

CLIMATE CHANGE AND HEALTH – TIME TO ACT

FACTS AND CONCLUSIONS FOR INDUSTRIAL AND
DEVELOPING COUNTRIES

Winfried Zacher



Brief Summary

Climate change will result in grave consequences for the health of the world population. While industrialized countries have begun to protect themselves by starting adaptation programs developing countries have only limited resources to do so. They however – and especially least developed countries – will suffer most from climate change. Yet historically the global warming is a result of the industrialization in the north although meanwhile emerging economies contribute more and more.

Because of the negative effects of climate change on health and the positive “side effects” of mitigation measures for human health the international discussion on climate change and the necessity for mitigation and adaptation needs to place much more emphasis on health issues.

Health professionals and the health sector in general need to battle climate change – for health reasons as well as for the sustainability of human life.

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Summary

Climate change will have grave consequences on the health of the world population. While industrial countries have started to protect themselves by developing adaptation interventions, middle income countries have only limited such capabilities and low income countries are hardly capable of doing this at all. The latter however will carry the main burden of the change although the historical reason is the industrialisation of the north – even though newly industrialized countries lately contribute considerably.

Climate change could result in the biggest health problems of the 21st century. Nevertheless health hardly plays a role in the international climate negotiations. At the same time there is new evidence to support mitigation of climate change, not only for climate but for health reasons as well. Many interventions that reduce greenhouse emissions produce considerable and immediate health “co-benefits”. This is not just due to a reduction in classical greenhouse gases – which are not toxic by themselves – but due to a reduction in coincidental short lived emissions. It is the latter that have direct negative effects on health. Their reduction therefore results in immediate health improvements. In addition many preventive health interventions have as a “side effect” substantial climate change mitigation.

Because of the negative health consequences of climate change and because of the positive health effects of mitigation, health interventions need to become a much more prominent issue in the international climate discussion. The health sector and health professionals have a special responsibility to emphasize these interdependencies – a responsibility which as yet is hardly taken seriously.

1 Analysis

1.1 Introduction

In Kyoto, in 1997, for the first time since the climate discussion started, an international and legally binding agreement to reduce emissions of greenhouse gases was signed by most industrialized countries. Its intent was to prevent a rise in global temperature to dangerous levels above the preindustrial era. This agreement ends in 2012. It was hoped that the Dec. 2009 conference in Copenhagen would achieve an extension of the contract and include the remaining industrialized countries (including the U.S.) and important middle income countries. This failed to materialize. In Dec. 2010, in Cancún the complex process of negotiations was restarted and some important agreements were signed. However these agreements fall far short of achieving the goal of the 2°C limit. The climate summit in Durban in Dec. 2011 once more failed to agree on new and binding measures. Its final decision to continue the talks in order to achieve a new agreement by 2015 to be implemented from 2020 onwards for some observers is a sign of hope, for others a complete disappointment. It remains absolutely essential to agree on more decisive reduction measures. Time is running out.¹ Projections need to be revised again and again as it becomes apparent that global warming is occurring more rapidly than previously expected (World Bank 2010 a).

The 4th report of the Intergovernmental Panel on Climate Change (IPCC) specifies health as one of the five areas most likely to be heavily influenced by climate change (IPCC 2007).

And the World Development Report of the World Bank 2010 summarizes the most important consequences of climate change above 2°C to be:

- “... significant loss from the Greenland and West Antarctic ice sheets and subsequent sea-level rise;
- ... increase of floods, droughts, and forest fires in many regions;
- ... **increase of death and illness from the spread of infectious and diarrhoeal diseases and from extreme heat;**²
- ... extinction of more than a quarter of all known species; and
- significant declines in global food production” (World Bank 2010 a).

1.2 Temperature rise and health

There is no doubt: human health will be influenced all over the world. However, existing and future consequences will depend very much on the social and geographic situation of the population. The consequences will sometimes be only marginal but frequently heavy. Rarely will they be positive. Often they will be catastrophic.

¹ There are still sceptics doubting the existence, the cause and the effects of climate change. However scientific evidence is overwhelming: meanwhile 85 % of climatologists agree on its man-made nature. (Bray 2008)

² emphasis by the author

Climate change affects health via a cascade of different mechanisms. (Fig. 1) **Direct** effects are diseases and deaths as a result of extreme weather events like heat, flooding, mud slides, storms and hurricanes. **Indirect** effects are those that result from changes in the ecosystem, such as conditions that facilitate infectious diseases, changes in agricultural production, and the availability of (clean) water. But climate change can also have indirect effects on health from the social and economic turmoil brought on by drought, flooding, famine, epidemics and movement of refugees.

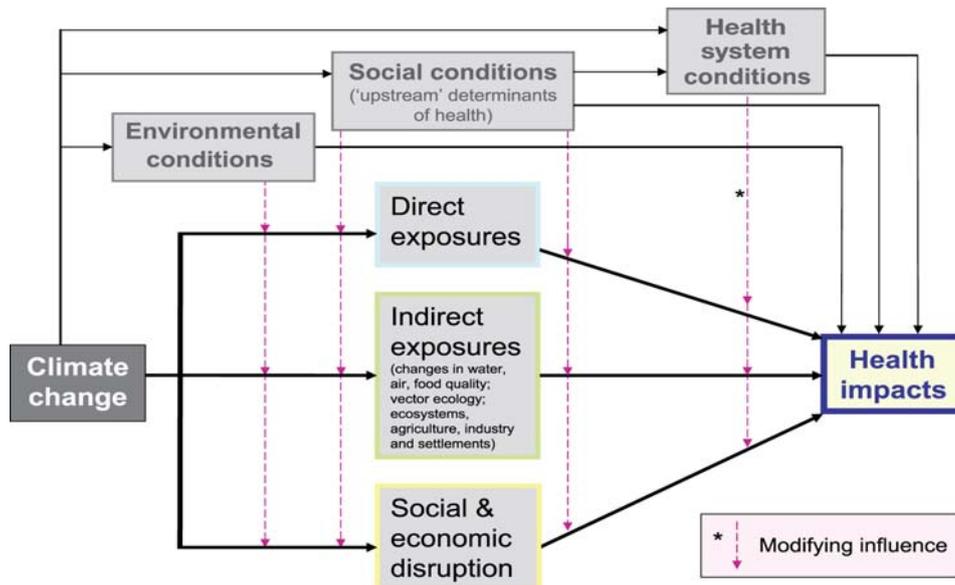


Fig. 1: Mechanisms of climate change affecting health (IPCC 2007)

Health care delivery systems too can suffer from the consequences of climate change. If a hospital is damaged by a hurricane it will not be able to care for the wounded. Floods may inundate health centres and compromise their task of caring. But also the capacity of a functioning system may quickly become insufficient if temperature rise suddenly increases demand for health care and result in paralysis or malfunction of an institution, if for example heat waves multiply cardiac and circulatory problems or an epidemic of Cholera rapidly leads to a lack of infusion fluid or if a sudden surge in infections leads to a lack of beds.

The impact of climate change on health is quite complex and different factors sometimes act as cause and at other times as effect. Interdependencies are the rule rather than the exception. Therefore even in industrialized countries research needs are still manifold (Portier 2010), and for developing countries they are considerable too (Dube 2009). Therefore, at the moment, predictions of the direction and quantity of climate change induced health consequences involve a degree of uncertainty.

The IPCC accommodates this uncertainty by attaching different degrees of probability to its scenarios:

	Negative impact	Positive impact
Very high confidence		
Malaria: contraction and expansion, changes in transmission season	←	→
High confidence		
Increase in malnutrition	←	
Increase in the number of people suffering from deaths, disease and injuries from extreme weather events	←	
Increase in the frequency of cardio-respiratory diseases from changes in air quality	←	
Change in the range of infectious disease vectors	←	→
Reduction of cold-related deaths		→
Medium confidence		
Increase in the burden of diarrhoeal diseases	←	

Fig. 2: The most important health consequences of climate change. (IPPC 2007)

However, there is no doubt about the direction and the tendency of the effects and it would be very unwise to underestimate the evolving problems and not to take action as long as it is still feasible.

