

Climate Change and Human Health in Asia and the Pacific: From Evidence to Action

Report of the Regional Workshop
Bali, Indonesia, 10-12 December 2007



World Health Organization

Regional Office for South-East Asia

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Contents

1.	Recommendations: Regional framework for action to protect human health from the effects of climate change in Asia and the Pacific	1
2.	Message from the Regional Director, WHO Regional Office for South-East Asia to the Regional Workshop on Climate Change and Human Health in Asia and the Pacific: From Evidence to Action	8
3.	Summary	10
4.	Background and objectives of the workshop	12
5.	Objective 1: Share the latest evidence on climate change and health	16
6.	Objective 2: Define the key strategic elements that protect health from the effects of climate change	32
7.	Objective 3: Develop a regional action plan to reduce the burden of disease linked to global warming and climate change	42
8.	Synthesis of the presentations and discussions	45

Annexes

1.	List of participants	48
2.	Programme	54
3.	List of documents & reference materials	57

Recommendations: Regional framework for action to protect human health from the effects of climate change in Asia and the Pacific

1

Participants of the regional workshop on climate change and human health, held in Bali, Indonesia from 10 to 12 December 2007, officially representing the governments of Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Fiji, Indonesia, Japan, Lao People's Democratic Republic (PDR), Malaysia, Maldives, the Federal States of Micronesia, Nauru, Nepal, New Zealand, Palau, the Philippines, the Republic of Korea, Solomon Islands, Sri Lanka, Tonga and Vanuatu, jointly developed a regional framework to guide regional and national action towards reducing the potential burden of disease linked to the effects of global warming and climate change.

Preamble

During the last 100 years, human activities related to the burning of fossil fuels, deforestation and agriculture have led to a 35% increase in the carbon dioxide (CO₂) levels in the atmosphere, causing increased trapping of heat and warming of the earth's atmosphere. The Fourth Assessment Report (AR-4) of the Intergovernmental Panel on Climate Change (IPCC) states that most of the observed increase in the globally-averaged temperatures since the mid-20th century was very likely due to the increase in anthropogenic greenhouse gas (GHG) concentrations. Eleven of the last 12 years (1995-2006) rank among the 12 warmest years in the instrumental record of global surface temperature. The IPCC also reports that the global average sea level rose at an average rate of 1.8 mm per year from 1961 to 2003. The total rise in the sea level during the 20th century was estimated to be 0.17 m.

The globally averaged surface warming projected for the end of the 21st century (2090–2099) will vary between 1.1-6.4 degrees centigrade.

The global mean sea level is projected to rise by 30-60 cm by the year 2100, mainly due to thermal expansion of the ocean. It is very likely that hot extremes, heat waves and heavy precipitation events will continue to become more frequent. It is likely that future tropical cyclones (typhoons and hurricanes) will become more intense, with larger peak wind speeds and heavier precipitation, causing loss of life and an increase in injuries. These climatic changes will cause disruption of the ecosystem's services to support human health and livelihood, and will impact health systems.

The IPCC projects an increase in malnutrition and consequent disorders, with implications for child growth and development. The disruption in rainfall patterns can be expected to lead to an increased burden of diarrhoeal disease and to the altered spatial distribution of some infectious-disease vectors. WHO estimates that the modest anthropogenic climate change that has occurred since 1970, claims 150 000 lives annually.

Therefore, the IPCC urges a drastic reduction in GHG emissions to mitigate global warming and an urgent implementation of adaptation measures.

The current and emerging climate change-related health risks in Asia and the Pacific include heat stress and water- and food-borne diseases (e.g. cholera and other diarrhoeal diseases) associated with extreme weather events (e.g. heat waves, storms, floods and flash floods, and droughts); vector-borne diseases (e.g. dengue and malaria); respiratory diseases due to air pollution; aeroallergens, food and water security issues; malnutrition; and psychosocial concerns from displacement.

These risks and diseases are not new, and the health sector is already tackling these problems. However, the capacity to cope with potentially increasing levels of these risks and diseases is limited, particularly in developing countries.

There is a growing, but still limited, political commitment to integrate health considerations into efforts to mitigate and adapt to climate change at national and international levels in the Region. Also, there is also insufficient awareness among the general public about climate change and its impact on health.

The availability of relevant hydro-meteorological, socioeconomic and health data is limited and available data are often inconsistent and seldom shared in an open and transparent manner. Furthermore, there is insufficient capacity for assessment, research and communication on climate-sensitive health risks in many countries, as well as insufficient capacity to design and implement mitigation and adaptation programmes.

There is an urgent need to incorporate health concerns into the decisions and actions of other sectors while they plan to mitigate and adapt to climate change, to ensure that these decisions and actions also enhance health. By promoting the use of non-motorized transport systems (e.g. bicycles) and fewer private vehicles, greenhouse gas emissions would be reduced, air quality would improve and more people would be physically active. Such an approach would produce associated benefits (i.e. reduce the burden of disease while lowering greenhouse gas emissions) and needs to be promoted.

Goal and objectives of the regional framework

Goal

To build capacity and strengthen health systems in countries and at the regional level to protect human health from current and projected risks due to climate change.

Objectives

- (1) Increase awareness of health consequences of climate change;
- (2) Strengthen the capacity of health systems to provide protection from climate-related risks and substantially reduce health system's greenhouse gas (GHG) emissions;
- (3) Ensure that health concerns are addressed in decisions to reduce risks from climate change in other key sectors.

Recommended actions

Objective 1: To increase awareness of health consequences of climate change

Governments, through relevant agencies, should:

- (1) Undertake studies on the health implications of climate change and share information to understand how to promote changes in individual and corporate behaviours that mitigate climate-related health risks, while protecting and promoting health.
- (2) Enhance political commitment and strengthen institutional capacity and arrangements to achieve adaptation and mitigation goals.
- (3) Facilitate national working groups, nongovernmental organizations and civil society to develop coordinated mitigation and adaptation plans by including relevant sectors, regions and disciplines.
- (4) Develop awareness-raising programmes and learning resource materials to educate and engage a broad range of stakeholders, including local communities, health and other relevant professionals, and the media on the potential health impacts of climate variability and change and on appropriate measures to reduce climate-sensitive risk factors and adverse health outcomes.

WHO should:

- (1) Provide specific climate change-related technical guidance for vulnerability and adaptation assessments and surveillance systems, which provide methods for identifying risks to vulnerable groups, quantifying the burden of disease from climate change, and quantifying costs and benefits of health adaptation measures to ensure comparability across countries.
- (2) Support countries in the development of vulnerability and adaptation assessment and analysis tools, and in the development of a set of indicators on climate change-related health risks.

- (3) Encourage and facilitate regional knowledge-sharing and networking on climate change and human health within the health sector as well as between disciplines.

Objective 2: To strengthen health systems capacity to provide protection from climate-related risks, and substantially reduce health system's GHG emissions

Governments, through relevant agencies, should:

- (1) Develop and implement national action plans for health that are integrated into existing national plans on adaptation and mitigation to climate change.
- (2) Develop integrated strategies to incorporate current and projected climate change risks into existing health policies, plans and programmes to control climate-sensitive health outcomes, including integrated vector management, and health risk management of disasters.
- (3) Strengthen existing infrastructure and interventions, including human resource capacity, particularly surveillance, monitoring and response systems and risk communication, to reduce the burden of climate-sensitive health outcomes. Key concerns vary by country; common concerns include vector borne diseases, air quality and food and water security.
- (4) Strengthen public health systems and disaster/emergency preparedness and response activities, including psychosocial support, through increased collaboration and cooperation across sectors. This should include documentation, sharing and evaluation of the effectiveness of local knowledge and practices.
- (5) Provide early warning systems to support prompt and effective responses to current and projected health burdens. In order to achieve this, national and regional climate forecasting information, including climate change projections, should be fully utilized.
- (6) Implement adaptations over the short, medium or long term; be specific to local health determinants and outcomes of concern;

and facilitate the development of community-based resource management. The costs and benefits of different interventions should be determined.

- (7) Establish climate change focal points or mechanisms within national health institutions to ensure the implementation, monitoring and evaluation of health mitigation and adaptation actions and ensure that health issues are adequately addressed in these actions.
- (8) Establish programmes through which the health sector substantially reduces GHG emissions; by doing so, it could also serve as a best practice model for other sectors.

WHO should:

- (1) Facilitate greater contribution of funds from donor agencies for climate change- and health-related programme implementation.
- (2) Support countries technically and financially to build national capacities to develop and implement national action plans on mitigation and adaptation, including conducting research on the health impacts of climate change.
- (3) Support countries technically and financially by providing training programmes on methodologies and assisting in the assessment and management of health risks due to climate change.
- (4) Develop and provide technical guidance on good adaptation and GHG emission reduction practices within the health sector.

Objective 3: To ensure that health concerns are addressed in decisions to reduce risks from climate change in other key sectors

Governments, through relevant agencies, should:

- (1) Develop integrated strategies to incorporate current and projected climate change risks into existing policies, legislation, strategies and measures of key development sectors to control climate-sensitive health outcomes. Examples include the

promotion of public and non-motorized transportation, clean energy and disaster risk management.

- (2) Facilitate the health sector to actively participate in national communications to the United Framework Convention on Climate Change (UNFCCC), and include health issues as the core elements in the negotiation process.
- (3) Ensure active health participation in the national climate change team.

WHO should:

- (1) Support the establishment of a regional centre on climate change and health, which has links to results of vulnerability and adaptation assessments and data sources, both between countries within and outside the Region, and links to hydro-meteorological services at global, regional and national levels. This centre will support a regional network of practitioners working on climate change and health, with access to international technical expertise to facilitate the sharing of best practices.
- (2) Identify and establish WHO collaborating centres on climate change and health in the Region.

Bali, Indonesia, 12 December 2007

Message from the Regional Director, WHO Regional Office for South-East Asia to the Regional Workshop on Climate Change and Human Health in Asia and the Pacific: From Evidence to Action, Bali, Indonesia, 10 – 12 December 2007

It is now universally acknowledged that the climate change we are witnessing will continue for a long period of time. This obviously has serious implications on human health. One of the main findings of the Fourth Assessment of the Inter-governmental Panel on Climate Change (IPCC) released in November 2007 is that *“Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level”*. The assessment also stated that *“Anthropogenic warming could lead to some impacts that are abrupt or irreversible, depending upon the rate and magnitude of the climate change”*.

Increasing global temperatures will translate into more frequent and more intense cyclones, unusual patterns of rains and floods, but also, in some places, droughts. At the same time, we will see a rise in sea levels. The consequences that projected climate change will have on water availability, food production, land and property loss have the potential for triggering major population displacements and, indeed, social conflicts. These changes could also gravely affect national economies and generate political and social unrest.

For countries in the South-East Asia Region, the projected effects from climate change will impact all countries of the Region, from rapid glacier melt in the Himalayas that will increase flooding, and rock avalanches, to reduced water and food resources, particularly in the large river basins. Indeed, IPCC states that *“Coastal areas, especially the heavily-populated megadeltas regions in South, East and South-East Asia, will be at greatest risk due to increased flooding from the sea and, in some megadeltas, flooding from the rivers”*.

