

# Climate change and the issues for health in the South



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The Matinhas district in Cayenne, French Guiana. The groups of people rendered most fragile by the effects of climate change are also those in precarious situations and who have received little education.

Climate change will increase inequality and hinder socioeconomic development of countries marked by chronic poverty and therefore have major health implications. According to the World Health Organization (2014), climate change is already having a direct effect on the social and environmental determinants of health but beyond this the repercussions could be more indirect. For example, crop yields and fish catches could be affected and as a result the nutrition of the population, or human migrations might be triggered, further exposing individuals and communities to sanitary threats. The development of transport and industry in the large megalopolises in the South should lead to hitherto unequalled pollution, aggravating cardiovascular and respiratory diseases that are themselves closely linked to climate upsets.

Although several determinants may thus be involved, it is still very difficult—outside observations that are often very alarmist and not based on scientific proofs—to actually measure the impacts of climate on health in countries in the South as the data are not available today. However, it has to be admitted that there will doubtless be several million victims. The most vulnerable populations that are often located in regions without adequate social and sanitary infrastructure will also be those least able to face these new situations. Improvement of health and well-being must form a major objective

in development policies in the light of the foreseeable worsening of health conditions. Such a policy will also make it possible in turn to act on the adaptation capacity of persons and public entities to adapt to these threats. In this context, the levers formed by the promotion of awareness of the population, the gathering of reliable scientific data and the strengthening of health systems are the basis for a major line of research for IRD and its various partners. Extreme events such as heat waves and repeated flooding, air pollution especially in developing megalopolises, soil erosion and the availability of water resources, nutrition and infectious or parasitic diseases are all fields in which the measurements and monitoring that are essential for anticipating the sanitary effects of climate change are still lacking. An overview of the probable or expected health risks ranging from mental health problems to infectious diseases.

## **The countries in the South are more vulnerable to climatic dangers**

According to the last annual report (2014) of the British institute Verisk Maplecroft, 67 of the 194 countries analysed seem more exposed to future climate events, with the most vulnerable being the countries in the South and especially those in sub-Saharan Africa. The study is based on evaluation of the exposure of populations to climate change and also their susceptibility in terms of health, agricultural dependence and available infrastructure and on their capacity to adapt to and combat these impacts. Unsurprisingly, the 67 states in question currently have the poorest and least well-informed population and are those with the scantiest public services. Here, climate change means inequality in the consequences, especially for health, as other regions that are exposed but that possess strong adaptation capacity because of their human, logistic and financial resources will prove to be much less vulnerable.

Although the effects of changes in climate and the vulnerability of poor populations vary considerably from one region to another, it is nonetheless accepted that the impacts of climate change will be added to existing vulnerability. The health of poor people will probably deteriorate and there may be a real threat to food security in many countries in Africa, Asia and Central and South America. According to the OECD, the effects of climate change could thus call development into question in numerous countries in the South.

## **Not enough long-term studies or reliable data**

Paradoxically, there is an almost total lack of scientific data, or at least data available today, on the links between climate change and health in developing countries. In addition,



Baduel district, Cayenne, French Guiana.

This district is like a Brazilian favela and the precarious conditions expose the population to climate risks and their consequences.

the rare examples that we can consult display an enormous disparity in research on infectious diseases (dengue, malaria, etc.) and that on chronic diseases. The reason is probably a tropical studies tradition in countries in the North in which the focus is only on endemic infectious and parasitic diseases.

As the changes in climate form continuous processes and are by definition complex with extremely heterogeneous consequences, the issue is that of adapting the gathering of scientific data both in time—avoiding one-off examination of obvious short-term features such as those occurring during extreme climatic events—and in space as in a region the zones lacking the necessary health infrastructure will be those most affected. There are thus very strong uncertainties in our understanding of the impact of climate change features in these regions and development sciences must stimulate mobilisation, innovation and militancy in future debates.

## The links between climate change and health, a three-stage process

Analysis of the 'conceptualisation' of the consequences of climate change for health from the mid-1980s, when the IPCC was founded, reveals three stages of structuring today. These stages become enriched semantically as calls are made on fields in other disciplines and new knowledge emerges. A linear and hence very simplified understanding of the 'impacts' of climate change on health lasted until the mid-1990s, and especially on the WHO website devoted to climate change (Fig. 29a). Although this essentially environmental and physical concept of the effects of climate on health made it possible to list expected or probable effects on health, it nonetheless had an orientation as it placed climate change upstream of the causes, considering them to have this single environmental determinant.