The World Health Organisation (WHO) assigns increasing importance to the relation between climate change and health. The 61st World Health Assembly in 2008 dealt with the topic extensively and appealed to all governments in the world to take counteraction (WHO 2008 b). And the director general, Margret Chan, considers climate change to be the most important health challenge of the 21st century (WHO 2010 d).

The European Union too increasingly recognizes the relevance of the topic. At their 5th conference the European Ministers for Environment and for Health jointly adopted the “Parma Declaration on Environment and Health” and at the same time launched an action plan: European Regional Framework for Action: “Protecting health in an environment challenged by climate change” (WHO 2010 e).

1.3 Consequences for Germany and for Europe

Like all the other industrialized countries, Germany will experience consequences of climate change in the health sector. Increasingly frequent extreme weather events have already had detrimental effects: the heat waves during the summer of 2003 resulted in an excess mortality of 70 000 lives in Western Europe. In Germany, in spite of a well functioning, country-wide health system, more than 9000 people died as a direct result (Robine 2007) – a fact that has not been sufficiently appreciated by the public.

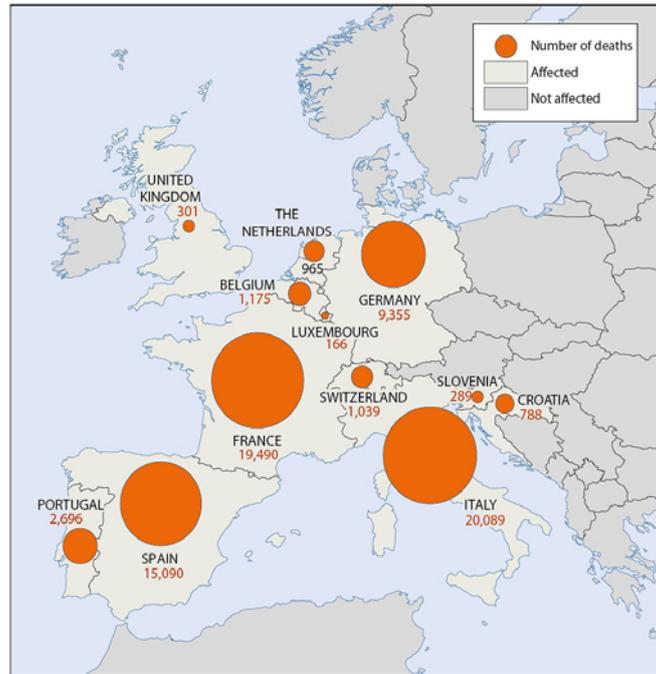


Fig. 3: The 2003 heat wave killed more than 70 000 people in Europe.³
(WB 2010, a)

Generally speaking, our infrastructure may be much more vulnerable than assumed. During the heat wave of 2010 air conditioning systems in German long distance rail-carriages were, to a large extent, malfunctioning. In one documented case this endangered the lives of healthy students. If seniors would have been the travellers, most likely the result would have been deaths. Storms, heavy rains, floods and earth slides are also taking their toll. Compared to the years prior to 1980, between 1998 and 2007 catastrophic events related to weather and climate change in Europe increased by 65 % (European Environment Agency 2008).

In addition to health consequences which are the direct result of climate change, a number of indirect results are being discussed, partly those that are already discernible, partly those that are expected in the future.

The most important ones are:

- an increase in allergic reactions as a result of extended flowering periods of relevant plants as well as the prevalence of newly “imported” plants like *Ambrosia artemisiifolia* (Richter-Kuhlmann 2010);
- the rise of the average temperature most likely will result in an expansion of rodents which in turn act as transmitters for viruses, bacteria and parasites (Meerburg 2009);
- whether the massive increase of Hanta-virus-infections in Germany during the first half of 2010 is a result of climate change, is currently still unclear (Hibbeler 2009);
- survival and reproduction of mosquitoes may increase as a result of global temperature rise. In Sept. 2010 in Nice the first autochthonous Dengue infection

³ “Note: Deaths attributed to the heat wave are those estimated to be in excess of the deaths that would have occurred in the absence of the heat wave, based on average baseline mortality trends.”

was documented (Robert Koch-Institut. 2010). In Ravenna the first case of Chikungunya-fever was diagnosed in 2007 and its transmitter, the *Aedes* mosquito was found near the Lower Rhine in 2007 (Hibbeler 2009).

Additional dangers are being discussed: the increasing incidence of the *Oak Procession Moth - Thaumetopoea processionea* – which causes severe allergic reactions; the spread of ticks as a result of global warming will increase the threat of Borreliosis and Meningoencephalitis; toxic sea algae grow better in warmer temperatures (IPCC 2007) and sand flies – vectors for Leishmaniosis – established themselves in Germany in 1999 (Gross 2001). Although still controversial⁴ if climate change results in an increase of UV-radiation there will be an increase in skin cancer as well as an earlier and more frequent occurrence of ocular cataracts (US Global change 2011).

Global warming may have a few positive health effects too. In England for example there are predictions of a decrease of up to 20 000 deaths per year after 2050 due to a reduction in cold related deaths either in the public or at home should global temperatures continue to rise (Gross 2001).

1.4 Consequences for developing countries

Health damages in industrialized countries will be considerable and the costs to counteract them will be high. Yet the major health consequences of climate change will be borne by developing countries. They will encounter a sharp increase in problems that already exist now. In addition they will face new health threats for which they lack the economic or social capability to respond.

The future has already started. An analysis by the WHO on the world wide “Burden of disease“ assumes that as of 2004, climate change is already causing about 150 000 deaths and 5,5 Mio. “disability adjusted life years (DALYs)“⁵ in the world per year (WHO 2008).

These figures will probably double by 2020 (Global Humanitarian Forum 2009) and by 2030 the number of deaths may increase to 500 000 per year (WB no year).

The question of whether climate change is truly the biggest health threat of the 21st century (Costello 2009, a)⁶ or not (Goklany 2009) is not the issue. WHO’s list of risk factors for the year 2000 places climate change as a direct risk factor at number 22. Underweight occupies first place and unsafe water, sanitation and hygiene rank no. 6. As factors in mortality they rank 4th and 10th respectively (WHO 2008, a). But as both of these risk factors (nutrition, cleanwater/hygiene) will be severely compromised by climate change, there can be no doubt, that the health problems caused and affected by climate change in developing countries will have a huge dimension.

⁴ The extent of UV radiation – toxic to humans and other organisms – depends heavily on the ozone layer in the stratosphere which in turn is influenced by Chlorine and Bromide concentrations. If these can be reduced – as foreseen by the Montreal protocol – the risk for additional UV radiation would be reduced.

⁵ DALYs are an internationally used measure for death and disease in a population. It is an aggregate figure from the sum of premature deaths (YLL yearly lives lost) and years of life compromised by disease or disability (YLD yearly lives disabled).