The impact on human health from climate change will be significant. The reduced availability of drinking water could mean more frequent and

more severe outbreaks of diarrhoeal diseases such as cholera. IPCC confirms that *“Endemic morbidity and mortality due to diarrhoeal diseases primarily associated with floods and droughts are expected to rise in East, South and South-East Asia due to projected changes in the hydrological cycle associated with global warming.”*

Scarcity of water and food could further affect current levels of malnutrition. Water and sanitation programmes in all countries in the Region have made significant efforts towards reaching the Millennium Development Goals. Although much still needs to be done, in particular in terms of ensuring safe water in rural areas and sanitation coverage in general, a lot has been achieved in the last decade; as an example, in the South-East Asia Region the estimated number of deaths from diarrhoeal disease has come down from close to 980,000 in 1999 to 504,000 cases in 2005. But, many of the achievements can be negated with the onset of climate change. There is a need to strengthen these programmes urgently and in a big way, in order to preserve achieved results and prepare the health sector to meet the new challenges ahead.

Warmer temperatures will favour the development of vector-borne diseases, such as dengue. One of the reasons could be more favourable breeding conditions – warmer temperatures and increased humidity, especially in urban settings. Vector-borne disease prevention and control will not be able to achieve results if not significantly strengthened and oriented towards achieving more efficient community participation. In this scenario, it is vital for the health sector to prepare for the challenges posed by climate change. But, responding to climate change does not mean creating new programmes. Effective action to protect human health from climate change can be achieved with stronger and well coordinated national health systems that give priority to climate-sensitive diseases – notably at the primary level. Key preventive public health actions will need to aim at both: to improve health today and to reduce vulnerability to climate change in the future. It is, therefore, vital for individuals, communities, the corporate sector and national authorities to make the behavioural and policy changes which will bring immediate health benefits and also reduce the impact on human health due to global climate change.

This workshop, aimed at developing a framework for the health sector to integrate preventive and adaptive actions addressing climate change into existing national plans, is a timely step in the right direction. I wish you fruitful deliberations and look forward to your recommendations which should help in mitigating the impact of climate change on human health.

The WHO-sponsored Regional Workshop on “Climate Change and Human Health in South-East Asia and the Pacific with the theme “From Evidence to Action” was organized at Bali, Indonesia from 10 – 12 December 2007.

It brought together almost 50 senior officials representing the governments of Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Fiji, Indonesia, Japan, Lao People’s Democratic Republic, Malaysia, Maldives, the Federal States of Micronesia, Nauru, Nepal, New Zealand, Palau, the Philippines, Republic of Korea, Solomon Islands, Sri Lanka, Tonga, and, Vanuatu.

The population of these countries, located within the South-East Asia and the Western Pacific regions, totals almost three billion.

Representatives from partner and donor agencies also attended. While most participants represented national health authorities, there were others from sectors such as agriculture and environment. Government representatives, nongovernmental organizations (NGOs) and international climate change experts also participated in the workshop.

The objectives of the workshop were to share the latest evidence on climate change and health, to define the key elements of a strategy for health protection from climate change and to develop a regional framework for action. Participants were briefed on the latest evidence on climate change and health by international experts.

A framework for action to protect human health from the effects of climate change in the Asia-Pacific region was developed. This framework

provided a series of recommendations for governments as well as WHO pertaining to awareness-creation and strengthening the health system capacity to reduce the impact of climate change.

Participants obtained a high degree of understanding and awareness; this was achieved mainly by bringing together national professionals and global experts. Many experts represented the International Panel for Climate Change (IPCC).

The first day allowed participants to present and share new knowledge on climate change *per se*, its relationships with human health and future perspectives, based on the latest national and global scientific information.

The second day focussed on sharing experiences in the health sector on mitigating greenhouse gas emissions (GHG) and on adapting to climate change.

The third day was reserved for working groups to prepare a draft framework for action detailing how to build capacity and strengthen health systems in countries and at the regional level so as to protect human health from the current and projected risks due to climate change.

The objectives of the framework are to increase awareness of the health consequences of climate change; strengthen health systems' capacity to provide protection from climate-related risks and substantially reduce health systems' GHG emissions; and to ensure that health concerns are addressed in decisions to reduce risks from climate change in other key sectors.

The workshop was timed to coincide with the Thirteenth Conference of the Parties (COP13) to the United Nations Framework Convention on Climate Change (held in Bali, Indonesia from 3 to 14 December 2007). As such it allowed some participants to attend the COP13 sessions on 14 December, notably the WHO-organized "side event" which the outcomes of the regional workshop were communicated to the public. This gave an opportunity to take forward the recommendations of the workshop, as well as a case for the health sector that had been neglected until then.

During the last 100 years, human activities, particularly related to burning of fossil fuels, deforestation and agriculture have led to a 30% increase in the carbon dioxide (CO₂) levels in the atmosphere causing trapping of more heat.

The Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC)¹, states:

- “Most of the observed increase in globally-averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations;
- Eleven of the last 12 years (1995-2006) rank among the 12 warmest years in the instrumental record of global surface temperature; and
- The global average sea level rose at an average rate of 1.8 mm per year from 1961 to 2003. The total rise in the sea level during the 20th century is estimated to be 0.17 m.

The AR4 IPCC 2007 report also draws on projections of future changes in climate:

- “The projected globally-averaged surface warming for the end of the 21st century (2090–2099) will vary between 1.1 and 6.4 degrees Celsius. The projected rate of warming is greater than anything humans have experienced in the last 10 000 years;

¹ <http://www.ipcc.ch/>

- The global mean sea level is projected to rise by 9.88 cm by the year 2100;
- It is very likely that hot extremes, heat waves and heavy precipitation events will continue to become more frequent; and
- It is likely that future tropical cyclones (typhoons and hurricanes) will become more intense, with larger peak wind speeds and heavier precipitation”.

At the 5663rd meeting of the United Nations Security Council held at New York, on 17 April 2007, Mr Ban Ki-Moon, United Nations Secretary-General², said that, according to the most recent assessments of the IPCC, the planet’s warming was unequivocal, its impact was clearly noticeable and it was beyond doubt that human activities had been contributing considerably to it.

WHO estimated that the warming and precipitation trends due to anthropogenic climate change of the past 30 years claimed over 150,000 lives, annually. In 2000, of the 154 000 deaths occurring globally that were attributable to climate change, about 77 000 of them occurred in countries of the South-East Asia (SEA) Region.

Populations within the SEA Region remain highly vulnerable to a wide variety of health effects from climate change, but are also the fast-growing contributors to GHG.

The WHO Regional Office for South-East Asia, in collaboration with WHO headquarters, started addressing the issue of climate change and health by co-convening a global meeting in Maldives in 2003. This event was oriented towards the urgent needs of Small Island States.

Together with the same partners, namely, the World Meteorological Organization, the United Nations Environment Programme and the United Nations Development Programme, WHO Regional Offices for South-East Asia and the Eastern Mediterranean organized an inter-regional workshop

² <http://www.un.org/News/Press/docs/2007/sc9000.doc.htm>

on Human Health Impacts from Climate Variability and Climate Change in the Hindu Kush-Himalaya Region”, in India in October 2005. This event was oriented towards the needs of Himalayan countries in the regions.

The members of the WHO/UNEP regional Thematic Working Group (TWG) on climate change, ozone depletion and ecosystem change took part in a WHO bi-regional “Workshop on Climate Change and Health in South-East and East Asian Countries”, which was held in Kuala Lumpur, Malaysia from 2 to 5 July 2007. The participants, both the TWG members and others reviewed the methodologies for country vulnerability assessment and mitigation, and developed a regional response to reduce the burden of disease from climate change in Asia. Participants felt the need to strengthen capacity for assessment, research and communication on climate-sensitive health risks. They recommended that awareness on health impacts of climate variability and change needed to be raised among political, financial and community leaders, health practitioners, nongovernmental organizations, other sectors and the general public. These recommendations provided a basis for the development of a draft regional framework for action at the Bali workshop.

At the 25th Meeting of Ministers of Health (1 August 2007, Thimphu, Bhutan) the highest health authorities in the Region concluded that climate change posed a major threat to health security in the SEA Region and called upon WHO to, inter alia, “support the formulation of a regional strategy to combat the adverse health impacts of climate change”. The Health Ministers also requested WHO to select “climate change and health” as the topic for World Health Day.

At its 58th session in September 2007, the Regional Committee for the Western Pacific deliberated on the issue of climate change and health, following a keynote speech on the subject, and decided that a regional strategy would be discussed at the 59th session in September 2008.

In October 2007, the Director-General of WHO decided that “Protecting Health from Climate Change” would be the topic for World Health Day 2008.

In November and December 2007, the WHO Regional Office for South-East Asia supported four national workshops on human health and climate change in Bangladesh, Indonesia, India and Nepal.

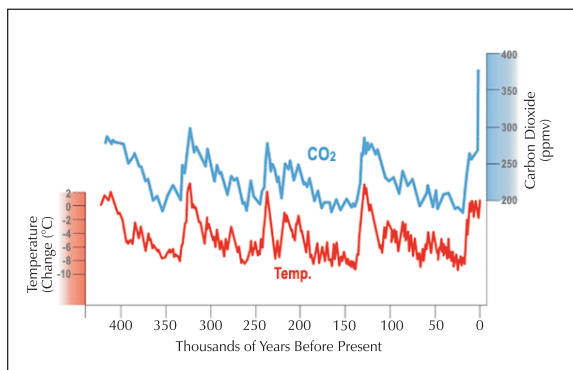
Taking all these aspects into consideration, the WHO Regional Offices of South-East Asia and the Western Pacific regions organized a workshop with the objective of preparing a regional action plan to protect human health from the effects of climate change in the Asia-Pacific region.

Objective 1: Share the latest evidence on climate change and health

5.1 The evidence

At the start, participants were briefed on the latest global, regional and national situations in relation to how global warming was occurring and what impact it was and was projected to have on human health.

On 10 December 2007, the Intergovernmental Panel on Climate Change and Albert Arnold (Al) Gore Jr. were awarded **the Nobel Peace Prize** for “*their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change*”. The



Source: IPCC, 2007

Fourth Assessment Report (AR4)³ is the result of three years of collaborative work by three working groups consisting of eight lead authors, 16 co-authors and 1800 expert reviewers. Over 4500 scientific articles were consulted and 300 comments from governments were taken into account.

The CO₂ level reached 385 part per million (ppm) in 2006, unprecedented in the past climate record for 650 000 years.

³ IPCC, 2007: Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A.(eds.)]. IPCC, Geneva, Switzerland, 104 pp.

The main cause of global warming is human activities, mainly those related to the burning of fossil fuels. Because of the amount of accumulated GHG in the atmosphere, global warming over the next two-three decades will almost independent of global greenhouse gas emissions scenario. The global emissions pathway will become significant beyond 2030–2040.

