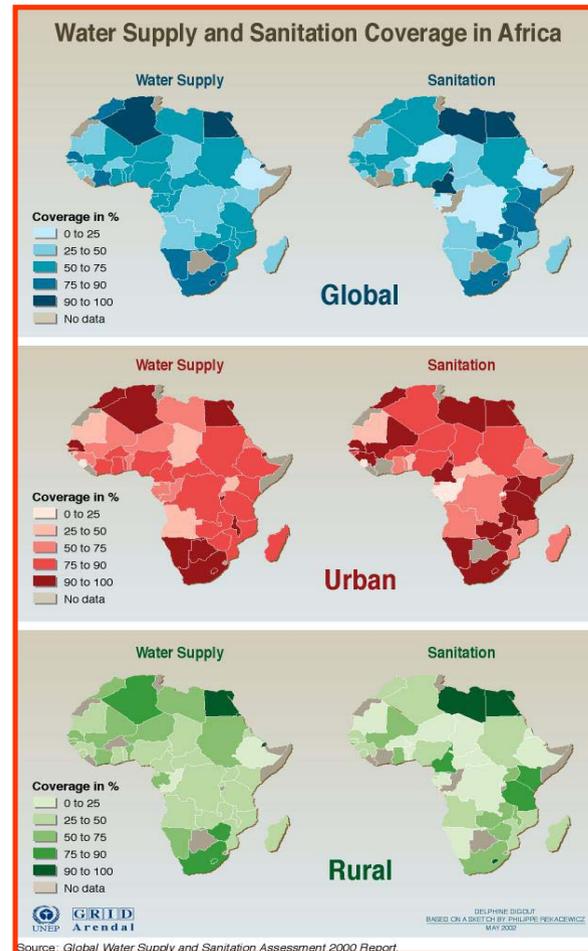
Africa in Context - 3



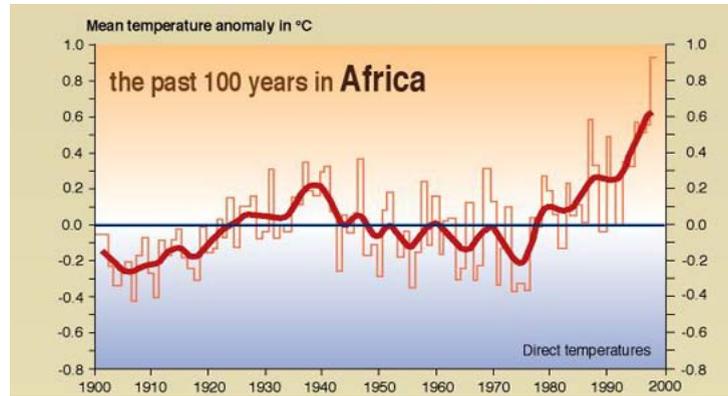
Countries facing food emergency



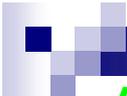
Least Developed Countries



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).



Africa's Changing Climate - 2

- GCM results based on SRES scenarios project an increase in temperature, while projections in precipitation are less consistent. Several GCMs predict a decrease in precipitation on the order of 10-20% in the main semi-arid zones of Africa,
- By the 2070-2099 period, maximum warming is expected to occur in Northern and Southern Africa (up to 9° and 7°C respectively) while it is minimum in the oceanic regions (up to 4.8°C in the tropical NE Atlantic and 3.6°C in the Indian Ocean).
- Modelled results using HadCM2 based on the IS92a scenario showing the effects of CO₂ stabilization at 550ppm (by 2150) and 750ppm (by 2250) indicate that for the Sahel region, the predicted reductions in warming are respectively 2.9° and 2.1°C.



Impacts of Climate Change:

Water Resources

- Between 1970 and 1995, Africa has experienced a 2.8 times decrease in water availability (Shiklomanov, 1996).
- In Southern Africa, by 2050 the area having water shortages will have increased by 29%, the countries most affected being Mozambique, Tanzania and South Africa.
- 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).



Impacts of Climate Change:

Agriculture

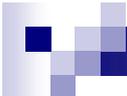
- Most of tropical (C4) crops modelled tend to have decreased yields. (US Country Studies Program, 1999; Desanker *et al.*, 2001).
- Projected losses in cereal production potentials in sub-Saharan Africa up to about 33 percent by 2060.
- A possibility that climate change will have a negative impact on 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).



Impacts of Climate Change:

Fisheries

- In Congo, it is estimated that more than 50% of the fish coming from the Conkouati lagoon could disappear due to an increased penetration of sea water in the lagoon (République du Congo, 2001).
- Shrimp production in Cameroon (mainly in the Cameroon estuary) could increase if rainfall increases. However, due to potential inundation of low lying areas in the estuary (for a 1 m sea level rise), about 38 fishing villages (53% of all the fishing villages) will have to be displaced inducing the migration of 6,000 fishermen (Republic of Cameroon/UNEP, 1998).
- In Comoros, Djibouti and Kenya, fisheries mainly depend on coral reefs, in Kenya, a decrease in fish catch (between 10 and 43%) was observed following the 1998 coral mortality (McClanahan *et al.*, 2002).



Impacts of Climate Change:

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.



Impacts of Climate Change:

Health

- Africa accounts for about 85% of all deaths and diseases associated with malaria (Van Lieshout *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).
- 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.



Impacts of Climate Change:

Coastal Zone

- 40% of the population of West Africa lives in coastal cities and it is expected that the coast between Accra (Ghana) and the Niger delta (about 500 km) become a continuous urban megalopolis with more than 50 million people by 2020 (Hewawasam, 2002). The shoreline of East Africa (11,000 km long) is occupied by 30 to 35 million people.
- In Kenya losses for three crops, mangoes, cashew nuts and coconuts (all coastal crops), could reach 472.8 million US \$ for a 1 m sea level rise (Republic of Kenya, 2002).
- In Guinea, it is estimated that by 2050, between 132.6 and 234 km² of rice fields will be lost due to permanent flooding (17 to 30% of the existing rice fields (République de Guinée, 2002).
- In Nigeria, it is estimated that about 259 oil producing wells are located in threatened areas, representing a value at risk of 10,790 million US \$ for a 1 m sea level rise (French *et al.*, 1995).



Impacts of Climate Change:

Ecosystem

- 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 (Dixon *et al.*, 2003).
- 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. (Payet and Obura, 2004).
- Other potential consequences of coral bleaching could be an increase in the number of people affected by intoxications due to the consumption of contaminated marine animals.



Mitigate or Adapt?

- Adaptation is Africa's most viable option for dealing with climate change risks?.
- The process of adaptation comprises a number of different activities, carried out by different actors:.
 - Facilitating adaptation - developing information and raising awareness, removing barriers to adaptation, making available financial and other resources for adaptation and otherwise enhancing adaptive capacity.
 - Implementing adaptation - making the actual changes in operational practices and behaviour, and installing and operating appropriate technologies and integrating indigenous knowledge systems.