⁶ Costello A, Abbas M, Allen A, et al. Managing the health effects of climate change. Lancet 2009

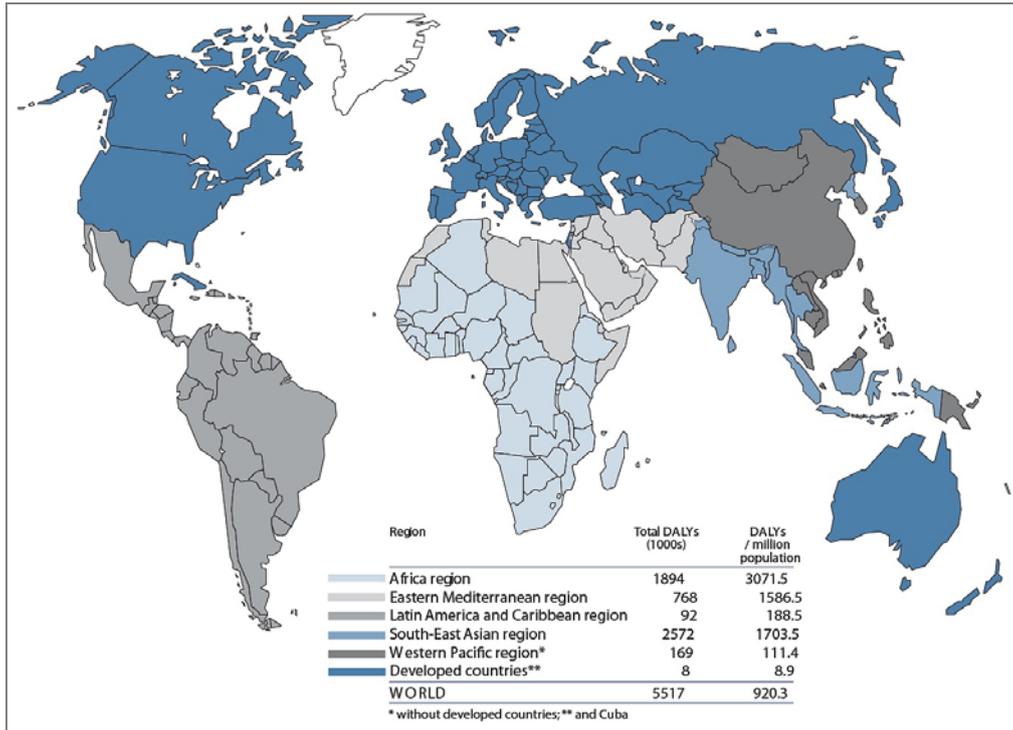


Fig. 4: An estimate of the results of climate change for the year 2000 according to WHO-Regions in DALYs (Campbell-Lendrum 2003)

Extreme weather events – as a consequence of climate change – are on the increase in industrialized as well as in developing countries (Huber 2011). While in Europe the consequences of heat waves – as in 2003 – are well documented this is not the case in developing countries. Without doubt the health consequences there however will be much more severe than in industrialized countries. In Western Europe the risk to die rises 0,2 - 5,5 % for every 1°C increase above the local average (Robine 2007). In situations where the health care system is much less elaborate – if it exists at all – the consequences are much worse. The heat wave together with the forest fires in and around Moscow during the summer of 2010 doubled the death rate for some time; altogether an excess of 56 000 people are believed to have died as a result of these factors (UNISDR 2011).

Floods like the one in August 2010 in Pakistan are on the rise. About 14 million people became homeless and were forced to leave their destroyed fields and villages. 16 000 deaths were recorded as an immediate result. Yet these represent only a small part of the diseases and deaths that result from the lack of hygiene, deprivation, hunger and malnutrition following the loss of one's home, means of providing a living and refugee status. Forced migration – whether the result of acute climatic catastrophes or slowly deteriorating conditions – results in major health problems in developing countries (Bauer 2010).



Fig. 5: The extension of floods in Pakistan (UN Office for the coordination. 2010)

It is important to realize the huge magnitude of such a catastrophe: the extension from north to south corresponds to the distance from Hamburg to Marseille.



Fig. 6: Flight from the floods in Pakistan – extreme weather events occur increasingly frequent.⁷

For most developing countries global warming means – beyond these direct consequences of heat waves and floods – the worsening of basic health problems that have existed for a long time, problems that were never adequately resolved – although theoretically this should have been easy to accomplish. Diarrhoea, malnutrition and malaria currently cause more than 3 million deaths per year (WHO 2004). Scientific calculations demonstrate the increase in risk as a function of the increase in temperature. It has already been calculated that a rise in temperature of 2°C compared to preindustrial times increases the risk for millions of people of water scarcity, malaria, hunger and floods. The more the average

⁷ picture: Jörg Böhling/agenda;

temperature rises, the worse will be the consequences. A temperature increase of 3°C might very well lead to a lack of water for 3 billion people (Swart 2008; Costello 2009, b).

Agriculture and nutrition will be especially compromised. Currently undernutrition is one of the biggest health problems in the world: about 800 million people or 12 % of the world population were already suffering from chronic undernutrition before the food crisis of 2008. Because of rising prices the number of people with undernutrition has doubled since. (Action Aid 2008) In that context press releases of May 2010 are not surprising announcing that due to an acute drought more than 10 million people in the Eastern Sahel are facing an acute hunger period (World Food Program 2010). The famine in Somalia in mid 2011 rendering 10 Million people dependent on emergency food aid – although aggravated by the political turmoil – is largely the result of rains failing for the second time in a row (World Food Pr. 2011).

Because of global warming, in the near future, food crops in the tropics and subtropics may shrink by 20-40 % (Battisti 2009). Agriculture will not be the only sector hit, productivity of forests animal husbandry and fisheries will be adversely affected as well, resulting in dire consequences for the nutrition of these regions. Moreover in the tropics, thunderstorms, heat waves and extremes in precipitation will reduce productivity (Friends of the Earth 2009). Nutrition as a basic human right cannot be overemphasized in that context (Bals 2008).

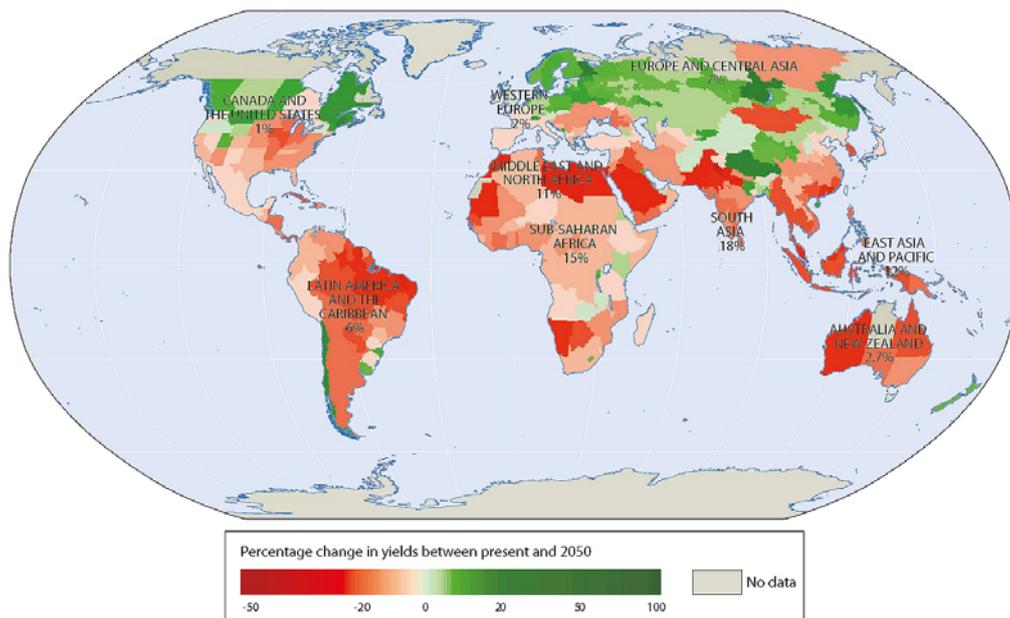


Fig. 7: Climate change will depress agricultural yields in most countries by 2050, given current agricultural practices and crop varieties. (WB 2010)⁸

⁸ Note: The coloring in the figure shows the projected percentage change in yields of 11 major crops (wheat, rice, maize, millet, field pea, sugar beet, sweet potato, soybean, groundnut, sunflower, and rapeseed) from 2046 to 2055, compared with 1996–2005. The yield-change values are the mean of three emission scenarios across five global climate models, assuming no CO₂ fertilization (a possible boost to plant growth and water-use efficiency from higher ambient CO₂ concentrations). The numbers indicate the share of GDP derived from agriculture in each region. (The share for Sub-Saharan Africa is 23 percent if South Africa is excluded.) Large negative yield impacts are projected in many areas that are highly dependent on agriculture.

Currently **diarrhoea** kills about 2 million people per year – mainly children in developing countries. Effective treatment is cheap and easy but frequently not accessible to patients. Most likely this problem will increase substantially in the near future. Hygiene not only suffers from a lack of water but too much water from strong rains and floods can have the same effect. When hygiene is reduced infectious agents are transmitted easily and widely leading to larger epidemics (Prüss-Üstün 2006).