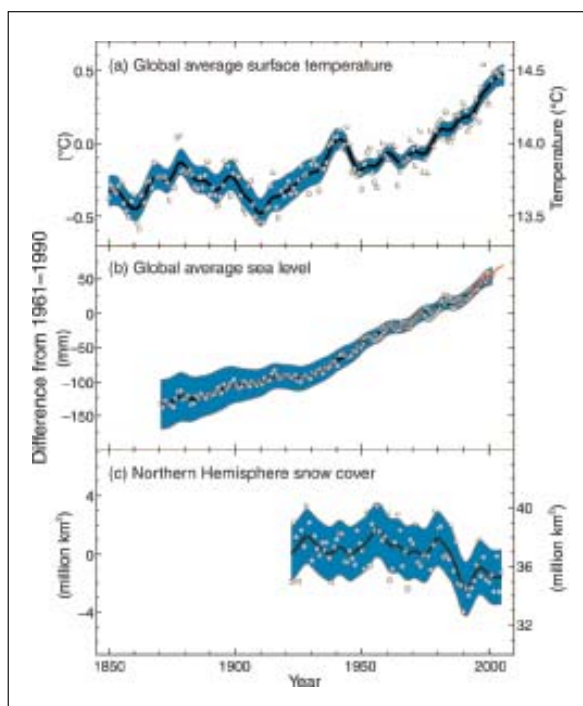
The IPCC established that for 2100, increases in temperature will at least be in the range of 1.8-4.0 degrees Celsius. Approximately 1.5 degrees Celsius is already realized or committed. It appears that the very recent IPCC AR4 report (2007) already looks conservative. Recent scientific reports indicate that climate change is accelerating. In general, political discourse now openly acknowledges the likely need for an 80+% reduction in emissions relative to now.

Of all the plant and animal species, 20-30% face an increased risk of extinction due to a 1.5-2.5 degrees Celsius rise in temperature.

The global average sea level rose at an average rate of 1.8 mm per year from 1961 to 2003. The total rise in the sea level during the 20th century is estimated to be 0.17m.

Major environmental disruptions are projected with glaciers and snow cover expected to decline further, reducing the supply of the melt water to major regions and cities.

The global warming-induced climate change will impact on rainfall and sea temperatures. The IPCC projected changes foresee an increase in heat waves and hot extremes and decrease in cold extremes. Rainfalls will increase in high latitudes and decrease in most subtropical land regions. Areas



affected by drought will also increase because of rapid melting of ice. Warmer seas will result in more intense tropical cyclones and a steady sea-level rise, even if GHG concentrations are stabilized, over many centuries to millennia.

In Asia, where population and demand growth will be most critical, receding glaciers and disturbed rainfall patterns will decrease freshwater availability, affecting millions of people, particularly in large river basins, and particularly during dry seasons.

The risk of flooding in mega deltas is the highest, where sea-level rise could be coupled with the risk of river floods and high population densities. All coastal regions would experience interactions of sea-level rise with other climate extremes. Coastal ecosystems could be destroyed (wetlands, mangroves, coral reefs) with increased coral bleaching leading to widespread coral mortality for temperature increases of 1-3 degrees Celsius.

Health impacts

In his keynote speech: *Global warming and climate change: Why should the health sector be worried?*, Professor (Dr) Anthony McMichael summarized the main health outcomes that are exacerbated by climate change.

Thermal stress, especially heat-waves: reference was made to the 2003 European heat wave that caused over 77, 000 extra deaths and to the numerous victims of heat waves in India in recent years.

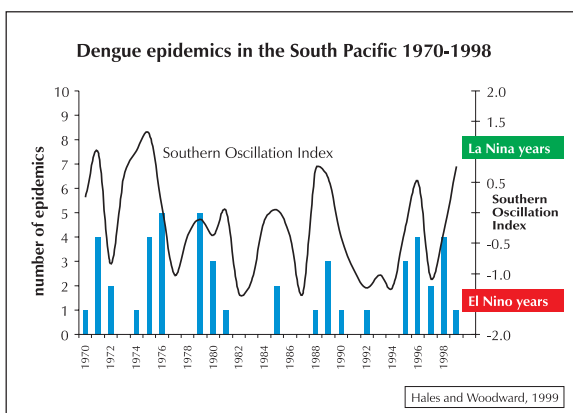
Respiratory disorders: An increase in air pollutants, allergens and ground-level ozone will increase the incidence of asthma, allergic rhinitis and bronchitis.

Malnutrition and child development: The largest health effect, globally, is projected to be from malnutrition. Today, malnutrition kills 3.7 million people annually, most of them children under five years of age. There are indications that it will take approximately 35 additional years to reach the World Food Summit 2002 target of reducing world hunger by half by 2015 (Rosegrant and Cline, 2003; UN Millennium Project, 2005).

Food production depends not only on water availability but also on ambient temperature. Globally averaged, a 0.5 degree Celsius increase reduces cereal grain crop yields by 3-5%. So, a 2 degrees Celsius higher

temperature (low end of IPCC-predicted rise this century) could mean 12-20% fall in the global grain production. Overall, the forecast estimates that the rice yield in 2080s will have dropped by 14.9% compared to 2000. Food prices would soar.

Vector-borne diseases: Higher temperatures will shorten the viral incubation period in mosquitoes, shorten their breeding cycle, increase the frequency of mosquito feeding and, in the case of dengue fever, allow a more efficient transmission of dengue virus from mosquitoes to humans. The graph shows how warmer El Niño and La Niña events correlate with dengue outbreaks in the South Pacific, 1970 – 1998 (Hales and Woodward, 1999)⁴.



Source: IPCC, 2007

Malaria, that already kills 1.1 million people each year, may also be exacerbated by disease vectors favouring climatic conditions.

Diarrhoeal diseases: Evidence of the positive correlation between daily hospitalizations for diarrhoea, and daily temperature in Lima, Peru, during the 1997-1998 El Niño events showed a 7% increase in daily cases per 1 degree Celsius rise. Each year, as of now, diarrhoea kills 1.8 million, mainly children.

Weather-related disasters: Loss of life, injuries, physical damage, dislocation, displacement and mental stress will be the health consequences from more intense and more frequent extreme weather events. The trends in health consequences from extreme weather events based on projections for the 21st century are listed in the table below.

Adverse health impacts will be greatest in low-income countries. Those at greater risk include, in all countries, the urban poor, the elderly and children, traditional societies, subsistence farmers and coastal populations.

⁴ D Maelzer, S Hales, P Weinstein, M Zalucki, and A Woodward: “El Niño and arboviral disease prediction”. *Environ Health Perspect.* 1999 October; 107(10): 817–818.

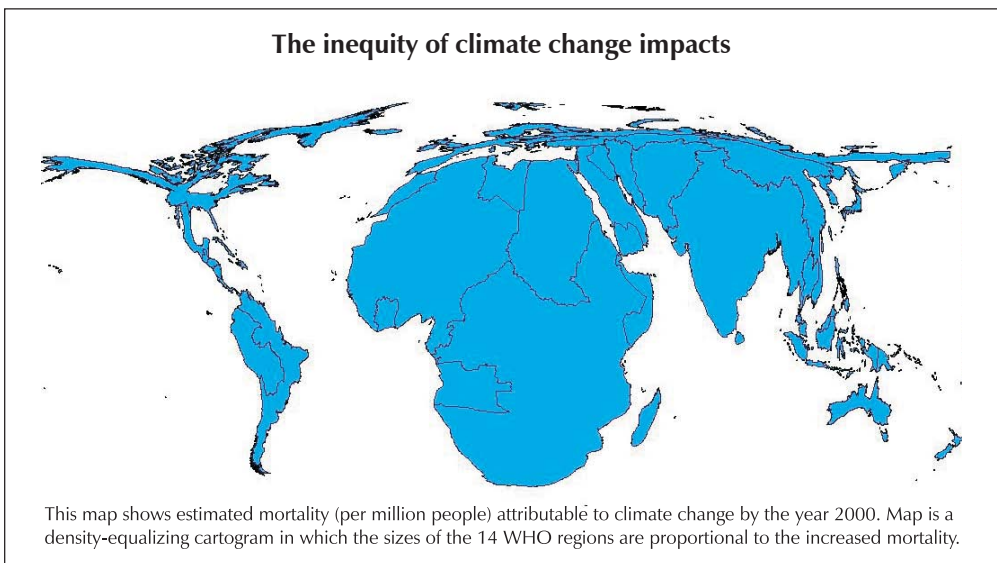
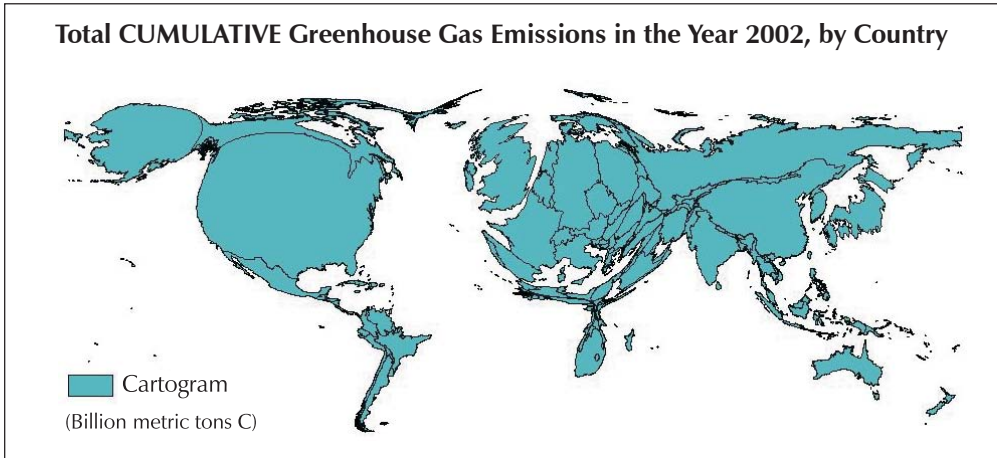
Phenomena of change	Human health {WGII 8.2, 8.4}	Likelihood of future trends(*)
Over most land areas, warmer and fewer cold days and nights, warmer and more frequent hot days and nights.	Reduced human mortality from decreased cold exposure.	Virtually certain.
Warm spells/heat waves. Frequency increased over most land areas.	Increased risk of heat-related mortality, especially for the elderly, chronically sick, very young and socially isolated.	Very likely.
Heavy precipitation events. Frequency increases over most areas.	Increased risk of deaths, injuries and infectious, respiratory and skin diseases.	Very likely.
Area affected by drought increases.	Increased risk of food and water shortage; increased risk of malnutrition; increased risk of water- and food-borne diseases.	Likely.
Intense tropical cyclone activity increases.	Increased risk of deaths, injuries, water- and food-borne diseases; post-traumatic stress disorders.	Likely.
Increased incidence of extreme (high) sea level (excludes tsunamis).	Increased risk of deaths and injuries by drowning in floods; migration-related health effects.	Likely.
Increased temperatures and disturbed rainfalls.	Contraction and expansion of the geographical range of disease vectors.	Likely.

(*): Using the Special Report on Emission Scenarios (SRES); From: Menne, 2007

The 2007 UNDP report “Fighting climate change: *Human solidarity in a divided world*”, provides a stark account of the threat posed by global warming. It argues that the world is drifting towards a “tipping point” that could lock the world’s poorest countries and their poorest citizens in a downward spiral, leaving hundreds of millions facing malnutrition, water scarcity, ecological threats and loss of livelihoods.

