Impact of Climate Change on Life in Africa

Africa is one of the most vulnerable regions in the world to climate change. This vulnerability and the limitations of poor countries to adapt to climate change challenges were highlighted in Climate Change 2001, the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). The report established how human activity (burning fossil fuels and changes in land-use) is modifying the global climate, with temperature rises projected for the next 100 years that could affect human welfare and the environment.

The historical climate record for Africa shows warming of approximately 0.7°C over most of the continent during the twentieth century; a decrease in rainfall over large portions of the Sahel (the semi-arid region south of the Sahara); and an increase in rainfall in east central Africa. Over the next century, this warming trend, and changes in precipitation patterns, are expected to continue and be accompanied by a rise in sea level and increased frequency of extreme weather events.

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Climate Change Vulnerability in Africa

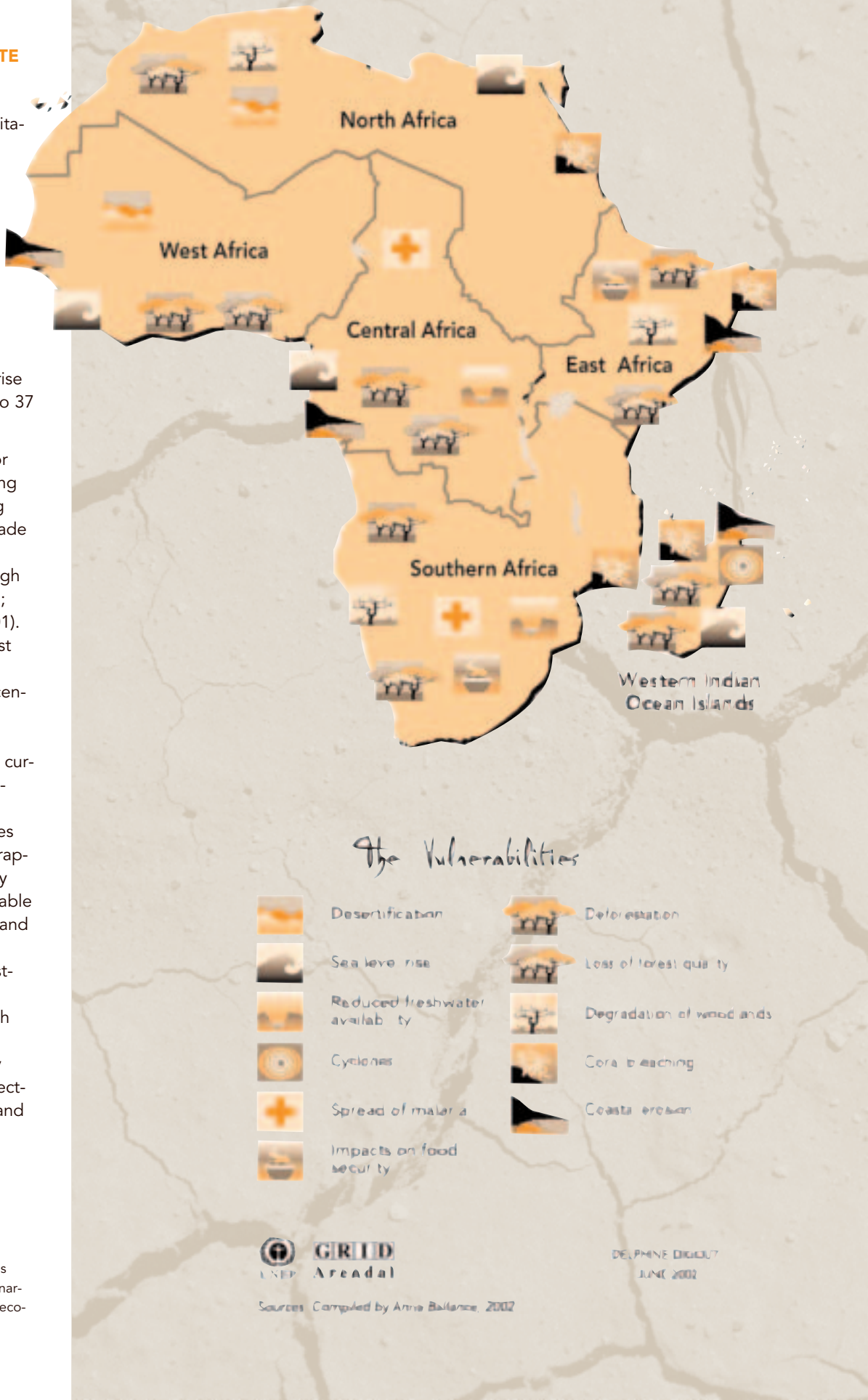
AFRICA'S CHANGING CLIMATE

While the exact nature of the changes in temperature, precipitation, and extreme events is not known, there is agreement about the following general trends.[1]