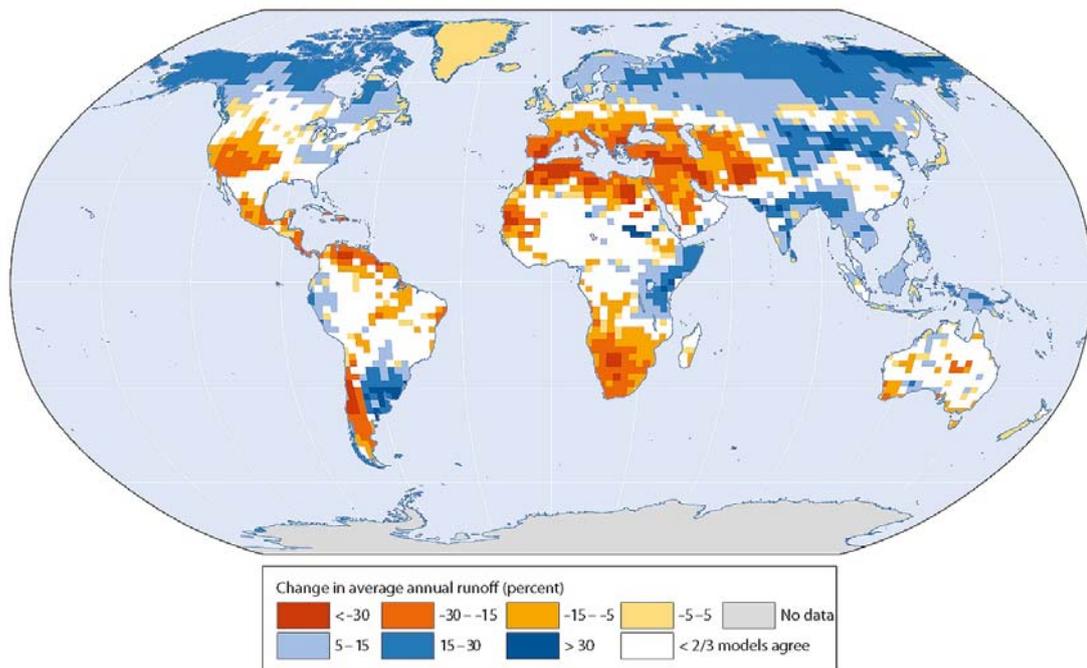


Fig. 8: Water availability in many parts of the world is projected to change dramatically by the middle of the 21st century (WB 2010).⁹

A change in the distribution of disease vectors – especially mosquitoes – harbours enormous dangers too. Dissemination of **malaria** depends on many factors: mosquitoes, temperature, precipitation, resistances; the correlation between average temperature and malaria distribution is not a simple one. Currently in Africa alone about 600 million people are exposed to malaria. Originally it was assumed that in some areas the risk would fall due to an increase in aridity, while in others it would increase due to a rise in temperature (IPCC 2007). More recent considerations however calculate that the number of people at risk will increase by another 390 million people (half of it due to the growth in population) by 2030 (WB 2010).

Dengue fever is transmitted by the *Aedes* mosquito. More than half of the infections run a benign course and the mortality rate is low; nevertheless about 20 million people per year suffer from quite serious attacks and 2 million develop a very dangerous form, “Dengue Hemorrhagic Fever” (Wichmann 2010). As a result of global warming the number of Dengue fever infections has already increased substantially in the last 15 years

⁹ Note: The colors indicate percentage changes in annual runoff values (based on the median of 12 global climate models using the IPCC SRES A1B scenario) from 2041–2060 compared with 1900–1970. The white denotes areas where less than two-thirds of the models agree on whether runoff will increase or decrease. Runoff is equal to precipitation minus evaporation, but the values shown here are annual averages, which could mask seasonal variability in precipitation such as an increase in both floods and droughts.

in both North and South America. During the second half of this century about 60 % of the world population, about 5 – 6 billion people, will live in endemic areas (WB 2010).

The distribution of other infectious diseases, will be influenced by climate change e.g. Schistosomiasis, Echinococcus and Leishmaniasis to name but a few. An increased incidence of mental illness resulting from the trauma of catastrophes and forced migration will play an increasing and demanding role too (World Bank no year).

2 What needs to be done?

On one hand, communities will need to adjust to the unavoidable consequences of climate change in order to minimize their impact; **to cope with the unavoidable: adaptation.**

On the other hand, it is of the utmost importance to try to limit global warming to less than 2°C; **to avoid the unmanageable: mitigation.**

The health sector needs to make both of these reactions its own. It has a special responsibility to do so because mitigation frequently improves health and health interventions sometimes will reduce the consequences of climate change.

2.1 Adaptation in developing countries

Climate change results in a whole range of different health risks each requiring a different adaptation approach. The “continuum of adaptation” illustrates the spectre. It differentiates between interventions resulting from changes having taken place already (on the right side of the graph) and those aiming at the general reduction of vulnerability – which would make sense even without climate change threats (on the left in the graph). At the same time reduction in vulnerability also helps to manage climate change risks.

National adaptation strategies are an instrument to better formulate the necessities for action and translate them into plans. This applies to the health sector too and helps to design sector specific strategies. Reduction of vulnerability is a principal goal of development cooperation and of the Millennium Development Goals (MDG). Adaptation measures however focus on specific consequences resulting from climate change.

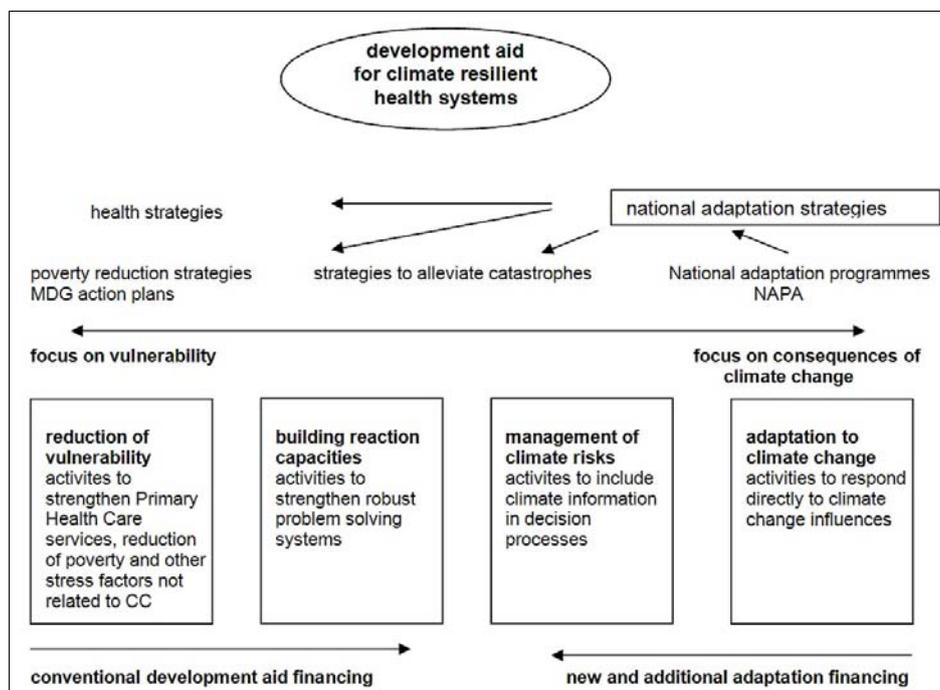


Fig. 9: The continuum of adaptation applied to the health sector (Harmeling 2007)

The “adaptation fund“ has been set up by the Kyoto Protocol as a specific financing mechanism for adaptation interventions. The role of the “Green Climate Fund” started in 2010 in Cancún is not yet clear. It remains to be seen whether it will focus on concrete and detailed adaptation interventions or whether it may be used to support the integration of adaptation interventions into sectoral programs. In any case it is assumed that adaptation costs for developing countries will amount to 100 Billion US \$ per year over the next decades – an amount roughly equivalent to the current OECD development aid (Official Development Aid, ODA) (World Bank 2010 c). A comprehensive study commissioned by the World Bank estimates the cost for adaptation only to the increase in malaria and diarrhoea in developing countries to be 3.3 to 4.8 billion US \$ per year for this decade with a decreasing tendency thereafter (World Bank 2010 b).

