



The Severe Impact of Climate Change on Developing Countries

Dr. Joachim Gross

“Climate Change 2001—Impacts, Adaptation, and Vulnerability,” the contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), was published in July 2001. Chapter 9 of that report entitled “Human Health” describes the current state of epidemiological research on the health impacts of global warming. It includes sections on the direct impacts of heat, floods, and droughts, as well as the indirect consequences on malaria, dengue, leishmaniasis, Hantavirus-related disease, cholera, meningococcal infections, and malnutrition. While the report attempts to quantify these impacts as far as possible, there is uncertainty about the magnitude of future climate change and further research will be needed to improve understanding of its impacts on human health. The authors develop strategies about how to counteract these impacts and they provide guidance for those making social, economic, and health care policies. *M&GS 2002;7:96-100.*

Over the past hundred years the mean global temperature has increased from 13.7 to 14.3 degrees Celsius. The 1990s were, in many respects, the warmest years of the 20th century. Most of the world’s glaciers have receded over the last few decades. The concentration of carbon dioxide (CO₂) in the atmosphere—the chief cause of the greenhouse effect—has risen from 280 parts per million (ppm) to 360 ppm since the start of the Industrial Revolution, through the burning of fossil fuels. The buildup of greenhouse gases is the most likely cause of the growing incidence of extreme weather conditions such as hurricanes, floods, and droughts.¹

JG is a specialist consultant in occupational and environmental medicine in Würzburg, Germany, at the Center for Occupational and Environmental Health. He is a lecturer at the University of Applied Sciences in Würzburg. Address correspondence to Joachim Gross, MD, 34 Lengfelder St. 34, 97078 Würzburg, Germany; e-mail: gross.joachim@web.de.

An Intergovernmental Panel on Climate Change (IPCC), established by the United Nations Environmental Programme (UNEP) and the World Meteorological Organization (WMO), has been issuing increasingly sobering reports on disruption to the global climate since May 1990. In the most recent report “Climate Change 2001—Impacts, Adaption, and Vulnerability,” published in July 2001,² a panel of high-ranking scientists and social scientists grappled with the question of the influence of climate change on the living conditions of humanity. In the ninth chapter of this comprehensive, 1,000-page work, epidemiologists from the London School of Hygiene and Tropical Medicine and other institutions outlined the influence of global warming on human health in various parts of the world. Climate change is merely one of many factors influencing the genesis of diseases, and it is often difficult for epidemiologists to separate out the socioeconomic and demographic influences. It is also difficult to predict future developments in

the nature of the world's climate, as the continued increase in CO₂ concentration very much depends on the amount of fossil fuel used in the future. From its present concentration of 360 ppm, predictions for concentration of CO₂ by the year 2100 range from 540 ppm to 970 ppm.

During the 1995 Chicago heatwave, an increased morbidity of 12 persons per 100,000 was reported, mostly among the elderly.³ Since extreme weather conditions such as this are likely to occur often as a consequence of climate change, a corresponding increase in morbidity can be expected.

Higher atmospheric temperatures cause more water evaporation, increasing humidity and leading to higher levels of precipitation in many areas of the world. The combination of heat and humidity in itself leads to an increase in morbidity rates.⁴ By the year 2050 in New York, despite that city's air conditioning, an increase in morbidity of 500 to 1,000 persons annually is possible.⁵ Some 30% of the world's people live in the vast metropoli of the Global South (see Schubel JR, Levi C. *The emergence of megacities*. M&GS 2000;6:107-109). As these cities have very little air conditioning, an even greater increase in morbidity is likely, especially in the slums.