- Global mean surface temperature is projected to increase between 1.5 °C (2.7°F) and 6 °C (10.8°F) by 2100.
- Sea levels are projected to rise by 15 to 95 centimeters (6 to 37 inches) by 2100.
- Climate change scenarios for Africa indicate future warming across the continent ranging from 0.2°C (0.36°F) per decade (low scenario) to more than 0.5°C (0.9°F) per decade (high scenario) (Hulme et al. 2001; Desanker and Magadza 2001). This warming will be greatest over the interior of semiarid margins of the Sahara and central southern Africa.

WWF is working to address the current and projected effects of climate change. To slow climate change, WWF advocates policies that reduce emissions of heat-trapping gases, and increase energy efficiency and the use of renewable energy sources like wind, solar and biomass. WWF also works to increase the resilience and resistance of natural systems to the stress of climate change through the creation of transboundary reserves, increased connectivity between reserves through protected area networks or corridors, and improved protection from non-climate stresses.

1 As simulated by global climate models using a consistent set of emission scenarios according to the latest IPCC socioeconomic scenarios (IPCC 2000).



The Multiple Impacts of Climate Change

PHOTO: DEBORAH BOYD/WWF

Impacts on Humans

BIODIVERSITY LOSS. Biodiversity is an important resource for African people. Uses are consumptive (food, fiber, fuel, shelter, medicine, wildlife trade) and nonconsumptive (ecosystem services and the economically important tourism industry). Given the heavy dependence on natural resources in Africa, many communities are vulnerable to the biodiversity loss that could result from climate change. The impact of climate change on humans will also be compounded by climate change-induced alterations of agriculture, water supply and disease.

AGRICULTURE. Most of Africa relies on rain-fed agriculture. As a result, it is highly vulnerable to changes in climate variability, seasonal shifts, and precipitation patterns. Any amount of warming will result in increased water stress. Roughly 70 percent of the population lives by farming, and 40 percent of all exports are agricultural products (WRI 1996). One-third of the income in Africa is generated by agriculture. Crop production and livestock husbandry account for about half of household income. The poorest members of society are those who are most dependent on agriculture for jobs and income. (Odingo 1990; FAO 1999).

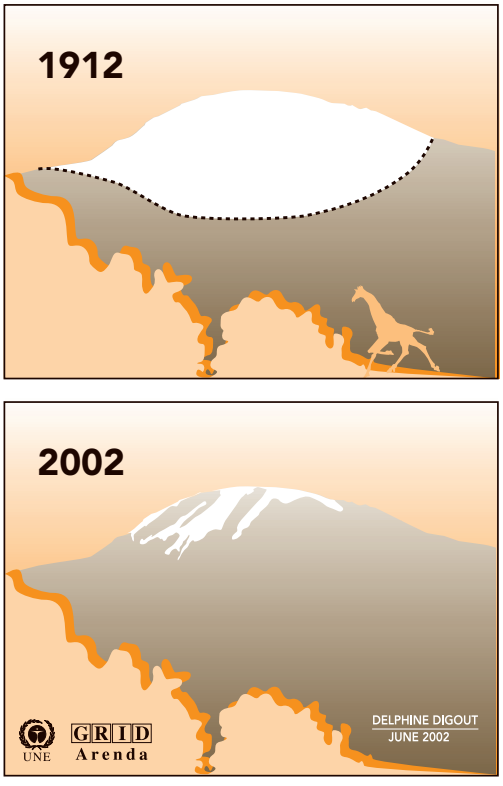
IMPACTS ON GLACIERS AND WATER SUPPLY. The gradual yet dramatic disappearance of glaciers on Mount Kilimanjaro is a result of global warming (IPCC 2001). An estimated 82 percent of the icecap that crowned the mountain when it was first thoroughly surveyed in 1912 is now gone (See Figure 2). According to recent projections, if recession continues at the present rate, the majority of the glaciers on Mount Kilimanjaro could vanish in the next 15 years. The snow and glaciers of Mount Kilimanjaro act as a water tower, and several rivers are drying out in the warm season due to the loss of this frozen reservoir. Other glaciers in Africa (Ruwenzori in Uganda and Mount Kenya) are also under similar threat.