From then until roughly the mid-2000s, with the broadening of the network of collaborators and scientific and public questioning, although the ontology of the consequences of climate change for health was not upset, better account was taken of the human aspect, especially as regards the capacity of societies to develop scientific knowledge or adapt to these adverse environments (Fig. 29b).

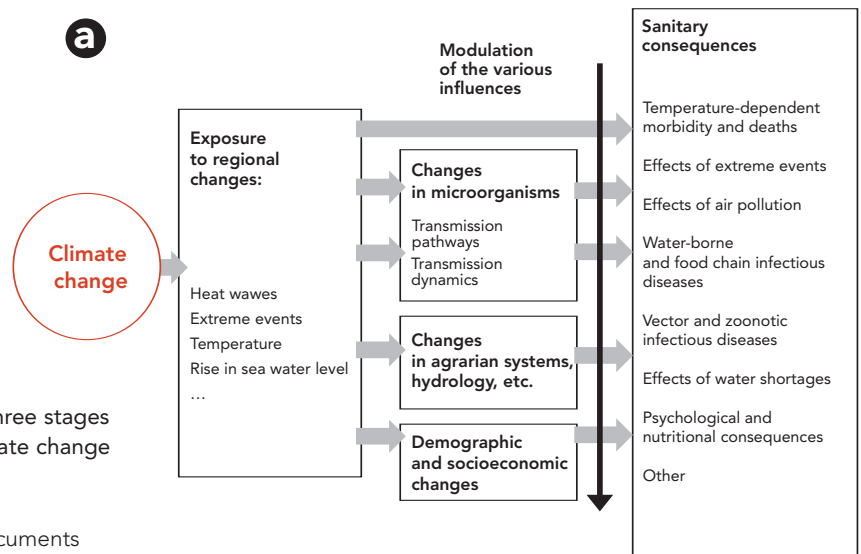


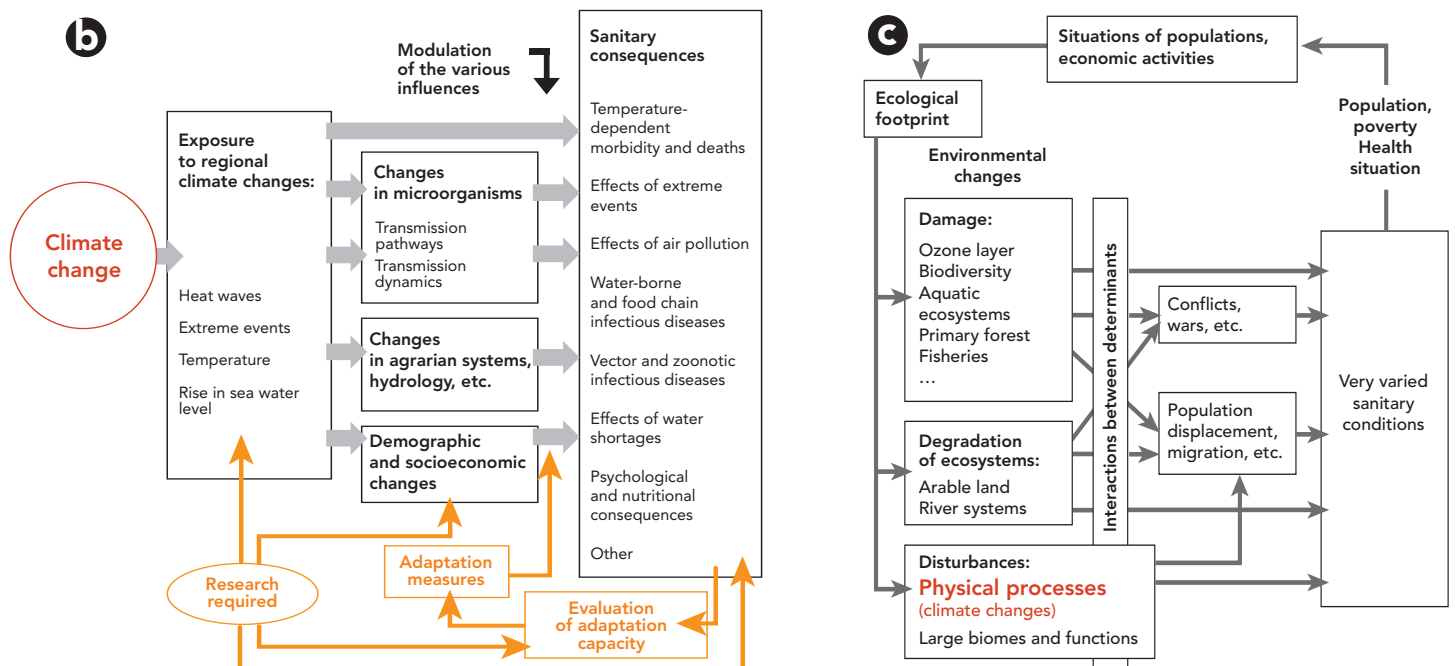
Figure 29. Illustration of the three stages of research on climate change and health. The diagrams are from the official documents of various international programmes and organisations (WHO, UNEP, etc.). Source: IRD/J.-F. Guégan