Ultimately, climate change is a threat to humanity as a whole. But it is the poor, a constituency with no responsibility for the ecological debt we are running up, who face the immediate and most severe human costs”.

The inequity of climate change impacts becomes evident when comparing density-equalising cartograms showing the countries scaled according to cumulative emissions in billion tonnes carbon equivalent in 2002 and countries scaled according to estimated mortality (per million people) based on burden-of-disease attribution to climate change that occurred from 1970s to 2000. (Patz, Gibbs, et al, 2007 and McMichael et al., 2003.)⁵



Source: Patz, Gibbs, et al, 2007, McMichael et al., 2003).

⁵ www.ecohealth101.org

5.2 Country reports

Countries attending the workshop made presentations, indicating how global warming and climate change are already impacting on human health and how they perceived the IPCC projections. A selection of country presentations follows.

Bangladesh as one of the most densely populated countries appears to be the most vulnerable to the effects of climate change. Indeed, the over 150 million population shares the scarce land area of 147 570 square kilometres that is mainly flat and occupied to 80% by floodplains. Most of the country is low-lying land comprising mainly the delta of the Ganges and Brahmaputra rivers. The anticipated adverse impacts of climate change are: sea level rise, higher temperatures, enhanced monsoon precipitation and run-off, reduced dry season precipitation and an increase in cyclone intensity. All of these would in fact aggravate many of the existing stresses that already pose a serious impediment to the economic development of Bangladesh.

The potential impacts from climate change on human health in Bangladesh are listed in the table below

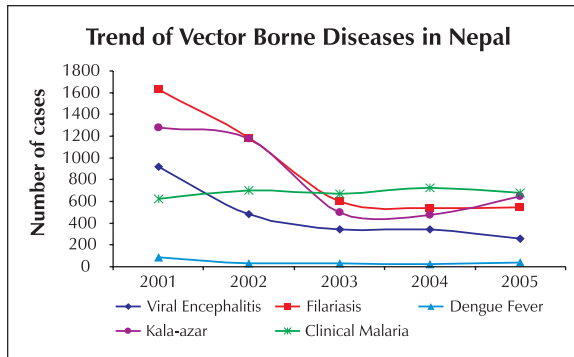
Climate Change related problems	What could happen?	Major risks
Temperature variation (heat and cold); Rainfall; Drought; Flood; Cyclone; Sea-level rise and salinity intrusion.	<ul style="list-style-type: none"> • Changes in air pollution. • Altered transmission of other infectious diseases. • Effects on food production via climatic influences on plant pests and diseases. • Population displacement due to natural disasters. • Crop failure. • Water shortages. • Destruction of health infrastructure in natural disasters. • Conflict over natural resources. • Direct impacts of heat and cold. 	<ul style="list-style-type: none"> • Food and water-borne diseases • Vector-borne disease • Unintentional fatal and non-fatal injuries. • Malnutrition. • Skin diseases. • Drowning. • Snake bites. • Cardiovascular disease. • Heat stress-related problems. • ARI and other respiratory illnesses. • Newly emerging diseases. • Psychological problems and social problems. • Strained health-care resources and facilities.

Source: Presentation made by the delegates from Bangladesh at Regional Workshop “Climate Change and Human Health in Asia and the Pacific: From Evidence to Action” held in Bali, Indonesia, 10-12 December 2007.

With an area of 38394 sq km, a population of 634 000 and a population density of 16 persons per square km, **Bhutan** is divided into three distinct climatic zones: (i) Southern foothills – hot, humid/cool; (ii) Inner Himalayas – cool/cold; and (iii) The Greater Himalayas – cold/snow. Bhutan is prone to multiple natural hazards that pose varying degrees of risk to the lives and livelihoods of its population. Global warming poses a major threat to Bhutanese communities in the higher mountains, as it increases the risk of glacial lake outburst floods or GLOFs. These occur when excess water from melting glaciers overflows the capacity of the glacial lake below, generating a flash flood of water, mud and debris that rush down the riverbed. Four such events have been recorded since 1957. As one of the most seismically active zones of the world, GLOFs and landslides pose serious hazards to human life. Currently, 24 glacial lakes have been identified as being prone to GLOFs. Rapid loss of glacial water will cause water scarcity that may lead to increased outbreaks of diarrhoeal diseases. Droughts will pose a threat of forest fires, especially during dry winter months. Warmer temperatures could facilitate the spread of tropical vector-borne diseases (malaria, dengue) to areas at higher elevations.

Maldives is an archipelago geographically situated in the Indian Ocean. It comprises 1192 Islands, of which 199 are inhabited. The country's population is approximately 300 000. Besides the very significant threats posed by sea-level rise and extreme weather events, Maldives faces possible increases of dengue outbreaks due to climate change. The first dengue outbreak of the disease occurred in 1979. In 1988 there was another major outbreak with 2054 clinically-diagnosed cases and nine deaths among children under 10 years of age. Both dengue virus carrying species *Aedes aegypti* and *Aedes albopictus* have been recorded in Maldives. Chikungunya was first reported in the country in mid-2006. A major outbreak of the disease occurred in December 2006 and continued till 2007. A total of 10 576 chikungunya cases were reported from 1 January – 25 November 2007. In general, there is limited knowledge and understanding of climate-related health problems.

Temperature in **Nepal** has increased by 0 to 0.5 °C per decade and will increase further by 1° to 3.5°C over the coming century. The monsoon rainfall has become less predictable and less dependable in terms of distribution and amount. Glacier retreat is evident; glaciers in the Himalayas are retreating 15 m per year. Due to global warming, the accumulation of water in glacial lakes has been increasing rapidly and the sudden discharge



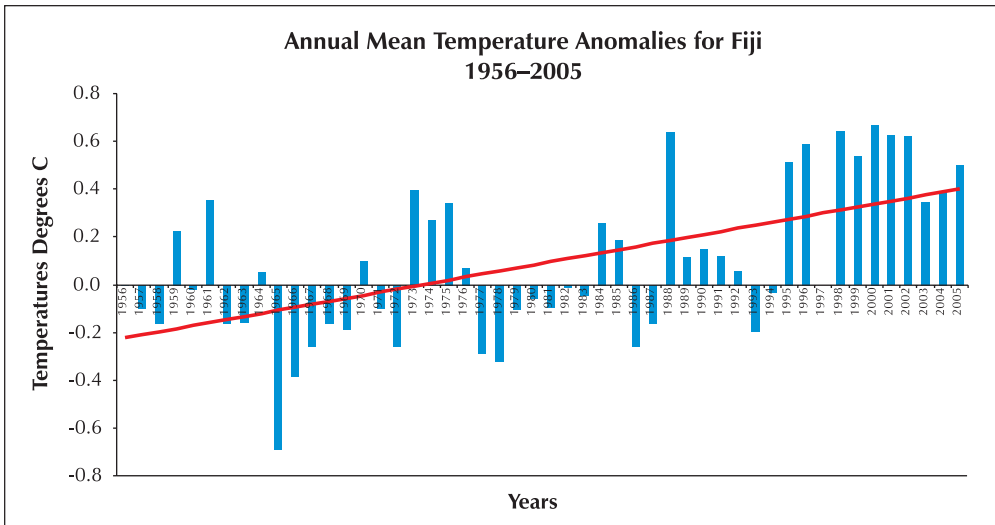
Source: Ministry of Health and Population, Nepal, 2006

of a large volume of water with debris causes GLOF. Over the past 50 years, Nepal has suffered 21 recorded GLOF's and currently there are 20 potentially dangerous glacial lakes. Altogether 3252 glaciers cover an area of 5322 sq. km with 481 cu. km of ice reserves in Nepal. There are 2315 glacial lakes in the country.

The impacts of rise in temperatures on health have not been well studied yet. Diarrhea, dysentery, malaria, kala-azar and Japanese encephalitis are the top five diseases in the country. Climate change may upset the achievements of the last decade in bringing down the burden of disease.

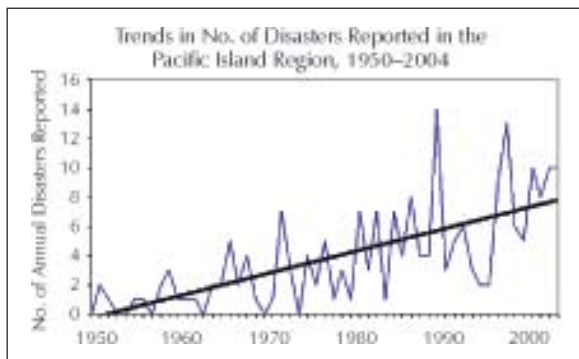
Samoa is located in the South-West Pacific, and consists of four main inhabited and six smaller uninhabited islands. Its total land area is 2 935 sq. km, and had a population of 174 140 in 2001. Approximately 70% of Samoa's population and infrastructure are located in low-lying coastal areas. The country's economy is based on tourism and exports including agriculture, fisheries and forestry products. The first signs of climate change show an increase in frequency of tropical depressions, gale winds forces and tropical cyclones during the cyclone season, December to February. The sea level is projected to rise by 3.8 mm per year, which is higher than IPCC's global projections of 0.9 – 0.88 m between 1990 – 2100. The main concerns about health impacts from climate change are dengue, filariasis, leptospirosis and food- and water-borne diseases, such as typhoid, respiratory infections, direct injuries including skin diseases and mental illnesses.

With 268021 sq km, **New Zealand's** population is 4 116 000 with a population density of 15.4 people per square kilometre. The climate is significantly affected by El Nino Southern Oscillation. It is noteworthy that skin cancer represents 10.5% of all cancer deaths. The projected direct effects of climate change are: temperature-fewer cold days, more hot days; Photochemical air pollution likely to be exacerbated by increased summer temperatures; rainfall: more flood events predicted, more drowning likely; and increase in injuries due to more landslides.



Source: Fiji School of Medicine, Fiji

Fiji has over 300 islands, but less than 100 are inhabited. Ninety per cent of Fiji’s population, totaling a little over 800 000, lives on the two main islands. Temperature has been increasing steadily over the last 50 years and is now 0.6° Celsius higher. Not surprisingly, extreme weather events have also increased as shown in the graph below.



Source: Fiji School of Medicine, Fiji

In the most highly vulnerable low-lying islands, extreme weather generates hazardous wastes such as asbestos containing debris (see photo). Its safe disposal poses a major challenge due to lack of know-how and space for landfill.



Source: Asbestos containing roof debris after cyclone, Fiji

Micronesia is located in the North Pacific Ocean, north east of Indonesia. It consists of four major island groups, totaling

607 islands. The land area, 702 sq. km, is inhabited by 107 900 people with a population density of 395 persons per square mile. The geography varies from mountainous islands to low, coral atolls. The highest point is 791 metres. The climate risk profile shows that rainfall, wind, temperature and sea level extremes will all increase as a result of global warming, as will the frequency of drought. The population of Micronesia faces health problems that could be exacerbated by global warming: dengue, filariasis, zika disease and malaria. Others are: water-borne/diarrhoeal diseases (cholera), respiratory diseases and fatality and injuries from landslides. The outer-island people are the most vulnerable: isolated by distance and by infrequent and unreliable sea and air transportation, they have poor access to basic services – education and health, etc. A major threat is sea-level rise and extreme climate events: they can be the source of salt water intrusion into water lenses causing grave water insecurity, destruction of food gardens and the food supply (food insecurity), and eventually population displacement and resettlement.