According to the WHO all developing countries should implement a basic public health package to resist climate change. This “minimal package” comprises comprehensive risk assessment, environment and health surveillance, preventive and curative interventions, disaster preparedness, and building institutional research capacity targeting the upcoming threats, in other words a complete program (WHO 2010, c). Given the economic, social, technical and human resource constraints of developing countries this amounts to wishful thinking for most of them.

When discussing adaptation, it is no longer useful to speak of “developing countries”. Even the differentiation between “low income countries” (LIC), “low middle income countries” (LMC) and “upper middle income countries”(UMC) (World Bank 2010, a) is insufficient. With developing countries, the number and size of differences is so great that a better system of differentiation is needed.

Least Developed Countries (LDC)¹⁰ characteristically are unable to provide basic health, social services, education and access to water in sufficient quantity and of acceptable quality for large parts of the population. Climate change will worsen their main health problems by increasing malnutrition, reducing access to water and adequate hygiene, and increasing exposure to Malaria and other infectious diseases. From a Public Health point of view, these problems are supposed to be prevented or treated by the Primary Health Care (PHC) System. However existing PHC-Systems in the LDC are far from adequate in coping with their current situation. To what extent will they be able to function if things get worse? Therefore it seems that the most urgent need to increase their ability to “adapt” or to increase their resilience would be to quickly and systematically improve their basic health care systems. If these were adequately organized and equipped and geographical and financial hurdles for patients would be reduced much could be achieved.

However, the lack of financial resources – and of political will – prevents most of them from achieving this goal. In 2001, in an attempt to enable LDCs to better adapt to upcoming threats the United Nations Framework Convention on Climate Change (UNFCCC) decided on a new approach to help alleviate this problem: the „National adaptation programme of action (NAPA)“ was inaugurated to provide a special fund, the “Least Developed Countries Fund”, for financing such activities (UNFCCC 2011). It is supposed to be fed by voluntary contributions from industrial countries and to be administered by the Global Environmental Facility (GEF). Currently 49 countries are

¹⁰ The United Nations have a system of categorizing developing countries different from the World Bank’s. A Least developed country (LDC) belongs to a group with the lowest indicators of socioeconomic development.

eligible for applying for funding. 40 NAPAs with 480 project proposals have been put forward since its inception but only 7 % are pure health projects (Lancet 2009). Only 15 proposals have managed to complete the complicated application process to receive financing commitments. All the proposed projects add up to a sum of about €2 billion. Almost ten years after its inception – up to Nov. 2010 – the donor countries have signed for an amount of US \$ 400 Mio – demonstrating the limited ability of the fund to solve the adaptation problems of LDC.

The graph shows the distribution of the resources up till now (Global Environment Facility 2011). It is acknowledged that improvement of water resources management and of agriculture/food security will both very much help to avoid health problems; nevertheless that only 1 % has been spent on health seems once more to emphasize that health issues do not receive sufficient attention in the climate change discussion.

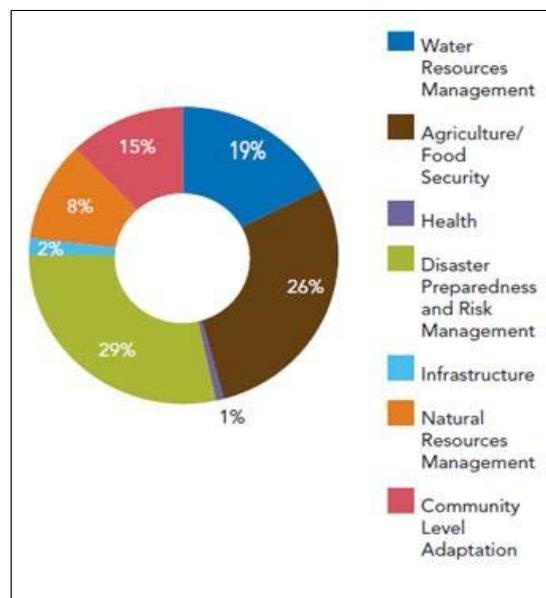


Fig. 10: LDCF Sector distribution of approved funding¹¹

Most of the health projects approved by NAPA amount to strengthening basic health services – putting the priorities right. The utility and need of other forms of adaptation have to be assessed using sound public health principles separately and specifically for each area or region. To what extent does it make sense to improve meteorological services to warn towns of upcoming heat waves? To what extent is it feasible or relevant to set up a system of texting to inform communities of the imminent risk of floods? Does it make sense to more precisely foresee increases in Malaria risk with elaborate geographical information systems (GIS) monitoring precipitation and temperature changes? These and similar interventions need to be discussed very critically and need to be judged according to the local situation.

In low middle and high middle income countries, too, well functioning Primary Health Care Services are a prerequisite for any additional adaptation activities. The feasibility for additional adaptation efforts in the health sector increases together with the financial and

¹¹ Global Environment Facility 2011

organisational capacities of the public sector as well as of the citizens and needs to be evaluated accordingly.

2.2 Increase Primary Prevention!¹²

Germany started years ago to plan adaptations in the health sector to respond to climate change. By 1999 the German Federal Ministry of Environment (BMU) and the Ministry of Health (BMG) had already fulfilled an obligation incurred during the WHO-Europe conferences on environment and health in 1989 and 1994 respectively (Bundesmin. f. Gesundh. 1999) by creating a joint “Environment and Health adaptation program (APUG)” for Germany. Since that time the German Federal Environment Agency (UBA) has been dealing only with adaptation problems and adaptation strategies in regard to health. Not, however, with mitigation, not with issues concerning the reduction of greenhouse emissions (Bundesmin. f. Umwelt 2009). A conference in Nov. 2010 once more demonstrated this limitation to adaptation (Bundesmin. f. Umwelt 2010).

Without question it is important to set up early warning systems for heat waves, UV-radiation, Ozone levels and airborne allergens. Informing the public of these dangers is as important as notifying practitioners, hospitals, assisted care facilities and other health care providers on how to meet these new challenges resulting from global warming (Bundesmin. f. Umwelt 2009). Yet this is not enough. The health sector should by no means restrict itself to adaptation. Adaptation interventions are typical examples of secondary prevention. This is necessary and needs to be set up as effectively as possible. However this does not justify the neglect of primary prevention. Exactly this however characterizes the discussion on climate change and health in Germany at the moment.

The increase of disease and deaths occurring already currently as a result of climate change and predicted to rise in future is an important, additional reason to limit global warming as soon and as much as possible.

A number of climate change mitigation measures can have direct and indirect impacts on health. Therefore they are classical examples of primary prevention. From a medical point of view primary prevention is much preferable. Thus there is a special responsibility for health and health sector professionals to lobby politicians for mitigation interventions. Both to contribute to solutions and maintain it's credibility the health sector needs to lead by setting good examples in its own field.

2.3 Protection against short- and long-lived emissions

The Kyoto Convention to reduce greenhouse emissions (in industrial countries) exclusively refers to the anthropogenic gases mainly responsible for the greenhouse effect causing global warming. They are carbon dioxide, methane, nitrous oxide and halocarbons (plus Sulfur hexafluoride)

¹² „Primary prevention“ in medicine means the fight against first or underlying causes of disease or death. „Secondary prevention“ refers to the fight against the health consequence of the underlying cause. Simplified e.g. CO₂ emissions cause global warming which leads to an increase in Malaria which can be (secondarily) prevented by mosquito control; or: substantial consumption of animal protein leads to a rise of blood fat and cholesterol which in turn contributes to myocardial infarction; this can be (secondarily) prevented by drugs to reduce blood cholesterol.