## Climate change, a component of global environmental changes

The third, ongoing sequence is aimed at incorporating climate change as a component of global environmental changes, while awarding obvious importance to human activities and their anticipation and resistance capacities (Fig. 29c). A great many scientific programmes focused on climate change and its consequences have evolved towards closer integration of their work, taking better account of ecological, sociological and economic aspects and of the progress made in green engineering. The setting up of the international UN programme Future Earth ([www.futureearth.org](http://www.futureearth.org)) combining four older scientific programmes on environmental and human changes (IHDP, Diversitas, WCRP and IGBP) clearly shows this trend.

The three approaches have oriented research on the consequences for health of climate change. Much research conducted from 1985 to 1995 showed a link between climate malfunctioning and health (mainly for infectious diseases). From 1995 to 2005 there were serious controversies concerning the direct effect of climate change on health. Finally, much previous work has been questioned since 2005, and human activities and behaviour and the organisation of socioeconomic systems have been placed at the centre of the discussion.



## An ecological approach to health

Recent work with ecological niche models to predict the risk of malaria in Africa and using a large number of parameters other than meteorological ones shows that factors such as human population density are preponderant in explaining the present and future distribution of this type of risk of infection. In contrast, the research carried out in the 1980s and 1990s contains numerous demonstrations of the major role played by climate changes in such infections and their future spread.

In parallel, there has been a distinct decrease in the number of pages on the consequences for health of climate change in publications by French and international institutions. Why this decrease at a time when the Director-General of the WHO has announced that 'Debates about climate change are still not giving sufficient attention to the profound effects that climate variables have on health'?

## The negative effects of alarmist communication

The three stages described above show the difficulty today in mastering the subject of climate change and health. The passionate statements and production of scientific information in the first stage, with demonstrations that were sometimes not particularly convincing, were followed by suspicion by some of the public and real lack of interest,

Figure 30.  
An example of an alarmist press communiqué published by Science News on 4 March 2010 and aimed at illustrating the possibly alarming spread of malaria caused by climate change. In fact the map shows, but with a few doubts, the regions in which various forms of malaria spread in 1900.



even in scientific spheres. The call by the Director General of the WHO comes at a moment when even in scientific circles it is considered that questions of health related to climate, and hence communication messages, are too alarmist and could frighten people! Might communication concerning research on climate change have switched to simplification? The media subject '...the effects that climate variables have on health.' must not harm world health. There is no doubt that health threats linked to climate change do exist. They should be the subject of awareness campaigns targeting the population and national and international public authorities, objectively and without exaggeration. They must also be based on scientific proof. The foundation of this scientific information is based on the establishment of a purpose-designed network of surveillance information services that obviously include countries in the South and on a long-term research approach to avoid a short-term catastrophic view.

## **What health effects are observed in countries in the South?**

This relatively recent (about a decade) research theme shows two main strategic orientations: the first approach is medico-geographical and aimed at understanding the geographic distribution of infectious systems and the evolution of their distribution according to changes in climate; the second is based on a methodological corpus of analyses of time series (cases of infectious diseases and climatic parameters) to study the short and long-term consequences of climate change on the appearance and frequency of infectious epidemics.