Nauru is the smallest independent republic in the world. It lays in the Western Pacific Ocean, surrounded by coral reef, with a total land area of 21 sq km. Its population totals 10 065 with a population density of 621 sq. km. As an island, Nauru is vulnerable to climate and sea-level change, notably rising of sea level. Mining phosphate on the island of Nauru has devastated the island environmentally and has created financial, legal and cultural problems for the islanders.



Source: Mining phosphate depleted the soil cover in Nauru.

As a result of mining, the vast majority of soil and vegetation has been stripped away. This prevents agriculture from taking place and makes it very difficult for a viable ecosystem to establish itself and to flourish. In addition, the combination of a pillar-and-pit landscape on Nauru and the loss of vegetation create a very hot interior, such that rising hot air prevents rain clouds from settling

over the island. There contributes to frequent droughts, exacerbating an already difficult problem. There is no proper data collection system regarding human health problems caused by climate change. However, such a system is planned to be initiated.

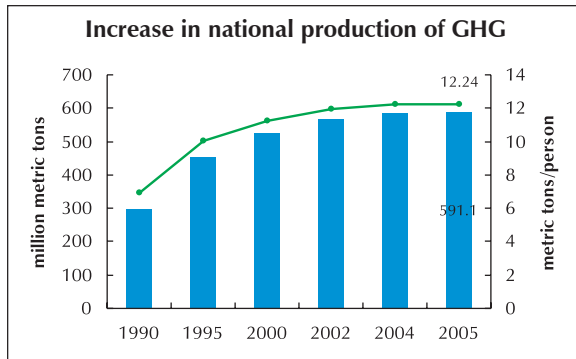
Indonesia is a tropical country with 17500 islands spread over 5000 sq. km. Its population is of 210 million in the year 2000.. Studies have shown that the temperature is increasing by 0.03°C/year and precipitation is rising by 2 to 3 % per year. The trend in sea-level rise is high, reaching an average of 0.57 cm/year (see graph).

Indonesia is a major contributor to GHG, mainly from forest and peat fires. The human health impact related to climate change will be in the form of: vector-borne diseases, mainly malaria, dengue, filariasis; water-borne diseases, such as: diarrhoea, cholera, typhoid; malnutrition; cardio cerebral vascular diseases, hypertension; influenza; respiratory diseases (asthma, indoor air); mental disorders; injuries (from extreme weather events) and food-borne diseases. The table below shows the trend incidence rate of dengue per year, from 1968 to 2005.

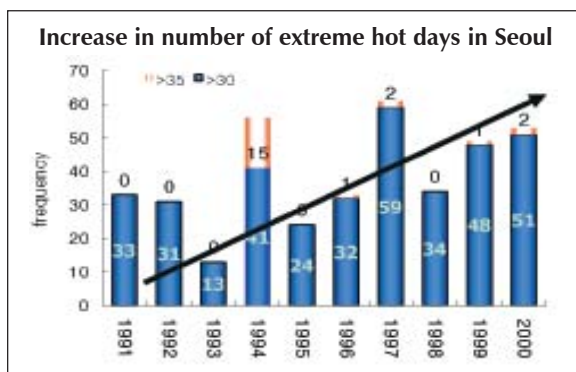
Sri Lanka, with about 20 million people and a population density of 344 persons/sq. km has estimated that climate change will have potential impacts on health in the form of: vector-borne diseases (malaria, filariasis, chikungunya, dengue, Japanese encephalitis); diarrhoea associated with floods and droughts; and lightning strikes. Warmer temperatures will aggravate the problem of access to safe drinking water. Individuals will be compelled to concentrate on staying around available common water sources, which could lead to occurrence and spread of communicable diseases such as diarrhoea, skin diseases, hepatitis A and E, and typhoid fever, etc. Increased air pollution will lead to more respiratory diseases.

Reduced crop yields and loss of income will exacerbate malnutrition and psychological problems linked to forced displacement. Coastal communities are the “particularly vulnerable populations” because of sea-level rise. Farmers will face losses due to drought effects in rain-fed agriculture. Factory labourers will be exposed to thermal stress. People living in the hills will face more landslides, while those in the plains will experience more floods. The dry zone could be affected by droughts and a resurgence of malaria, while in the urban and peri-urban areas, the poor, will suffer from malnutrition, dengue and heat stress.

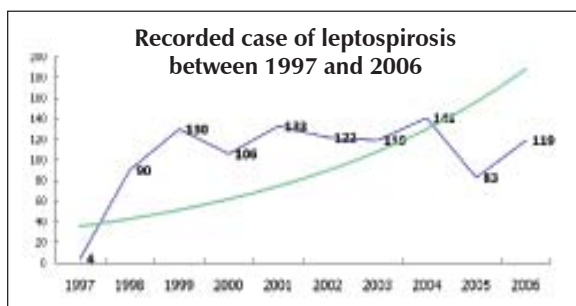
Having an area close to 100 000 sq. km., the **Republic of Korea’s** population totals 48 138 000, resulting in a population density of 474 persons/sq. km (third highest in the world). The Republic of Korea is an industrialized nation and contributes to GHG, mainly from the energy producing sector (see graph). Air temperature has risen by 1.5 degrees Celsius



Source: Korea Centers for Disease Control & Prevention, Seoul, 2006.



Source: Korea Centers for Disease Control & Prevention, Seoul, 2006.



Source: Korea Centers for Disease Control & Prevention, Seoul, 2006.

in the period from 1905-2005, compared to only 0.74 ± 0.18 degrees Celsius at the global level. The number of extremely hot days in Seoul increased drastically between 1990 and 2000 (see graph).

The sea-level rise has been 1-6 mm/yr, more than the global average of 1.3-2.3 mm/yr.

At the end of the 21st century, the average temperature is projected to increase by 5 degrees Celsius and the increase in sea level is expected to be 50 cm. The average annual precipitation should increase by 15%. Climate-sensitive diseases such as malaria and dengue, as well as leptospirosis have been increasing in severity.

Participants were briefed on the special climate change vulnerability of people living in **mountainous regions**. The vision according to which mountain populations of the greater Himalayas enjoy improved well-being in a sustainable global environment is ill-conceived.

Indeed, as it is, temperature increases faster at high altitudes (see graph in page 29, Source: Liu, X. and B. Chen, 2000.

Climatic warming in the Tibetan Plateau during recent decades. International Journal of Climatology, 20: 1729-1742).

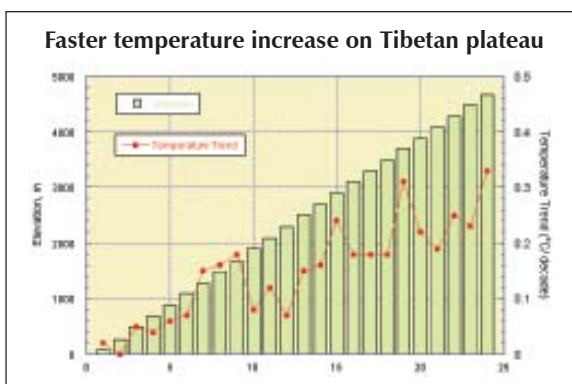
Glaciers in the Himalayas are melting at a faster pace than anywhere else on earth (Dyurgerov and Meier, 2005)⁶, thereby reducing the water reserves for a total of 1.3 billion people who depend on the nine large river basins flowing from the Himalayan range.

The predicted climate-induced changes in the Himalayas will affect rainfall, with longer wet seasons and drier dry seasons. The more intense rainfall events will be less predictable. The combined effect of decreasing water availability and increased demand provide a future challenge and can have a devastating impact on food production and therefore on human health.

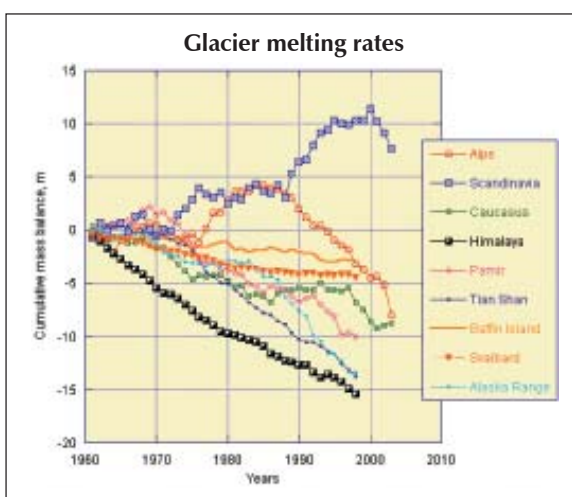
Melting glaciers and disturbed rainfall patterns will increase the amount of water-induced hazards such as floods, flash floods, landslides, debris flows and droughts.

The immediate health implications are increased number of physical injuries and loss of life. The loss of property and income-generating sources would increase the vulnerability of local communities. The mid-term effect of these extreme events would result in high psycho-social stress.

Extreme rainfall would create floods during which faeces can contaminate water resources, the more in areas with inadequate sanitation, contributing to an increased risk for epidemics.



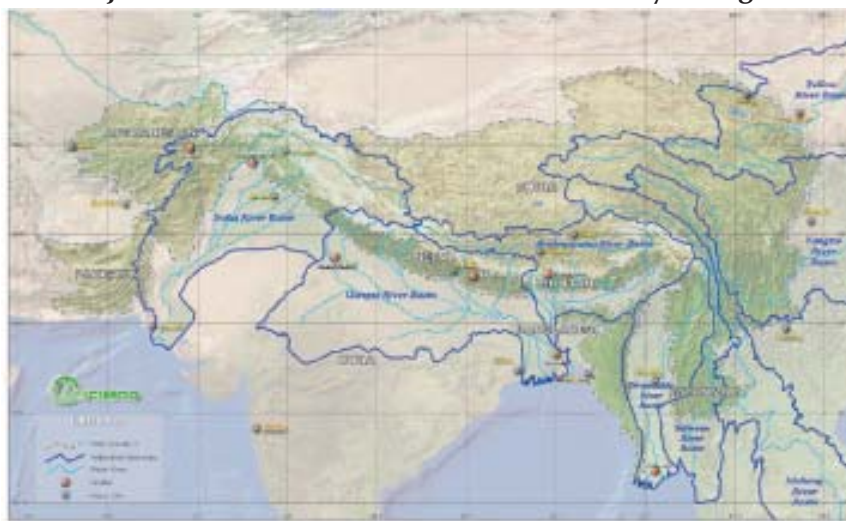
Source: Liu, X. and B. Chen, 2000.



Source: Dyurgerov, M.B. and Meier, M.F. 2005, op.cit.