These „long lived“ emissions partly remain in the atmosphere for centuries¹³ and therefore have long term effects on the climate. For this reason climate specialists almost exclusively deal with the reduction of these emissions. These “classical” greenhouse gases however do not have a direct negative effect on human health. They are not toxic (in atmospheric concentrations).

		share in anthropogenic greenhouse effect	direct (and immediate) negative health effects	atmospheric lifetime	indirect (and delayed) negative health effects via climate change
K y o t o	carbon dioxide	60%	---	120 years	+++
	methane	20%	---	10 years	+++
	nitrous ox.	5%	---	100 years	+++
	halocarbons	10%	---	10 to 100 years	+++
	ozone (partly from CH ₄)	(+)	+++	W	---
	nitrogen ox.	(+)	+++	W	---
	NMVO ¹³	(+)	+++	W	---
	Russ/black c.	(+)	+++	W	---
	Sulfate	(+)	+++	W	---
	organ. carb.	(+)	+++	W	---

Tbl. 1: Greenhouse emissions and their effect on health¹⁴
(+) = very small effect; W = days to weeks to months

Together with the origination of „Kyoto-gases“, however, other emissions are generated usually. They have much less – or scarcely any – greenhouse effect and therefore hardly any effect on global warming. These – being not covered by the Kyoto protocol – are however the ones which have immediate negative health effects.¹⁵

These short lived emissions – they remain in the atmosphere only for days, weeks or months – are the ones having direct and immediate negative health effects: partly themselves like organic carbon aerosoles and sulfate predecessors, partly – like methane and nitrogen oxides – after having been converted into ozone by chemical reactions in the atmosphere. Carbon monoxide and non-methane-volatile-organ-compounds act via both mechanisms.

These immediately toxic, short-lived emissions are emitted by the same processes that generate long-lived emissions. Thus a reduction in CO₂-emissions usually results in a reduction of short-lived emissions as well. The contribution to people’s health is immediate (Smith 2009).

¹³ methane will remain in the atmosphere for about 10 yrs – between the short lived and the long lived emissions

¹⁴ Tbl. according to Smith, K., 2009; NMVO¹³ = non-methane volatile organic compounds; atmospheric lifetime according to Wikipedia, Treibhausgas, acc. 15.2.2011

¹⁵ Although the Federal Environment Agency (Umweltbundesamt, UBA) has pointed out this fact in 2009 it is hardly ever mentioned in the current climate change discussion. Umweltbundesamt 2009

Short-lived emissions and their effects on health are – simplified – are shown here:

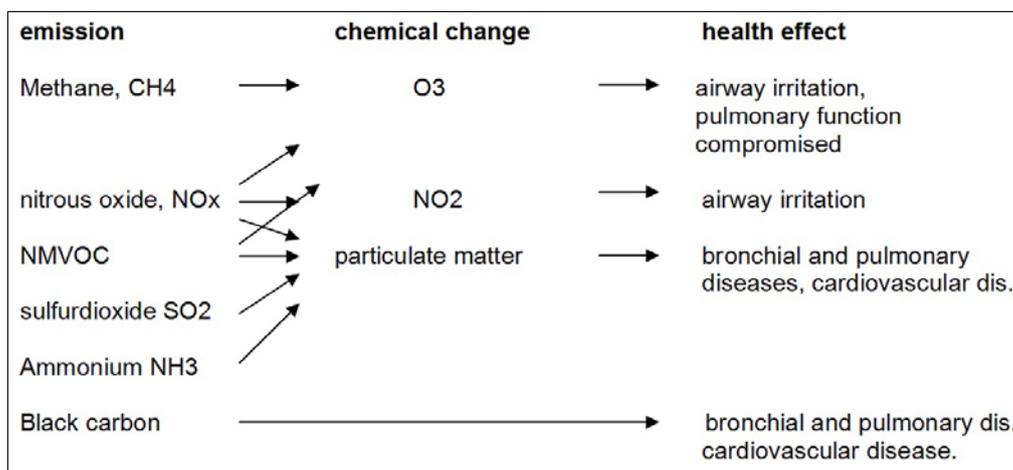


Fig. 11: Chemical changes and health effects of short lived greenhouse emissions (Umweltbundesamt 2009)

2.4 The health “co-benefits” of mitigation interventions

Extensive studies on the health effects of climate change mitigation processes demonstrate positive effects on the health of populations. This applies to environmentally friendly production of energy, to carbon reduced traffic concepts, to energy efficient improvements in buildings or in carbon conscious production and consumption of food. All these interventions produce bigger or smaller improvements in health as a “side effect”. There is good reason to support such interventions from the standpoint of improving health.

In the table below these effects are quantified for England and compared with some scenarios from developing countries. It shows that the beneficial health effects of mitigation intervention apply not only in industrialized countries but in specific situations in many developing countries if action is taken (Watts 2009).

Country/area	intervention	mechanism of health effect	approximate reduction in burden of disease (in DALYs/mio. pop.)
Household energy			
UK	housing-related energy efficiency	change in indoor air pollution	850
India	clean cook stoves	changes in exposure to indoor pollution	12 500
Transport system			
London	lower carbon and more active transport	altered air pollution, changes in physical activity	7 400
Delhi	as for UK	as for UK	13 000
Food and agriculture			
UK	lowering consumption of animal products	lower saturated fat intake	2 900
Sao Paulo	as for UK	as for UK	2 200
Electricity generation			
EU	low carbon fuels/technologies	reduced (particulate) air pollution	100
China	as for EU	as for EU	550

Tbl. 2: Climate change mitigation interventions and their co-benefits for health.¹⁶ The table gives an overview of some intervention areas and the assumed results in health co-benefits.

A detailed study for the EU deals with similar questions. The EU has decided to reduce its emissions by 20 % by 2020. Table 3 shows the amount of additional health co-benefits which could be achieved by increasing the reduction to 30 %. With this additional reduction alone 140 000 life-years could be saved per year from 2020 onwards and many diseases would be reduced considerably.

Additional annual health benefits from 2020 onwards of moving from 20% to 30 % emissions reduction		
	EU total	Germany
Mortality – life years lost, people aged > 29 yrs.	140 000	38 000
Chronic bronchitis - cases	6 000	1 600
Cardiac and respiratory hospital admissions	4 000	1 000
Working days lost	3 Mio.	800 000

Tbl. 3: Health benefits to the EU-member states of cutting EU27 Greenhousegas emissions by more than 20 % for 2020¹⁷

These studies clearly demonstrate the health benefits of better mitigation and how many deaths, disease episodes, hospital admissions and work-day-losses could be avoided. These health effects or co-benefits resulting from mitigation interventions had not been

¹⁶ Tbl. adapted from to Haines,A., 2009. The calculations are based on the assumption of “.. reductions ... (of .CO2 and other green house gases) .. consistent with meeting a global 50 % reduction target compared to 1999 by 2050 and an 80 % reduction ... for high-income countries”.

¹⁷ Tbl. according to Health and Environment 2010, giving only parts of the benefits

quantified until recently. They have probably been underestimated and have not received sufficient attention in climate change discussions, yet they constitute an important and additional argument to stop global warming.

These health co-benefits produce another welcome “side-effect“. They would create considerable savings in the health sector. Health services in the EU would save between € 10,6 and 30,5 billion per year while for Germany, the savings would amount to €3 – 8 billion per year (Health and Environment 2010).

Added annual benefit from 30 % emissions cut by 2020 in Mio €		
	EU	Germany
Mortality	7 334 - 27 245	1 961 - 7 283
Morbidity	3 222	861
total health benefit – low calculation	10 556	2 822
total health benefit – high calculation	30 466	8 144

Tbl. 4.: Economic assessment of health co-benefits¹⁸

Although cost-benefit considerations generally play an important role in mitigation discussions, the aspects of health economics have been neglected so far in the climate change debate. An analyses of 37 studies dealing with health co-benefits showed a savings of \$ 49 US for every ton of CO₂-emission avoided. For industrialized countries the median of these economic benefits for health amounts to \$ 31 while for developing countries – where air pollution frequently is much worse – the median of health expenses saved amounts to US \$ 43 per ton of CO₂-emissions avoided (Nemet 2010).