DISEASE. Climate change has critical health implications. Changes in rainfall will affect the presence and absence of vector- and water-borne pathogens (IPCC 2001). For example, it can be expected that small changes in temperature and precipitation will boost the population of disease-carrying mosquitoes and result in increased malaria epidemics (Lindsay and Martens 1998). Increased flooding could facilitate the breeding of these malaria carriers in formerly arid areas (Warsame et al. 1995).

These problems will be exacerbated by the inability of many communities to cope with increased disease. In many African urban settlements, population expansion has outpaced the capacity of municipal authorities to provide civic works for sanitation and other health delivery services. If settlement conglomerations such as those envisaged for west Africa and the eastern seaboard of South Africa develop, vulnerable populations will cover entire regions, not just isolated areas (Nicholls et al. 1999).

HUMAN MIGRATION. Semi-arid areas of the Sahel, the Kalahari, and the Karoo historically have supported nomadic societies that migrate in response to annual and seasonal rainfall variations. Nomadic pastoral systems are intrinsically able to adapt to fluctuating and extreme climates —provided they have sufficient scope for movement and other necessary elements in the system remain in place. However, the pro-

THE MELTING SNOWS OF KILIMANJARO



longed drying trend in the Sahel since the 1970s has demonstrated the vulnerability of such groups to climate change: they cannot simply move their axis of migration when the wetter end already is densely occupied and permanent water points fail at the drier end. The result has been widespread loss of human life and livestock, and substantial changes to the social system.

Given the multitude of stress factors on biodiversity, climate change may exacerbate the stress on environmental systems beyond recovery.

Impacts on Animals

BIODIVERSITY. Africa occupies about one-fifth of the global land surface and contains about one-fifth of all known species of plants, mammals, and birds in the world, as well as one-sixth of amphibians and reptiles (Siegfried 1989).

Climate change has already affected the marine animals of Africa. Coral reefs in the Indian Ocean experienced massive bleaching in 1998, with over 50 percent mortality in some regions (Spalding 2001). Damage to coral reef systems has far reaching implications for fisheries, food security, tourism and overall marine biodiversity.

On land, animal biodiversity in Africa is concentrated in the savannas and tropical forests. Loss or alterations of terrestrial habitats by climate change will likely impact these species. Few detailed studies have been done on how climate change will affect terrestrial animals in Africa, but those that have been done demonstrate the potential extent of its impact. For example, climate change of the magnitude predicted for the twenty-first century could alter the range of African antelope species (Hulme 1996). World antelope biodiversity—more than 90 percent of the 80 species—is concentrated in Africa (Macdonald 1987).

BIRD MIGRATION. About one-fifth of African bird species migrate on a seasonal basis within Africa, and an additional one-tenth migrate annually between Africa and the rest of the world (Hockey 2000). One of the main intra-Africa migratory patterns is flown by waterfowl, which spend the austral summer in southern Africa

PHOTO: RICK WEYERHAEUSER

CLIMATE CHANGE: ONE OF MANY THREATS

Biodiversity in Africa is under threat from multiple stresses. Climate change is one of several pressures. Other threats include increasing land-use conversion and subsequent destruction of habitat; pollution; and the introduction of exotic (nonnative) species. Land-use conversion from wild habitat to agricultural, grazing and logging uses, for example, leads to habitat loss, fragmentation, and introduction of exotic species—all of which adversely impact biodiversity. Given this multitude of stress factors on biodiversity, climate change may exacerbate the stress on environmental systems beyond recovery.

In addition, conservation areas are too few. In a survey of 39 African countries, a median 4 percent of the continental land surface is in formally declared conservation areas. The percentage of landscape that is conserved varies greatly among countries (from 17 percent in Botswana to none in 4 countries), as does the degree of actual protection offered within nominally conserved areas (MacKinnon and MacKinnon 1986). A very large percentage of African biodiversity occurs outside of formally conserved areas (especially in central and northern Africa) as a result of the relatively low rate of intensive agricultural transformation on the continent. These regions of unprotected biodiversity will be lost if a predicted massive expansion of agriculture and clearing of tropical forests occurs in Africa during the next century (Alcamo 1994). Of additional concern is the protection of habitat along migration routes that must be secured before changes in land-use result in permanent loss of access by key wildlife species.

and winter in central Africa. Palearctic migrants spend the austral summer in locations such as Langebaan lagoon, near Cape Town, and the boreal summer in the wetlands of Siberia. If climatic conditions or specific habitat conditions at either end of these migratory routes change beyond the tolerance of the species involved, significant losses of biodiversity could result. Although the species involved have some capacity to alter their destinations, in a world of intense human land use the probability of finding sufficient areas of suitable habitat is small.