⁶ Dyurgerov, M.B. and Meier, M.F. 2005. Glaciers and the changing earth system: A 2004 snapshot. Occasional paper 58. Institute of Arctic and Alpine Research, University of Colorado, Boulder, USA.

Major River Basins of the Hindu Kush Himalayan Region



Source: ICIMOD, 2008

River	Area (sq. km.)	Mean discharge (m ³ /s)	% of glacier melt in river flow	Population depending on the river	Population density	Water per person m ³ /year
Indus	1081718	5 533	44.8	178483000	165	830
Ganges	1016124	18 691	9.1	407466000	401	~2500
Brahmaputra	651335	19 824	12.3	118543000	182	~2500
Irrawaddy	413710	13 565	unknown	33097000	80	18614
Salween	271914	1 494	8.8	5982000	22	23796
Mekong	805604	11 048	6.6	57198000	71	8934
Yangtze	1722193	34000	18.5	368549000	214	2265
Yellow	944970	1 365	1.3	147415000	156	361
Tarim	1152448		40.2	8067000	7	754
Total				1324800000		

Himalayan waters: a key resource. Source: ICIMOD, 2008

Higher ambient temperatures could increase vector-borne diseases, such as malaria, dengue fever and schistosomiasis.

With warmer ambient temperatures the altitudinal distribution of vegetation will change. The impact on biodiversity may lead to extinction

of certain species of flora and indigenous fauna. As ecological zones change, land-use patterns will also alter, triggering shifts in livelihoods. Nomad populations may need to become sedentary, as this is already occurring for some groups in the northern Himalayas (Dingri County). While trying to cope up with new lifestyles, traditional ethnic groups may enter a phase of depression triggered by social tensions and loss of their identity. Psychological stress, alcohol abuse, domestic violence, and other negative behavioural changes may be the outcomes.

Mountain communities are vulnerable *per se*, due to their high exposure to natural hazards, remoteness, poor infrastructure and marginalization. But it is women, the elderly, the poor, children and the disabled and ethnic minorities who are physically, socially and psychologically more vulnerable because they have the least capacity to cope and recover. Already, women are increasingly becoming household heads and have the double burden of social reproduction and agricultural work as their husbands/fathers of their children leave the rural areas in search of work in urban centres.

Presentations made under this Objective are listed below. Copies of selected PowerPoint presentations are annexed to this report:

Keynote address: <i>“Global warming and climate change: Why should the health sector be worried?”</i>	Professor Dr Anthony McMichael, National Centre for Epidemiology and Population Health, Canberra, Australia.
Country presentations	Bangladesh, Bhutan, Fiji, Indonesia, Lao People’s Democratic Republic, Maldives, Micronesia, Nauru, Nepal, New Zealand, Republic of Korea, Samoa, Solomon Islands, Sri Lanka, Tonga, Vanuatu
<i>“The results of the IPCC and implications for South-East and East Asia :”</i>	Dr Andy Reisinger, IPCC and The Energy and Resources Institute (TERI), New Delhi, India.
<i>“Main findings of the Fourth Assessment Report of the IPCC, Chapter 8: Climate change and human health”.</i>	Dr Bettina Menne, European Centre for Environment and Health, WHO, Rome, Italy.
<i>“The special vulnerability of mountain people to climate change.”</i>	Dr Mats Eriksson, International Centre for Integrated Mountain Development, Kathmandu, Nepal.

Objective 2: Define the key strategic elements that protect health from the effects of climate change

Countries participating to the workshop presented the national plans to mitigate and adapt to climate change to reduce the potential disease burden.

Cambodia, Laos, Maldives, Nepal and Palau, as well as other developing nations indicated that there still is limited knowledge and understanding of climate-related health problems. However, there is general consensus that adaptive measures and interventions to protect human health from the consequences of climate change need immediate attention and that mitigation measures, such as drastically reducing the emissions of GHG, are most vital.

An urgent call was made to countries causing the majority of emissions to recognize their responsibility for climate change and to reduce their GHG emissions for the sake of long-term sustainability.

Data and research needs in these countries focus on the need to conduct vulnerability assessments and people action plans thereof, including the establishing of additional weather recording stations across countries, and better understanding of relationships between increase in vector-and water-borne diseases and climatic elements. Similarly, country representatives mentioned the need for understanding the relationship between food-deficit populations/districts and climate change.

A need was also expressed to collect and disseminate the database on climate and health components thereby making them available to the larger public.

Countries like **Bhutan and Sri Lanka** have recognized the threats posed by climate change and have engaged in national and international action.

In 2008–2009, Bhutan will strengthen its existing health programmes that are addressing climate-sensitive health outcomes. Some of the programmes are: strengthening community-based clean water supply schemes and health hygiene campaigns (urban and rural); supporting proper waste disposal methods to reduce methane emissions; monitoring air and drinking water quality; integrated vector management and capacity building for emergency medical services.

Sri Lanka plans to conduct a series of activities that will benefit human health in the long run. Such activities include the use of energy-efficient technologies; enforcing and monitoring the emission standards of vehicles and of the industrial sector; encouraging the use of railway; and providing incentives for the use of public transport systems.

The agriculture and forestry sectors are aiming at forestation and reforestation of degraded lands, breeding crop species for higher CO₂ sequestration and promoting intermittent irrigation in rice cultivation to reduce methane emissions from paddy fields.

Adaptations programmes to the current and projected climate-related health burdens include a pilot project to reduce the reliance on insecticide use in vector control, by implementing integrated pest and vector management at the community level.

More needs to be known, via research studies on the vulnerability to climate change of tea and other plantations, together with the potential impact of climate change on land degradation (erosion). National authorities need to know more about the relationship between El Nino events and malaria incidence; impact of climate change on crop production; and the potential of community-based integrated pest and vector management (IPVM) schemes, to increase climate resilience.

Bhutan and Sri Lanka agree that more needs to be done, in particular putting much more emphasis on health education, notably primary prevention and promoting strict adherence to environmental laws.

Samoa submitted its Initial National Communication to the United Nations Framework Convention on Climate Change (UNFCCC) in 1999 covering the years 1994-1997. It included a section on Climate and Health.

The country published its first GHG inventory in 1999; the second GHG inventory will be released in early 2008. In order to implement the National Climate Change Policy, the Ministry of Natural Resources and Environment has prepared a National Greenhouse Gas Abatement Strategy. The Ministry of Finance has prepared a National Energy Policy, with provisions for renewable energy. Concrete action is planned aimed at promoting solar and wind power; using diesel made from coconut oil; expanding hydropower and improving energy efficiency on both the supply and demand side.

The National Adaptation Programme of Action (NAPA) identifies urgent and immediate actions for climate change adaptation in the health sector. A detailed vulnerability and adaptation assessment of the health sector is currently being prepared as part of Samoa's Second National Communication project.

Health activities identified in Samoa's NAPA include developing a national policy on climate and health to increase support for a health surveillance systems that will allow collecting data and information on climate and health. This will allow the development of a research and training unit and setting up of an early warning system. Samoa also focuses on improving the quality of public health-care services, notably at the primary level.

The Ministry of Natural Resources and Environment is the lead agency on Samoa's climate change activities. The Ministry of Health is responsible for climate change activities in the health sector and is a key member of the National Climate Change Country Team. The Ministry of Foreign Affairs is the political focal point for the UNFCCC and Kyoto Protocol. The Ministry of Finance coordinates and administers all funds for climate change projects. Other ministries and agencies are responsible for specific climate change activities relevant to their area of operation.

Indonesia is planning to conduct a number of specific vulnerability assessments vis-à-vis climate change impacts on health, at national, regional and district levels. Currently, climate change impacts on human health are being addressed through the National Programme: *"Self Motivated Community to Live Healthy Lives"*. Its aims are to empower communities to improve the quality of health services, improve health surveillance, establish a monitoring and information system and address the issue of increasing health financing. Within this programme, activities are aiming to promoting

safe drinking water, integrated vector management, locally-sustainable adaptation and mitigation, environment health capacity building for infectious disease surveillance and health action in emergencies.

As in Samoa and in most countries where action has already been taken, Indonesia also has a legally recognized National Climate Change Inter-sectoral Committee, headed by the Ministry of Environment, with ministries of forestry, energy, industry, agriculture and health, the Planning Board, the Public Works Department and universities as full members.

Bangladesh is implementing a series of adaptation measures. Sri Lanka submitted its first National Communications to the UNFCCC in late 2002, and has adopted “The National Adaptation Programme of Action (NAPA)”, Ministry of Environment and Forests. The health sector’s contribution to NAPA was limited. Some immediate measure will also benefit human health, such as reducing air pollution in cities by phasing out two-stroke three wheelers and all vehicles older than 20-25 years, making mandatory the use of catalytic converters and diesel particulate filters for petrol-and diesel-driven vehicles. Through the installation of 30 000 solar home systems in rural households (under validation process) the health burden from indoor air pollution would be lowered.

Bangladesh has conducted three major studies on climate change and health (focusing on malaria, dengue and cholera). A broad-based and in-depth study should be undertaken for generalization and better understanding of the cause-effect relationship between climate change factors and human health. Results should help develop more suitable and efficient early warning systems.

Countries that are more industrialized, like the **Republic of Korea** and **New Zealand**, made a presentation on their ongoing initiatives and targets that were far more elaborate and ambitious. For instance, New Zealand has set some national targets that aim at having the electricity sector carbon-neutral by 2025; carbon-neutral stationary energy sector by 2030 and carbon-neutral transport sector by 2040. To achieve this, specific strategies/programmes/standards are being implemented, such as:

- National Energy Strategy
- Building code review and New Zealand housing strategy

- Investment in public transport and “Walking School Bus”
- New Zealand waste strategy
- National environmental standard for landfill gas
- Carbon-neutral public service programme. The Ministry of Health plans to be carbon-neutral by 2012.

The Republic of Korea plans to address energy issues by, *inter alia*, stabilizing the supply of natural gas at 80% by 2015 and implementing nation-wide energy efficiency standards and labeling programme.

The health sector will focus its attention on infectious disease control programme (national malaria elimination, *tsutsugamushi* and dengue control programmes), boosting water and food-borne disease surveillance and control. The country will also address climate-sensitive non-infectious diseases by strengthening the “Yellow dust” – health surveillance system, national survey on cerebro-cardiovascular disease and allergic disease, and the development of an asthma index.

For Republic of Korea and New Zealand, the priorities in terms of data and research needs regarding the potential health impacts of climate change are basically related to:

- Further modelling of vector-borne disease risks;
- Effects on water availability and quality;
- Influence of climate variability/extremes on notified illnesses;
- Burden of water-related illnesses (including those that are non-notifiable), especially in more vulnerable areas;
- Impacts on vulnerable groups: Role of socioeconomic and cultural factors in determining climate-related health risks; and
- Public health impacts of mitigation measures (secondary health benefits, for example, reduced dependence on private motor vehicles).

The typical challenges that need to be addressed are: to develop new, broader public health legislation; enhance disease surveillance; improve vector surveillance and response, and enhance emergency preparedness.

On the whole, in both countries, the national institutional organization focuses on government approach, with Ministry of the Environment as the lead agency. The Ministry of Health is actively engaged, as also the business community, local government, academic institutions and local communities.