On the other hand, milder winters can have a positive effect on longevity. One study has estimated that up to 20,000 fewer deaths would occur as a result of winter in Great Britain in the year 2050.⁶

Natural Disasters, Atmospheric Pollution, and Climate Disruption

The number and severity of natural disasters such as hurricanes, droughts, and floods appear to be increasing as global warming increases. There is a corresponding increase in the number of victims and their injuries, hospitalization, and financial losses. This has important repercussions for insurance companies.^{7,8} For developing countries with poor economies and weak socioeconomic structures, climatic phenomena such as El Niño have especially grave consequences. The droughts and floods caused by the El Niño cycle in 1982-83 led to a fall in gross national product of some 10% in Bolivia, Chile, Ecuador, and Peru, with corresponding consequences for health care.⁹

Increasing evaporation of water from the oceans will increase the likelihood of floods. The immediate effects of flooding include a rise in the number of injuries and drownings. In the medium term, a consequent acute shortage of clean drinking water and infection from contaminated water often leads to an increase in cases of hepatitis-A and cholera. In the long term, the destruction

of croplands and the wiping out of harvests result in undernourishment.¹⁰ China, in particular, has been hit by increased flooding in recent years: in 1998 alone more than 3,000 people died and four million were rendered homeless as a result of floods. Deforestation and misguided agricultural policies are additional causes that are often cited.

Populations in the southern regions of the world are far more vulnerable to such catastrophes than those in the industrialized nations. When drought strikes, the consequences for health are mostly an indirect result of impaired food production. Chronic undernourishment intensifies quickly into starvation. When water is scarce, its priority use is in cooking, with little left over for washing and hygiene. This results, among other things, in an increased incidence of trachoma and scabies. When water is stored for long periods, or has faecal contamination, outbreaks of diarrhea occur. Undernourishment in this situation increases susceptibility to infection.

The effects of atmospheric pollution on public health are currently seen mostly in the Global South. In the industrialized countries, the use of catalyzers in vehicles and cleaner fuels (e.g., natural gas instead of coal) has reduced emissions of noxious particles and of pollutant gases such as sulphur dioxide, carbon monoxide, and nitrous oxides (though CO₂ emissions are as high as ever).

But in India some 40,000 people die prematurely every year as a result of atmospheric pollution.¹¹ The combination of local air pollution and warm weather is a heightened risk factor for the rising incidence of chronic obstructive pulmonary disorders (COPD). Rising temperatures provide the conditions for an increased risk of forest fires. The release of soot particles contributes to an increased rate of COPD. We can expect a further increase in COPD through the increased release of pollen, not only from earlier onsets of spring, but also because higher concentrations of CO₂ lead to increased production of pollen. Experimental investigations have shown an almost four-fold increase in the highly allergenic pollen of *ambrosia artemisiifolia* (ragweed) when CO₂ levels double from 300 to 600 ppm.¹²

There is clear evidence that global warming leads to an increase in the concentration of radon in the lower layers of the atmosphere.¹³ As a source of alpha radiation, this radioactive gas is a well known cause of malignant lung cancers.

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Increase in Infectious Diseases

Many infectious diseases, especially in the tropics, are borne by vectors (such as the *anopheles* mosquito) that have no control over their own temperature regulation system. A rise in humidity or of ambient temperature can have a sustained influence on the activity, dispersal, and spread of such vectors and can thereby increase the spread of a variety of tropical diseases:

Malaria: Recent studies based on climate change models provide evidence that the zones in which malaria has the potential to spread will become larger through climate change. By the year 2080, 260 to 320 million people are likely to find themselves living in areas with potential malaria infestation.¹⁴ Successful stabilization of CO₂ emissions to levels of between 550 and 750 ppm could limit the expansion of malaria-infected areas by a third.¹⁵

Dengue fever: This disease, carried by the mosquito *aedes aegyptii*, has widened its geographical boundaries in tropical regions over the past decade. Epidemics have broken out in provinces of Mexico bordering the United States. Cases of endemic spread have been reported in Australia and the US. What is not clear is the extent to which climate change is affecting the spread of dengue fever in subtropical

regions, since socioeconomic factors tend to limit its impact here.¹⁶

Leishmaniasis: Vectors of this disease, found even in southern Europe, are several species of sandflies whose spread and activity are strongly influenced by ambient temperature. Studies show an increasing spread in the subtropical regions of Brazil, Paraguay, Bolivia, and Argentina.¹⁷ In Italy there is a mixed picture with a variety of species of sandflies.¹⁸