Therefore it is high time we included cost-benefit calculations when discussing different models of global warming and their effects. For the producers of greenhouse gases, health costs are a classical example of external costs, for which they are not responsible and for which there is no incentive to reduce. For society, however, these are tremendous costs – or potential savings. Politicians need to focus on this fact (Epstein 2011).

2.5 Climate change mitigation and health co-benefits in developing countries

It is not only the industrialized countries that need to stop global warming – also for health reasons. At the summits in Copenhagen and in Cancún industrialized as well as developing countries agreed to reduce their greenhouse emissions. These agreements however are not legally binding. Nor are they sufficient: even if kept they would result in an increase of global average temperature of 3 – 4 °C. The lack of reduction decisions in Durban reinforces the probability of such a rise in temperature.

Newly industrialized countries – not completely unjustified – partly refuse to contribute more because they perceive global warming as a result of the industrialisation of the north. They see current initiatives as attempts to prevent them from catching up. At the

¹⁸ Tbl. according to Health and Environment 2010 giving only parts of the calculations

same time many of them have turned into big emitters and therefore need to contribute to mitigation. Awareness about this problem is on the rise. In this context health might be seen and used as an additional argument.

Two examples:

In New Delhi due to a large program to use more compressed natural gas (CNG), CO₂-emissions decreased by 72 % between 2000 and 2008. At the same time, the emission of the toxic gas SO₂ sank by 57 %. This must have resulted in substantial health co-benefits. During the planning this aspect however was not part of the reasoning and data were not collected to prove the effect – which in turn might now be used as an additional argument in similar settings (Höhne 2009).

China meanwhile has ambitious targets for the reduction of energy consumption and greenhouse emissions. Although they are not always mentioned (China 2011) health and health co-benefits nowadays play an ever increasing and important role in the mitigation discussion. This is a response to the fact that in 2000 about 2,5 % of all DALYs including 420 000 excess deaths per year were due to indoor smoke from solid fuel and 1,5 % of all DALYs resulted from urban outdoor air pollution (Smith 2005).

These are promising signs. But all in all the co-benefits from mitigation interventions are not sufficiently known or taken into account neither in industrialized nor in developing countries.

The German Ministry of Economic Cooperation and Development and climate change

In the context of developing countries the German Ministry of Economic Cooperation and Development¹⁹ (BMZ) plays a potentially important role for how these countries approach climate change.

The importance of climate change for developing countries is well known to the BMZ. Sustainability of any development has long been a pillar of its strategy along with a strong awareness that global warming jeopardizes all achievements and threatens future success (BMZ 2011).

In order to make it a crosscutting issue for all sectors since the beginning of 2011 an obligatory check on environmental and climate aspects has been introduced for all bilateral programs and projects. Applied – if possible – already during the planning stadium it is supposed to outline potential negative effects of climate change on the ability to achieve program goals; at the same time possible negative effects of the program on climate are supposed to be identified – and remedied.

This examination is done in several grades of intensity and is supposed to allow for early modifications of the program to ensure its success and prevent aggravating global warming by program activities (BMZ 2010, a). This is an important step to assure climate change and its negative effects for developing countries to be taken into account and to embed the issue expressively and permanently into planning, implementing, monitoring and evaluating of development cooperation activities.

¹⁹ Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (BMZ)

Note is to be taken that this approach does not only plan adaptation steps to the negative consequences of global warming in advance but tries to help avoid it altogether by asking whether the project itself will in turn aggravate and speed up the problem. The question of the energy efficiency of the program and of its CO₂-footprint, the question of possibilities to reduce emissions in the context of the program is systematically asked.

This approach is remarkable and helps to introduce the issue of emissions and avoidance of global warming in developing countries in general. As opposed to other German Federal Ministries – in this context here notably the Ministry of Health – BMZ demonstrates that a coherent policy in regard to climate change is possible where foreign, environmental, economic and development policy are integrated and strive to include global warming aspects in all political activities.

All these general considerations apply to the health sector too: evaluating environmental and climate effects as well as mitigation options. The health sector in developing countries is an energy-intensive operation as well, where considerations of expansion and development need to include the avoidance of fossil fuels wherever possible and propagation of energy efficiency in all areas. All programs, without exception, need to assess mitigation possibilities. WHO can help with advice (WHO 2011).

As the BMZ's crosscutting approach has only recently been introduced, it needs to be followed up on to determine to which extent it will be taken seriously and to what extent it will be implemented. But the important first step has been taken to make sure that mitigation and adaptation to global warming is a crosscutting theme.

Up until now, hardly any projects in the German Bilateral Cooperation exist where climate change and health constitute the core of the setup. There is only one single project – implemented by Gesellschaft für Internationale Zusammenarbeit (GIZ) on behalf of BMZ in Tunisia to advise on climate change adaptation (GTZ 2009). However it may well be unnecessary to set up many separate projects to start adaptation and mitigation in the health sector. Instead it may be a better approach to integrate the climate change adaptation and mitigation aspects in all existing and future programs and projects in the health sector.

2.6 Health interventions help mitigate climate change

Not only do mitigation interventions frequently have substantial health co-benefits, but health interventions on the other hand can have mitigation benefits. An increase in “active transport” referring to more cycling and walking instead of riding a car or public transport has positive health and climatic effects (Haines 2009); by reducing – for health reasons – the consumption of meat and animal products in England by 30 % heart disease would drop by 15 % (Martin 2010). If consumption dropped by 60 %, 30,000 premature deaths per year could be avoided (Scarborough 2009).

Cattle raising and dairy production is responsible for almost 20 % of all greenhouse emissions. Reducing consumption would also lessen the emissions resulting from the fossil fuels utilized in these industries and result in further mitigation (Friends of the Earth 2010). In both of these examples, preventive health measures result in mitigation and climate “co-benefits”. But one could also see these as examples where mitigation produces health “co-benefits.”

Another example found in developing countries is the introduction of fuel efficient stoves. The smoke of traditional cooking stoves used currently by about 3 billion people in the world using wood, charcoal, dried dung and other forms of biomass has dire consequences on peoples health. About 1,5 million people around the world die each year from respiratory infections and chronic lung and heart-diseases for which traditional stoves are either the cause or an important cofactor. Most of the victims are children but the figure includes mothers and other adults as well. The introduction of energy efficient stoves therefore can be seen as a health intervention and the attendant reduction of CO₂ and other emissions is a welcome side effect. Better stoves save fuel and therefore reduce the labor required to collect it, reduce work loads, support greater gender equality and diminish poverty. Regardless of the prospect clean and efficient cook stoves are considered under, there are big advantages for users. They should be a high priority. German International Cooperation has realized the importance of efficient cook stoves for some time and supports the international “Global alliance for clean cookstoves”. This public private partnership has helped to provide 1.5 million stoves during the last few years. It now hopes to get 100 million clean, energy efficient stoves in use by 2020 with its “100 by 20” campaign (Global alliance for clean cookstoves 2011).

Family planning needs to be mentioned in the context of climate change. Many women in developing countries suffer from high birth rates and the resulting health problems. Currently the need for family planning is large: probably 200 million women worldwide would make use of modern family planning methods if only they had access. This lack of access results in 76 million unwanted pregnancies, 150,000 deaths of mothers or children because of incompetent attempts at abortion or delivery complications and 9 million DALYs (Lancet 2009). It is to prevent these deaths, to alleviate this suffering and to protect the health of mothers and children that self sought and responsible family planning is a medical priority. The close causal relationship between the number of pregnancies and the mortality of mothers and children has been known for many years. The continuous existence of a large gap between the desire of many families for modern family planning and its availability is very regrettable.

The situation is made worse by the fact that many countries’ population growth results in increased demand for food while climate change at the same time leads to a reduction of crop yields. Countries with the biggest population growth rates are foreseen to face the steepest drops in future food availability (Population action 2011).