Costs of adaptation

A study conducted by the World Health Organization (WHO)-Global Burden of Disease (GBD) – has projected the relative risks associated with climate change for the year 2030 as under:

The number of cases estimated to suffer from malnutrition by 2030, globally, is 46 352 000. The number associated with climate change is estimated to be 4 673 000 cases (+10%).

Cases of diarrhoeal diseases are estimated to increase up to 451 3981 000 of which about 3% or 131 980 000 would be attributed to climate impacts.

For malaria, in 2030, the number of cases is estimated to be 408 227 000 of which 21 787 000 would be related to climate change-sensitive health outcomes.

The total costs involved to address all cases of disease would be:

- \$67 billion for diarrhoeal diseases;
- \$2 billion for malnutrition and
- \$36 to \$50 billion for malaria

By effectively addressing the threats from climate change that will affect human health, the projected health costs in 2030 can be reduced by an amount between \$3992 and \$ 12 603 million.

Health co-benefits from reduction in GHG emissions

“There is *high agreement and much evidence* that mitigation actions can result in near-term co-benefits (e.g. improved health due to reduced air pollution) that may offset a substantial fraction of mitigation costs”, IPCC, 2007.

According to the 2002 WHO Global Burden of Disease Report, urban air pollution causes 800 000 annual deaths.



Source: © Deb Kushal – UNEP/Still Pictures

Due to lack of monsoon rains, major forest fires related to El Nino broke out in Indonesia in 1998. Among the health effects were 262 deaths, an increase by 70% of patients with worsened ARI symptoms and 30% increase in outpatient attendance for eye irritations and respiratory disorders.

Most sources of GHG emissions also emit ‘conventional’ air pollutants which have negative impacts on human health. Many, but not all GHG mitigation measures reduce these air pollutants.

The findings of IPCC AR4 for North America, Europe, Asia and Latin America reveal that by taking moderate measures (reducing GHG emissions by 10-20%), the associated gains in health impacts (depending on the contribution of source sector to population exposure and on the level of air pollution control) could be 10.000 avoided cases of premature deaths per year for Asia and Latin America.

According to the 2002 WHO Global Burden of Disease Report, there is an annual loss of 1.9 million deaths, and 19 million years of healthy life, from physical inactivity.



Mass marketing and availability of junk food and ‘supersized’ portions, (production of which also leads to GHG emissions) as well as sedentary lifestyles lead to obesity. Globally, physical inactivity accounted for 21.5% ischaemic heart disease cases; 11% of ischaemic stroke cases; 14% cases of diabetes; 16% cases of colon cancer and 10% cases of breast cancer.

In Europe, urban planning and transport policies at the local level can be part of the answer. More than 30% trips made in cars in Europe cover distances of less than 3 km. and 50% of less than 5 km. These distances can be covered in 15 – 20 minutes by bicycle or in 30–50 minutes by brisk walking. This corresponds to the recommended daily dose of at least 30 minutes of regular, moderate-intensity physical activity.

According to the 2002 WHO Global Burden of Disease Report, there were 1.2 million deaths and over 50 million injuries from road traffic accidents in 2000.

Policy options can address multiple health concerns:

- Co-benefits of GHG mitigation on human health can be substantial, especially in respect of measures in the domestic sector in developing countries;
- In industrial countries with advanced air quality legislation, cost-savings resulting from air pollution control measures can compensate in large parts the GHG mitigation costs.
- These co-benefits need to be included in a comprehensive assessment of mitigation options. They additionally provide local and near-term benefits of measures aimed at global and long-term goals.

Policy	Reducing crashes	Reducing air pollution	Reducing noise	Mitigating climate change	Promoting physical activity	Promoting community cohesion
Speed management	😊	😊	😊	😊	😊	😊
Traffic calming and speed reduction in residential areas	😊	😊	😊	😊	😊	😊
Reducing transport demand (such as by telecommunication)	😊	😊	😊	😊	😊	😊
Road pricing	😊	😊	😊	😊	😊	😊
Cleaner fuels and more efficient vehicles	😊	😊	😊	😊	😊	😊
Promotion of safe cycling, walking and public transport	😊	😊	😊	😊	😊	😊
Safer cars (including fronts protecting pedestrians)	😊	😊	😊	😊	😊	😊
Implementing noise reducing barriers	😊	😊	😊	😊	😊	😊
Investment in safe infrastructure for cyclists and pedestrians	😊	😊	😊	😊	😊	😊
Urban parking management	😊	😊	😊	😊	😊	😊
Environmentally differentiated fees for motorized transport in urban areas	😊	😊	😊	😊	😊	unclear
Reducing the power of vehicles	😊	😊	😊	😊	😊	unclear

(Source: Racioppi, F., et al. *Preventing road traffic injury: a public health perspective for Europe*. WHO Regional Office for Europe, 2004)

Presentations made under this Objective are listed below. Copies of selected PowerPoint presentations are annexed to this report:

<i>“Climate change policies, instruments and cooperative arrangements”</i>	Dr Dennis Tirpak, Environment Directorate, OECD, and International Institute for Sustainable Development (IISD), Winnipeg, Canada.
<i>“Urban climate and respiratory diseases”</i>	Dr Jonathan Patz, University of Wisconsin, USA.
<i>“The health benefits from reducing greenhouse gas emissions”</i>	Dr R. Bertollini, Senior Adviser, WHO, Geneva.
<i>“Adaptation concerns, scope and the UNFCCC Nairobi Work Programme”</i>	Ms Suruchi Badhwal, Tata Energy and Resources Institute, India.
<i>“Costs of Public Health Adaptation to Climate Change in 2030”</i>	Dr Kris Ebi, Consultant, USA.
<i>“Protecting Health from Climate Change: WHO’s strategic framework”</i>	Dr Maria Neira, Director, Protection of the Human Environment, WHO Geneva.

Objective 3: Develop a regional action plan to reduce the burden of disease linked to global warming and climate change

Participants working in four different working groups were asked to produce the key elements for a regional action plan. They established that planning for action to address climate change impacts on health was very timely. Not only because of the COP13 meeting held in Bali, Indonesia during the same time, but also because they felt there is now consensus of all countries and international agencies to get involved. At the same time, there is very strong evidence of climate change and its health impacts: This information is reaching policy-makers. The UN leadership and WHO have taken the lead in promoting action to address climate change.

Participants also indicated some weaknesses. For many it was still difficult to make clear-cut assessments of health impacts from climate change, like for instance in projecting the dynamics of vector-borne diseases. Another hurdle for the health sector was its limited involvement, till then, with other concerned sectors. There was an urgent need to take intersectoral collaboration seriously.

Finally, participants pointed out that the recommended actions to reduce the health burden from climate change will very much depend on local conditions and will vary in developing and industrialized nations/regions.

Opportunities definitely exist for the health sector to engage strongly in tackling climate change threats; this would allow for health concerns to be included in national mitigation and adaptation plans – compensating for weak health response capacities. It would also allow the health sector to capture the health relevance of activities initiated by other sectors.

The following two major threats were identified:

- (1) Climate change may occur more rapidly and in a sudden and irreversible manner, limiting the opportunities and reducing the time to address its health consequences; and
- (2) Funds needed to actually prepare for climate change may not be available, especially for poor countries.

The key elements to be included in regional action plans should consider the development and use of an integrated surveillance system for the early detection and warning of outbreaks of climate-sensitive diseases (both communicable and non communicable). This would include an international risk communication procedure.

Countries should pursue the development of healthy public policies, based on effective and efficient intersectoral collaboration.

The health sector will need to strengthen public health systems and disaster preparedness. Significant efforts need to be made to create awareness and to build up capacities for climate change resilience, at all levels, including empowering of local communities. This cannot be done by the health sector alone.

For that, the health sector needs to participate actively in national communications with the United Nations Framework Convention on Climate Change (UNFCCC), and include health issues as the core in the negotiation process.

Results from studies undertaken to understand how to motivate behavioural changes in individuals and in the corporate sector, would allow undertaking those actions that mitigate climate-related risks, while promoting health.

Presentations made under this Objective are listed below. Copies of selected powerpoint presentations are annexed to this report:

<i>“Climate change and human health: lessons learnt in Europe”</i>	Dr Bettina Menne, European Centre for Environment and Health, World Health Organization (WHO), Italy.
<i>“Climate change and human health: activities in Brazil”</i>	Dr Guilherme F. Netto, Ministry of Health, Brazil
<i>“Outcomes of the EMRO meeting on climate change and health”</i>	Dr Hamed A. Bakir, Coordinator, WHO Centre for Environmental Health Activities, Jordan.
<i>“Outcomes of the 2007 national workshops on climate change and health in Bangladesh, India and Indonesia”</i>	Mr Alexander von Hildebrand, Environmental Health Adviser, WHO SEARO.
<i>“Outcomes of the workshop on climate change and health in South-east and East Asian Countries, Kuala Lumpur, Malaysia, July 2007”</i>	Datuk Dr Mukundan S. Pillay, Chairman of the workshop in Kuala Lumpur in July 2007, and Dr Hisashi Ogawa. Environmental Health Advisor, WHO WPRO
<i>“Regional Forum on Environment and Health in South-east and East Asian Countries and Thematic Working Group on climate change, ozone depletion and ecosystem change”</i>	Dr Hisashi Ogawa. Environmental Health Advisor, WHO WPRO

- (1) Climate change currently contributes to the global burden of disease and premature deaths;
- (2) Projected climate change-related exposures are likely to affect the health status of millions of people;
- (3) The most affected systems and sectors are human health in populations with low adaptive capacity. Health is one of the most vulnerable sectors;
- (4) Adaptive capacity needs to be improved everywhere;
- (5) Reviewing and adapting current public health programmes to the challenges from climate change – as well as mainstreaming health in climate change are a must today;
- (6) Extreme weather events are likely to increase; and could overwhelm the response capacity of the health sector;
- (7) Climate change has the power to jeopardize other ongoing health gains – especially in low-income/vulnerable populations (e.g. MDG; advances in HIV/AIDS pandemic; etc.);
- (8) The health sector has, generally, been slow to recognize and respond to risk, and consequently has inadequate capacity-building (research, prevention, policy) and a deficient contact/engagement with other sectors;
- (9) Society has been slow to understand that the threat to health is the most serious and fundamental risk because the population's health is the ultimate indicator of 'sustainability';

- (10) Mitigation options include energy supply from low-carbon sources, and improved energy efficiency;
- (11) Biomass from agriculture and dedicated crops could make an important contribution to bioenergy; competition with land for food production, water use, and biodiversity;
- (12) Reducing emissions from deforestation could make a significant contribution to reduce regional GHG emissions;
- (13) Impacts are compounded in the context of multiple stresses (poverty, health);
- (14) Non-climate policies can significantly affect GHG emissions and vulnerability to climate change;
- (15) Adaptation is most effective where it complements broader sectoral initiatives;
- (16) GHG emission reductions can have health co-benefits that can offset a substantial fraction of the mitigation cost; also possible benefits in area of energy security and reduced resource use; and
- (17) Making development more sustainable is the way forward.