### **Change in the spatial distribution of the infectious system**

As regards geographic distribution, research by IRD and its partners in West Africa has shown for example that the spatial distribution area of the bacterium *Borrelia crocidurae* has increased by 350 km in comparison with its original area. Spread by ticks, the illness causes recurrent fever and is a public health problem in this part of Africa. The southern limit of the infectious system is now at isohyet 750 mm and the northern limit crosses the River Senegal and reaches northwest Morocco. The recent change in the geographic area of the disease and its vector has been linked to climate changes in the region. Other similar studies by IRD are focused on the evolution of the geographic distribution of *Leishmania/Phlebotominae* sand flies in several countries around the Mediterranean and also of the mosquito *Aedes albopictus*, the vector of dengue and chikungunya viruses at the Mediterranean and world scales. However, links with climate are

Searching for ticks, the vector of Lyme disease, in Senegal. The area of distribution of the disease and its vector has shifted northward because of climate change.



still difficult to establish while all this research often lacks references for the establishment of past distribution and are also potentially biased by confusing factors such as the spreading of disease by humans and transport. But it remains essential to identify and map the zones most vulnerable to these new health risks and determine the intervention measures necessary for human populations.

### **The development of early warning systems**

A second category of research work is performed on correlating time series (often long) of cases of several infectious diseases with time series of meteorological parameters such as temperature or rainfall or with indicators used as approximation variables of climate changes. Thus work on cases of dengue in New Caledonia and Thailand, on cholera and meningitis in Africa and on Buruli ulcer in French Guiana and Cameroon makes it possible to specify the effects of medium and long-term climate change on the



appearance of epidemics of infectious diseases and the increase in their frequency. More generally, this work makes possible the construction of statistical models to explain and predict epidemics of the various infectious diseases, prefiguring the development of early warning systems.

Box 48

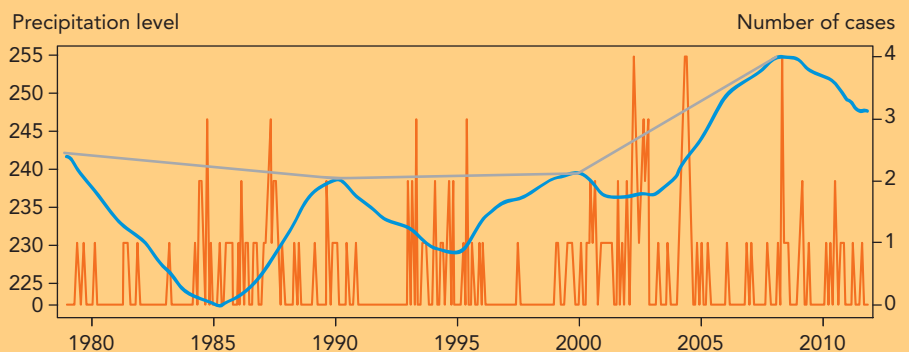
**An (in)direct link between Buruli ulcer and climate change**

In French Guiana, a team of IRD researchers and their partners have shown for the first time and over a 40-year period, the relation between climate change and epidemics of Buruli ulcer. This emerging disease in South America is caused by an aquatic mycobacterium naturally present in tropical freshwater ecosystems. The research team compared changes in rainfall in the region with the changes in the number of cases of Buruli ulcer recorded in French Guiana since 1969 (Fig. 31). The rise in surface water temperature in the Pacific tends to increase the frequency of El Niño events that hit in particular Central

and South America approximately every 5 to 7 years, causing periods of drought. The decrease in rainfall and rainfall flow results in an increase in areas of residual stagnant water where the mycobacterium that causes the disease proliferates. The subsequent greater accessibility of marshy habitats results in more movement of humans there for fishing or hunting for example, intensifying their exposure to the infectious microorganism. This example illustrates the possible indirect effects of climate change on natural ecosystems, the change in habitats of species that may result and the emerging risk of infection.

Figure 31. In French Guiana, the number of cases of Buruli ulcer (in red) changes according to precipitation levels (in blue). The periods with the lowest precipitation levels, marked by the El Niño phenomenon in the sub-region, display the largest number of cases of Buruli ulcer.

Source: Nature Publishing Group, 2014.



## Health prospects in the South

While weather conditions have a considerable effect on diseases spread in water (numerous bacteria and viruses) and those spread by arthropods (malaria, dengue, etc.) and even by reservoir animals (molluscs, rodents, bats, etc.), the effects of climate change are not always propitious for the spread of vector diseases. For example, in some parts of West Africa the decrease in rainfall forecast in the medium term would be unfavourable for the malaria parasite cycle and the geographic area should decrease in certain zones. It is very probable that an increase in temperatures and greater variability of precipitation will result in very variable health pictures in tropical regions.

Another source of uncertainty concerns the specific responsibility of climate in relation to the other parameters, especially in countries in the South where anthropisation has many forms and affects all socio-ecosystems and where biophysical and human aspects are closely entwined. In just a few decades, industry and agriculture

Polluted water,  
a habitat for mosquito larvae  
in Yaoundé (Cameroon).