In 37 of the already mentioned 40 NAPAs, too, it is acknowledged that a high growth of the population will make it more difficult to adapt to the problems resulting from global warming and increases it at the same time. Nevertheless, few adaptation programs include family planning activities. Smaller families result in less CO₂ emissions, a welcome side effect. In the general context of the discussion on climate change and global warming, it would however seem problematic and even counterproductive to promote family planning for mitigation reasons although some cost-benefit-calculations claim that investing in family planning is more cost effective in terms of avoiding a ton of CO₂ than other interventions (Wire 2009). This need not be used as an argument in support of family planning. The health benefits to mothers and children provide enough reason for making universal access to family planning an essential commodity. Arguing that family planning should be pursued to mitigate climate change would quickly be seen as neo-colonial which is understandable given the fact that historically the north has been the main source of CO₂ production and the resulting global warming.

2.7 Germany needs to catch up

In Durban in Dec. 2011 health finally received more attention than at previous conferences. A number of side-events dealt with the issue and the first “Global Climate and Health Summit” was organised by NGOs and attended by WHO, other international organisations and many government representatives. It resulted in the “Durban Declaration on Climate and Health” (Durban 2011 a) and a corresponding “Global Call to Action” (Durban 2011 b) which in turn hopefully will contribute to make health aspects more relevant in international and local climate discussions.

In the US there is considerable awareness in the health community about environmental issues, climate change and its relevance for the health sector. “Practice green health” (Practice 2011) considers itself “the nation’s leading membership and networking organization for institutions in the healthcare community that have made a commitment to sustainable, eco-friendly practices. ...” It has hundreds of members including hospitals and healthcare systems, healthcare providers, manufacturers and service providers, architecture and engineering firms, group purchasing organizations, and affiliated non-profit organizations. By providing technical expertise, hosting networking events, organizing training workshops, setting incentives by providing awards, supporting initiatives and implementing many other activities they foster the idea of a sustainable and green health system.

“Health Care Without Harm” (Health care 2011) is another network of the health community dealing with environmental issues and supporting the “greening of health care”. It is organized internationally and has more than 450 institutional members in four continents. Offices in the US/Canada, Europe, Southeast Asia and Latin America support their members “... to implement ecologically sound and healthy alternatives to health care practices that pollute the environment and contribute to disease.”

In the UK, climate change mitigation is seen as a specific responsibility and obligation of the health sector: “Failure to agree radical reductions in emissions spells a global health catastrophe, which is why health professionals must put their case forcefully (BMJ 2009).

Consequently global warming is an important topic for medical societies and health professions. The “Climate and Health Council“ counts 37 professional societies and organisations as members including 10 with international or foreign background (Climate and Health Council 2011). “10 : 10” is a worldwide movement whose members have pledged to annually reduce their emissions by 10 %. In England alone 159 health institutions and organisations are members of “10 : 10”, among them the Royal College of General Practitioners, the Royal College of Nursing and the Royal College of Psychiatrists (Cutting carbon 2011). The government-owned “National Health Service” (NHS) calculates to be responsible for 18 million tons of carbon emissions and has pledged to reduce this output by at least 26 % by 2020 (National Health Service 2009).

However in Germany climate change mitigation is hardly addressed by the health sector. Although the NHS in the UK is organized differently from the health care sector in Germany, this does not sufficiently explain the fact that the German Federal Ministry of Health does not deal at all with mitigation. The above quoted health co-benefits of mitigation interventions for the German population should by themselves be good reason to officially and intensively lobby for climate change measures. In 2010 the European – including the German – Ministers of Environment and of Health signed the “Parma Declaration on Environment and Health” (WHO 2010, a) and together with it passed a

corresponding „Action program“ (WHO 2010, b). In these memorandums the Ministers pledged “... to increase the health sector’s contribution to reducing greenhouse gas emissions and strengthen its leadership on energy- and resource-efficient management and stimulate other sectors to do the same.” Nothing of that sort has happened to date in Germany.

Since 2001, in the German „Deutsches Ärzteblatt“ – the official journal of the German Medical Association (Bundesärztekammer) – published about 20 papers dealing with climate change. They almost exclusively focus on adaptation (i.e. “early warning systems“ for heat waves or allergy threats) and on improving ways the German health care system can best cope with the effects of global warming on public health. Prevention of climate change in order to avoid its detrimental impact on health does not seem to be a part of the discussion.

At the same time the health sector in Germany is consuming a lot of energy – and thus indirectly is a large producer of green house emissions (afp 2010). For industrialized countries it is assumed that 3-8% of the total climate change footprint is caused by health care facilities (WHO 2011). This should be seen as an obligation not only to deal with health consequences of climate change but with its mitigation. The “Friends of the Earth Germany” (BUND) calculates that German hospitals could avoid the emission of 6 million tons of CO₂ per year and at the same time save €600 million in energy costs. It has been running a project on “Energy efficient hospitals” for 10 years now to convince hospitals and rehabilitation clinics to save energy. Successful achievement of targets set by the project results in a “certificate of merit” being awarded. Currently 30 out of 3000 hospitals and rehabilitation centres in Germany hold this certificate (BUND 2011). In other words only 1 % of German hospitals have tried to contribute to the primary prevention of the health consequences of global warming by meeting the set standards.

For political as well as for reasons of health, the need to act is great.

3 Conclusions

- **Already climate change has negative consequences for the health of humankind – especially in developing countries. This will merely increase with time.**
- **The international discussion on climate change needs to do a better job of integrating the health consequences.**
- **The international – and the German - health discussion needs more emphasis on climate change mitigation.**
 1. **Climate change mitigation** through the reduction in the use of fossil fuels will have long term effects on global warming. It will also have immediate and mid-term consequences on health through the reduction of diseases.
 2. The immediate and mid-term health co-benefits of mitigation mainly materialize in the vicinities where emissions arise. They result from the reduction of short lived emissions along with the reduction of longer-lived greenhouse emissions.
 3. Long-lived greenhouse emissions are not directly detrimental to health. They develop their negative health effects only indirectly via global warming, but coincidental short lived emissions produce negative health effects.
 4. The immediate health co-benefits are in the direct interest of the population. This applies to emission centers in industrialized as well as developing countries. The reduction of these health problems produces substantial cost savings for the health sector. For all these reasons climate change mitigation in industrialized as well as developing countries is urgent.
 5. Some **medical preventive actions** in industrialized countries as well as among the well-to-do classes in developing countries not only have positive effects on health but as a “side effect“ mitigate climate change.
 6. This **line of reasoning** needs to be put forward forcefully in any discussion on development as well as on climate politics.
 7. **Adaptation measures** for the health consequences of climate change are being increasingly and competently planned and implemented in Germany, but have hardly been addressed in developing countries.
 - For least developed countries, adaptation means the improvement of existing but insufficient Primary Health Care Systems battling to cope with the upcoming increased health risks like malnutrition, diarrhoeal diseases, Malaria, Dengue and other diseases.
 - For upper middle income countries situation-specific adaptation programs need to be developed.

3.1 *The need to act*

1. Internationally Ministries of Health, professional bodies, health institutions and all organisations dealing with health should not only be concerned with adaptation but urgently need to play an important role in promoting mitigation
 - because of the immediate health co-benefits of mitigation interventions;
 - because the health sector is energy intensive and contributes substantially to global warming;
 - because of the negative health effects of global warming for the world population.

2. Ministries of Health in Europe have a special responsibility
 - because they have signed the Parma-Declaration committing themselves not only to adaptation but also to mitigation activities;
 - because they have promised there to even set the example for other sectors.
Therefore they need to win their own governments
 - to increase their mitigation efforts and
 - to prompt the EU to increase its mitigation target from 20 % to 30 % by 2020.

3. All international, multilateral and bilateral donors and agencies dealing with development cooperation
 - need themselves to be aware of health co-benefits of adaptation and mitigation interventions in developing countries;
 - need to emphasize this aspect in the design and implementation of cooperation programs;
 - should support developing countries to see this link more clearly;
 - need to introduce an environment and climate check in all their programs to make sure this aspect is taken seriously and implemented across board.

4. Overall donor countries need to substantially increase their contributions to funds that assist developing countries, in particular those most vulnerable, in adaptation to climate change, such as the Least Developed Countries Fund, the Adaptation Fund and the Green Climate Fund.

Awareness of the health and climate change links should be promoted in this context.

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