The challenges posed by climate change demand urgent action in terms of primary prevention – i.e. drastic reduction of GHG emissions and secondary prevention in terms of developing and implementing adaptive measures:

- Public education and awareness;
- Early-alert systems: heat waves, other impending weather extremes, infectious disease outbreaks;
- Community-based neighbourhood support/watch schemes;
- Climate-proof housing design, and ‘cooler’ urban layout;
- Disaster preparedness, including health-system capacity to respond to surges;
- Enhanced infectious disease control programmes;
- Development of vaccines and effective vector control, case detection and treatment

- Improved surveillance;
- Risk indicators (eg. mosquito numbers, aeroallergen concentration); and
- Appropriate workforce training and mid-career development.

Adaptation at different levels and across different scales is needed:

- International
 - Global climate-related infectious disease surveillance;
 - Regional early warning mechanisms and actions for the health sector; and
 - Inclusion of climate change into multilateral agreements
- National and regional
 - Early warning systems linked to intervention plans (heat and infectious diseases);
 - Specific disease risk identification and surveillance;
 - Specific awareness programmes; and
 - Inclusion of climate change into risk management mechanisms
- Health sector
 - Health system response plans; training of health professionals; climate-proof infrastructure
- Corporate sector
 - Information on how climate change affects health
 - Information on corporate responsibility to reduce carbon footprints and the health co-benefits thereof.
- Individual
 - Information about solutions (eg heat waves); and
 - Information on how individual carbon footprints can be reduced
- Across scales: win-win approaches
 - Climate proof housing, other

Annex 1

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Annex 2 Programme

10th December 2007

Time	Activity	In charge
8.30	Opening address	Dr Nyoman Kandun, Director Communicable Diseases and Environment, Ministry of Health, Indonesia, on behalf of HE Minister of Health, Dr Dr. dr. Siti Fadilah Supari, Sp JP (K), Government of Indonesia
8.45	Welcome remarks	Dr Poonam Singh, Deputy Regional Director, WHO SEARO
8.50	Announcements and selection of meeting officers	Mr Alexander von Hildebrand, Environmental Health Advisor, WHO SEARO
Objective 1: Latest evidence on climate change and health		
9.00	Keynote address: <i>"Global warming and climate change: Why should the health sector be worried?"</i>	Professor Dr Anthony McMichael, National Centre for Epidemiology and Population Health, Australia
9.30	Country presentations	Country delegates
12.00	Questions & Answers	
14.00	Country presentations (continuation)	Country delegates
15.00	Questions & Answers	
15.30	<i>"The results of the IPCC and implications for South East and East Asia :"</i>	Dr Andy Reisinger, IPCC SYR TSU, Met Office Hadley Centre, UK, and The Energy and Resources Institute (TERI), India,
16.00	<i>"Main findings of the Fourth Assessment Report of the IPCC, Chapter 8: Climate change and human health"</i>	Dr Bettina Menne, , European Centre for Environment and Health, World Health Organization (WHO), Italy

16.30	<i>"The special vulnerability of mountain people to climate change"</i>	Dr Mats Eriksson, International Centre for Integrated Mountain Development, Nepal
16.50	Questions & Answers	Participants
17.30	Wrap –up Day One	Facilitator
19.00	Reception	WHO SEARO

11th December 2007

Objective 2: Towards a global strategy for health protection from climate change		
9.30	<i>"Climate Change Policies, Instruments and Co-operative Arrangements"</i>	Dr Dennis Tirpak, L.S. , Environment Directorate, OECD, and International Institute for Sustainable Development (IISD),Winnipeg, Canada
9.50	<i>"Urban climate and respiratory disease"</i>	Dr Jonathan Patz, University of Wisconsin, USA
10.10	<i>"The health benefits from reducing greenhouse gas emissions"</i>	Dr R. Bertollini, Senior Advisor, WHO Geneva
10.30	<i>"Adaptation concerns, scope and the UNFCCC Nairobi Work Programme"</i>	Ms Sruchi Badhwal, Tata Energy and Resources Institute, India
11.00	<i>"Costs of Public Health Adaptation to Climate Change in 2030"</i>	Dr Kris Ebi, Consultant, USA
11.20	Panel discussion: <i>"Role for health sector in adaptation"</i>	Dr Kris Ebi; Dr Jonathan Patz; Dr R. Bertollini, Dr Anthony McMichael
12.50	Questions & Answers	Participants
14.00	<i>"Protecting Health from Climate Change: WHO's strategic framework"</i>	Dr Maria Neira, Director, Protection of the Human Environment, WHO Geneva
14.30	Questions & Answers	Participants
Objective 3: Developing a regional framework for action		
15.15	<i>"Climate change and human health: lessons learnt in Europe"</i>	Dr Bettina Menne, WHO EURO
15.30	<i>"Climate change and human health: activities in Brasil"</i>	Guilherme F.Netto, Ministry of Health, Brasil
15.45	<i>"Outcomes of the EMRO meeting on climate change and health"</i>	Hamed A. Bakir, Coordinator, WHO Centre for Environmental Health Activities, Jordan

16.00	<i>"Outcomes of the 2007 national workshops on climate change and health in Bangladesh, India and Indonesia"</i>	Mr Alexander von Hildebrand, Environmental Health Advisor, WHO SEARO
16.45	<i>"Outcomes of the workshop on climate change and health in Southeast and East Asian Countries, Kuala Lumpur, Malaysia, July 2007"</i>	Datuk Dr Pillay, H. Ogawa. Environmental Health Advisor, WHO WPRO
17.00	<i>"Regional Forum on Environment and Health in Southeast and East Asian Countries and Thematic Working Group on climate change, ozone depletion and ecosystem change"</i>	H. Ogawa, WHO, WPR
17.30	Questions & Answers	Participants
18.00	Wrap up of Day Two	Facilitator

12th December 2007

8.30	Presentation: <i>"Introduction to the Asia Pacific regional action plans on protecting health from climate change"</i>	A. Hildebrand & H. Ogawa
9.00	Group work to draft regional action plans Group 1 – East Asia; Group 2 – Southeast Asia Group 3 – South Asia; Group 4 – Islands	Facilitators, Participants
11.15	Reporting back of group work	Reporters & participants
14.00	Group work: SEAR countries - Action plans for cross- sectoral collaboration in countries WPR countries – Regional cooperation in health impact assessment of climate change	Facilitators, Participants
15.15	Report back from breakout groups to plenary, Q&A	Reporters & participants
16.30	Conclusions and recommendations	Facilitator
17.00	Closure	WHO

Annex 3

List of documents & reference materials

Selected WHO publications

- *El Niño and its health impacts*. WHO, 2000: <http://www.who.int/mediacentre/factsheets/fs192/en/>
- *Ecosystems and human well-being: a health synthesis*. WHO, 2005. <http://www.who.int/globalchange/ecosystems/ecosystems05/en/index.html>
- *Using climate to predict infectious disease epidemics*. WHO, 2005. <http://www.who.int/globalchange/publications/infectdiseases/en/index.html>
- *Climate variability and change and their health effects in small island states: information for adaptation planning in the health sector*. WHO, 2005. <http://www.who.int/globalchange/climate/climatevariab/en/index.html>
- *Synthesis workshop on climate variability, climate change and health in small-island states, Maldives, 2003*. WHO, 2005. <http://www.who.int/globalchange/climate/oeh0402/en/index.html>
- *Human health impacts from climate variability and climate change in the Hindu Kush-Himalaya Region : A report of an Interregional Workshop, India, 2005*. WHO, 2006. http://www.searo.who.int/en/Section23/Section1001/Section1110_11692.htm
- *Climate change – Quantifying the health impact at national and local levels*. Environmental Burden of Disease Series No. 14, WHO, 2007. http://whqlibdoc.who.int/publications/2007/9789241595674_eng.pdf
- *Global climate change: implications for international health policy*. Bulletin of the World Health Organization 85, 2007. <http://www.who.int/bulletin/volumes/85/3/06-039503/en/>
- *Executive Board – Climate change and health. Report by the Secretariat, 2008* http://www.who.int/gb/ebwha/pdf_files/EB122/B122_4-en.pdf

Selected publications of WHO with partner organisations

- *Biodiversity and human health, Interim Executive Summary*. Center for Health and the Global Environment at Harvard Medical School, WHO and UNEP, 2002. <http://chge.med.harvard.edu/publications/>
- *Climate change and human health - risks and responses*. WHO, WMO and UNEP, 2003. <http://www.who.int/globalchange/publications/cchhbook/en/index.html>
- *Comparative Risk Assessment of the Burden of Disease from Climate Change*. Environmental Health Perspectives, 2006. <http://www.ehponline.org/members/2006/8432/8432.pdf>
- *Climate change and developing-country cities: implications for environmental health and equity*. Journal of Urban Health 84, 2007. <http://www.pubmedcentral.nih.gov/articlerender.fcgi?tool=pubmed&pubmedid=17393341>
- *Climate and Human Health Impacts*. IPCC Fourth Assessment Report, Working Group II: Impacts, adaptation and vulnerability, Chapter 8, 2007. <http://www.ipcc-wg2.org/>

Useful web links on climate change and human health

- Convention on Biological Diversity: <http://www.cbd.int/>
- Center of Global Change and Health: <http://www.lshtm.ac.uk/cgch/>
- Climate Action Network: <http://www.climatenetwork.org/>
- Global Environment Facility (GEF): <http://www.gefweb.org/>
- Global Warming Climate Change Greenhouse Effect: <http://www.global-greenhouse-warming.com/index.html>
- European Commission: <http://ec.europa.eu/environment/climat/campaign/>
- International Centre for Integrated Mountain Development: <http://www.icimod.org/home/>
- Intergovernmental Panel on Climate Change: <http://www.ipcc.ch>
- International Federation of Red Cross and Red Crescent Societies <http://www.ifrc.org/>
- Met Office Hadley Centre, UK: <http://www.metoffice.gov.uk/research/hadleycentre/>

- Stern Review Report on the Economics of Climate Change : www.hm-treasury.gov.uk/independent_reviews/
- United Nations Framework Convention on Climate Change (UNFCCC): <http://unfccc.int/2860.php>;
 - see also NAPA at: <http://unfccc.int/adaptation/napas/items/2679.php>
 - UNFCCC Kyoto Protocol: http://unfccc.int/essential_background/convention/items/2627.php
 - UNFCCC Nairobi Work Programme: http://unfccc.int/adaptation/sbsta_agenda_item_adaptation/items/3633.php
- UN System's Work on Climate Change: <http://www.un.org/climatechange/index.shtml>
- United Nations Environment Programme: <http://climatechange.unep.net/>
- United Nations Conventions to Combat Desertification (UNCCD): <http://www.unccd.int/>
- US Green Building Council: <http://www.usgbc.org/>
- World Health Organisation (WHO): <http://www.who.int/globalchange/climate/en/index.html>
- WHO Regional Office for South-East Asia: www.searo.who.int
- World Meteorological Organization (WMO): http://www.wmo.ch/pages/index_en.html
- World Wildlife Fund: http://www.panda.org/about_wwf/what_we_do/climate_change/index.cfm



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