LARGE MAMMAL MIGRATION. The vast herds of migratory ungulates—rhinos, swine, and elephants among others—in east and southern Africa remain a distinguishing ecological characteristic of the continent. A major migratory system is located in the Serengeti area of Tanzania and the Masai-Mara region of Kenya. Reduced large-mammal migratory systems persist in the Kalahari (Botswana, South Africa, and Namibia) and Etosha (Namibia) areas of southern Africa. Typical migrations involve regular movement between dry-season and wet-season grazing areas, and are therefore sensitive to climate change. The impact of climate change on these systems is uncertain, but they could be compromised by climate change in the presence of additional land-use pressures.

Impacts on Plants

BIODIVERSITY. Africa's biodiversity is concentrated in several unique native environments. The Cape Floral Kingdom (fynbos), which occupies only 37,000 square kilometers at the southern tip of Africa, has 7,300 plant species—of which 68 percent occur nowhere else in the world (Gibbs 1987). The adjacent Succulent Karoo biome contains an additional 4,000 species, of which 2,500 are native (Cowling et al. 1998). These two floral biodiversity hot spots occur in winter rainfall regions and would be threatened by a shift in rainfall seasonality. For instance, a reduction in winter rainfall or an increase in summer rainfall would alter the fire regime that is critical to the life cycle in the fynbos.

Other important floral regions affected by global warming include Madagascar, the mountains of Cameroon, and the island-like Afromontane habitats that stretch from Ethiopia to South Africa at altitudes above about 2,000 meters (Mace et al. 1998). Montane centers of biodiversity are particularly threatened by increases in temperature because many contain isolated plant populations with no possibility of migration. Several thousand species of plants are potentially affected.

PLANT MIGRATION. As the climate changes, plants will naturally attempt to adapt by migrating, assuming the landscape is not too fragmented. However, given that most of the land in Africa is inhabited by humans, not all species will be able to migrate. From a conservation management perspective, this indicates that creating avenues of migration for critical plant groups (in either direction of the climatic gradient) might be a useful hedge against destructive changes in climate. Unfortunately for some regions, such as the fynbos, which is at the edge of the continent, there are limited options for migration.

THE ROLE OF FIRE IN AFRICAN CLIMATE CHANGE

Extensive use of fire as a management tool in Africa—for slash-and-burn agriculture and other purposes—results in at least a third of the savanna region being burned every year. Vegetation is heavily controlled by fire and other disturbances such as grazing regimes (Bond and van Wilgen 1996). Forest and savanna fires contribute to climate change, both by causing loss of vegetation and soils that serve as carbon stocks and by releasing of carbon (and other greenhouse gases) to the atmosphere by burning.

As global warming increases, these fires are likely to get more intense and extensive, and may result in significant ecosystem changes that would affect biodiversity through species loss or changes in species composition. In southern Africa, changes in the fire and grazing regimes during the past century are thought to have increased woody plant density over large parts of the region.

PHOTO: RICK WEYERHAEUSER

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Conclusion

Climate change will have significant impacts on biodiversity and food security in Africa. Therefore, substantial reductions of heat-trapping gas emissions in developed countries and adaptation strategies are crucial. For example, biodiversity must be managed to ensure that ensure that conservation is occurring both inside and outside of parks and reserves, and that adequate habitat is preserved to enable species—plants, animals and humans—to migrate. The conservation of African biodiversity will ensure delivery of ecosystem goods and services necessary to human life support systems (soil health, water, air, etc…) An integrated approach to environmental management is needed to ensure sustainable benefits for Africa.

WWF Climate Change Program

Climate change poses a serious threat to the survival of many species and to the well-being of people around the world.

WWF's program has three main aims:
- to ensure that industrialised nations make substantial reductions in their domestic emissions of carbon dioxide—the main global warming gas—by 2010
- to promote the use of clean renewable energy in the developing world
- to reduce the vulnerability of nature and economies to the impacts of climate change

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