Hantavirus disease: Changes in climate can also work to the advantage of warm-blooded pests. An explosion in the mouse population after heavy rainfall in the wake of the 1991-92 El Niño phenomenon was seen as responsible for the first ever outbreak of Hantavirus pulmonary syndrome in the US.¹⁹

Cholera: This disease, spread via contaminated water and food supplies, appeared in a new serogroup (*V. cholerae* O 139) in 1992. During the El Niño phenomenon of 1997-98 large areas of Djibouti, Somalia, Kenya, Tasmania, and Mozambique were flooded. Faeces-contaminated drinking water led to a number of cholera epidemics. The warming of the great African lakes is considered a potential cause of an increased risk of cholera

outbreaks in adjacent lands.²⁰

Meningococcal meningitis: Ever larger epidemics of this infection are striking regularly every five to 10 years in the African "meningitis belt." The pathogens of this disease, carried by dust particles, are spread especially during the dry season. El Niño causes a lengthening of dry periods, leading to a wider spread of pathogens from the "belt" into Kenya, Uganda, Rwanda, Zambia, and Tanzania.²¹

Background climate and annual climate patterns are the key factors in agricultural productivity, despite gains in irrigation and the diversity of national production. Changes in precipitation and temperature can therefore compromise food supply and can indirectly affect public health. World food production is subject to many economic, social, and cultural influences. Climate change is likely to increase pressure on the production of food supplies for six billion people. Until now, growth in production has kept pace with population developments. But since the 1990s there are signs that this dynamic is waning.²²

The UN Food and Agricultural Organization's (FAO) 1999 report named potential crisis regions where agricultural production is especially endangered due to environmental factors. These are areas that are frequently hit by drought and flooding or that have a particularly steep landscape or tendency toward erosion. Extreme weather conditions, occurring often, can lead to an intensification of undernourishment and starvation.²³

The melting of the polar icecaps and the expansion of sea water by global warming has already resulted in a detectable rise in sea level.¹ The possible effects on the health of coastal peoples should not be underestimated. For example, a rise of 50 cm in the Nile delta would put 32% of town and city areas under water. Quite apart from loss of living area, water reticulation systems, especially sewage systems in populated areas, would be rendered inoperable, with major implications for hygiene. A rise in sea levels would also cause problems for food production, leading, for example, to the salting up of rice growing areas in Bangladesh.²⁴

Public Health

The most cost-effective and efficient means to avoid compromising public health is the establishment of public health protection measures.²⁵ In many countries public health has sharply deteriorated in recent years. Many health problems that arise from the altered influence of climatic factors could be averted through the action of public health bodies with relatively moderate means.

These actions could include improved monitoring of particular infectious diseases, early warning systems for extreme weather conditions, education programs in public health care and in ongoing preventive measures, and control programs for particular diseases that are spread by vectors or are caused by poor nutrition.²⁶

Many of the negative health effects of climate change befall countries in the tropical zones of Africa, Latin America, and Asia, while the emissions of greenhouse gases that underlie these problems stem mainly from the industrialized countries of the Global North. Yet the underdeveloped lands are the very nations that lack the means to establish expensive infrastructures—flood dams, for example—in response to these threats. On the other hand, they face huge costs: the cost of treating victims of the dengue fever epidemic in Puerto Rico in 1994 was estimated at more than US\$12 million.²⁷ The inequity between causes and effects of climate change must be acknowledged by decision makers in politics and economics. On a global level the health of a population can be a “biomarker” for the effectiveness of measures that have been implemented.

The Kyoto Protocol

A consistent application of the Kyoto Protocol in limiting greenhouse gases would be a first step in arresting the warming of the Earth’s atmosphere. Further regulations could contribute to the speedy application of energy-efficient technology in the production of consumer products and in industry. The replacement of fossil fuel with renewable energy sources will play a key role in the stabilization of the greenhouse effect and thereby indirectly alleviate its effects on public health. Even in hospitals and medical clinics, which consume a great deal of energy, there is great potential to cut down on CO₂ emissions.²⁸

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