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have caused numerous cases of soil and water pollution. Accelerated urban spread has resulted in the artificialisation of shores and the degradation of natural environments. The globalisation of transport has caused the arrival in ecosystems of exotic, sometimes invasive species. The impact of these pressures on the environments is combined with that of climate change that leads for example to more favourable conditions for the pullulation of certain species and speeds up the eutrophication of aquatic environments. Likewise, the rise in temperatures results in increased need for irrigation water and in return this generates further impacts on the discharge of coastal rivers, groundwater levels and the creation of new habitats for insect vectors of infectious diseases.

### **The long list of health impacts expected**

Crop yields will be affected in several regions with higher temperatures and less rainfall, aggravating affecting food insecurity. As is said in this Peul proverb: 'Grass isn't growing, millet isn't growing, so you have to leave'. Population displacement will increase tension and increase the risk of conflicts. These movements will disturb individuals psychologically. Longer, more frequent periods of intense heat could cause an increase in deaths caused by asthma-type respiratory complications or cardio-vascular diseases. Such health risks will increase in cities in developing countries where the effects of heat waves and air pollution will complicate the epidemiological situation. The scarcity of water in the driest zones could have anthropological, social and economic repercussions that are still difficult to forecast, as is shown by certain human behaviour in south-west India where men take a second or even a third wife, referred to as the 'water wife' whose main task is searching for potable water for the family. In this context of multiple interactions, the attribution of an observed impact to a given cause is a recurrent difficulty for scientists.

The effects of ultraviolet radiation caused by changes in the ozone layer in numerous southern countries, and especially in cities where pollution by gases may damage the ozone layer, will cause an increase in the number of cases of skin cancer or sensorial disturbances that can lead to blindness. Natural catastrophes such as extreme weather causing floods or landslides will form an increased risk of mortality for populations and regions that are already very vulnerable. These conditions will increase the risks of water or vector transmission, making this aspect more serious.

There is thus no doubt that the effects of climatic evolution on health in southern countries are numerous, with several being preoccupying, and are not limited to infectious vector diseases alone. An ecological transition with serious repercussions for public health will therefore be added to the epidemiological transition experienced by developing regions.

## Anticipating crises by adapting health systems

As in the saying 'Prevention is better than cure!', the improvement of health and care systems, including surveillance and health monitoring systems, can form the first measures of adaptation to climate change, especially in developing countries. For example, it is surprising that most of the countries in central and West Africa have not set up health security agencies and national public health councils. It is not just a wager. The improvement of health and the quality of life of the population will result in an increase in capacities to adapt to climatic conditions and also better protection against other threats and catastrophes. The quality of ecosystems, air, food and potable water and better education/information for the public on these subjects will enhance the **compliance** of populations and generate reactivity in the face of climate threats. This more global approach is the basis of what is called 'health ecology', a relatively new health research discipline.

Although long-term investments aimed at limiting global warming sometimes seem discouraging or even vain, those made in the health sector will have concrete results and benefit the greatest number. The uncertainties that remain with regard to the numerous health, social, environmental and economic consequences must now make it possible to establish a closer link between the mitigation and adaptation agenda and the other development agendas.

Box 49

### For a multisite world research programme

Today, IRD is anticipating the consequences for health of climate evolution by conducting research with its partners in the South and with various French and European research institutions on public health in relation with climate change. Historically specialised in tropical infectious, parasitic and nutritional diseases, IRD is evolving and adapting to take better account of the multiple facets of the health effects of climatic evolution on vulnerable populations in the South.

With its history, its knowledge of southern countries and with a procedure of responsibility and exchange with these partner countries, IRD is campaigning for the drawing up of a multisite world research programme allowing comparative approaches. Furthermore, the programme should be run on a long-term basis because health effects may occur after a long time in comparison with the life histories of populations.





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### Cairo, Egypt.

Cairo has a population of 18 million and is the largest city in Africa and the Middle East. Intense pollution of water, air and soil is a deeply concerning public health problem for the authorities.

Politicians' need for decision aid correspond to the need to make progress in scientific knowledge. By shedding light on the bidirectional relations between economic development and health, recent work encourages a closer relation between fighting climate change, protection of the environment and the strengthening of health systems. From the scientific point of view, this requires better organisation of interdisciplinarity between ecology, infectiology, plant, animal and human biology, economics and social science, modelling and the strengthening of longitudinal monitoring services focused on the environment and population and health behaviour.



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