

# Strengthening Health Resilience to Climate Change

Technical Briefing for the World Health  
Organization

Conference on Health and Climate

## Scope and purpose of the paper

This is one of two technical background papers prepared as a basis for discussion at the WHO Health and Climate Conference. It provides a brief summary of the available evidence on the health impacts of climate change, and an outline of the necessary response to protect health from these evolving risks. Specifically, it considers the need for overall strengthening of the health system, specific functions both within and outside the health sector that require strengthening and modification to address climate risks, and introduces some of the main areas and opportunities for future progress.

The accompanying paper covers the health benefits that can be achieved through mitigation measures.

## Acknowledgements

The paper was prepared by Nick Watts (University College London), Diarmid Campbell-Lendrum, Marina Maiero, Lucia Fernandez Montoya and Kelly Lao (WHO-HQ). It benefited from review and input from the following WHO staff: Carlos Corvalan, Guto Galvao (WHO-AMRO), Hamed Bakir (WHO-EMRO), Bettina Menne, Gerardo Sanchez (WHO-EURO), Lesley Onyon (SEARO), Elena Villalobos Prats, Jonathan Abrahams (WHO-HQ), Marie Noel Brune Drisse (WHO-HQ), and Silvia Ferazzi (Roll Back Malaria Partnership), and from the following members of the Technical Advisory Group of the Health and Climate Conference: Jonathan Balbus (US National Institute of Environmental Health Sciences), Kristie Ebi (University of Washington), Andy Haines (London School of Hygiene and Tropical Medicine), Jonathan Patz (University of Madison-Wisconsin). The paper also draws on material prepared for WHO by Joy Shumake-Guillemot (WMO/WHO joint office), and Kristie Ebi. The paper was copy-edited by Nina Behman.

# Table of contents

Scope and purpose of the paper.....	2
Acknowledgements.....	2
Executive summary .....	4
1. Introduction .....	6
2. Health impacts of climate change.....	7
2.1 Potential health impacts with confidence assessments .....	7
2.2 Additional reasons for concern.....	9
3. Equity, gender and vulnerable populations.....	10
3.1 Child health and climate change.....	10
3.2 Promoting gender equity while responding to climate change.....	10
4. Protecting human health in a changing climate – the role of the health sector .....	12
4.1 A public health approach to protecting populations from climate change.....	13
4.2 Health engagement in iterative, multi-sectoral adaptation .....	13
4.3 Building climate-resilient health systems .....	13
4.3.1 Health governance and policy .....	14
4.3.2 Human resources for health .....	16
4.3.3 Information systems .....	16
4.3.4 Essential products and technologies .....	19
4.3.5 Service delivery .....	19
4.3.6 Financing .....	21
5. Challenges and opportunities to strengthen health protection from climate change.....	22
5.1 Raising awareness and ensuring policy coherence.....	23
5.2 Building technical, organizational and institutional capacity .....	23
5.3 Mobilizing resources and supporting implementation.....	24
References .....	24

## Executive summary

There is now clear evidence that human actions, principally the burning of fossil fuels and associated release of climate pollutants, are causing significant changes to the global climate system. As many aspects of health are strongly influenced by weather and climate conditions, this inevitably presents risks for human health. Member States have agreed the need both to reduce the human impact on the climate system in order to avoid the most extreme scenarios of climate change, and to strengthen resilience to climate-sensitive health risks. This paper focuses on strengthening health resilience to climate change.

At the global level, there is considered to be the strongest evidence for the following health impacts by the middle of the coming century: greater risk of injury, disease, and death due to more intense heat waves and fires; increased risks of food- and water-borne diseases; increased risks of vector-borne diseases; increased risk of under-nutrition resulting from diminished food production in poor regions; consequences for health of lost work capacity and reduced labour productivity in vulnerable populations. There is weaker evidence for some positive effects, including modest improvements in cold-related mortality and morbidity. However, there is considered to be high confidence that negative health effects will outweigh positive effects at the global level.

In addition, there are other important potential health risks for which there is less conclusive evidence, but which nonetheless require consideration. These include: the potential for increasing severity and frequency of extreme weather events including storms and floods; mass displacement and disruption of livelihoods in low-lying coastal zones and small island states; inland flooding in particularly vulnerable urban centres; breakdown in food systems from drought, flooding, and extremes in precipitation; the potential for increased risk of violent conflict associated with resource scarcity and population movements; slow-down in economic growth and exacerbation of poverty, with negative implications for health targets including achievement of the Millennium Development Goals, and the objectives of the forthcoming post-2015 development agenda.

All of the health risks above are strongly affected by non-climatic determinants, such as socioeconomic status, age, gender, ethnicity, displacement, or disability. There is strong evidence that health impacts of climate change disproportionately affect poorer populations and children, and, for some risks in some situations, differ between women and men. Overall, climate change is likely to widen existing health inequities, both between and within populations.

The health community has a critical role in the response to climate change. The emerging evidence and experience in this area suggests that to be fully effective, this requires a broad public health approach, including not only the preventive and curative functions that are under direct control of the formal health sector, but also appropriate leadership, guidance and regulatory roles with regard to health-determining sectors and functions, such as water and sanitation, or disaster risk reduction.

Due to the strong influence of social determinants on health vulnerabilities, overall progress in alleviation of poverty, reduction of inequities in the social and environmental determinants of health, and strengthening of basic public health interventions are critical to health protection from climate change. There is also a need for more specific efforts to adapt to changing climate through a continuing and iterative process of assessing health risks, identifying, prioritizing, and implementing adaptation options, and monitoring and evaluation.

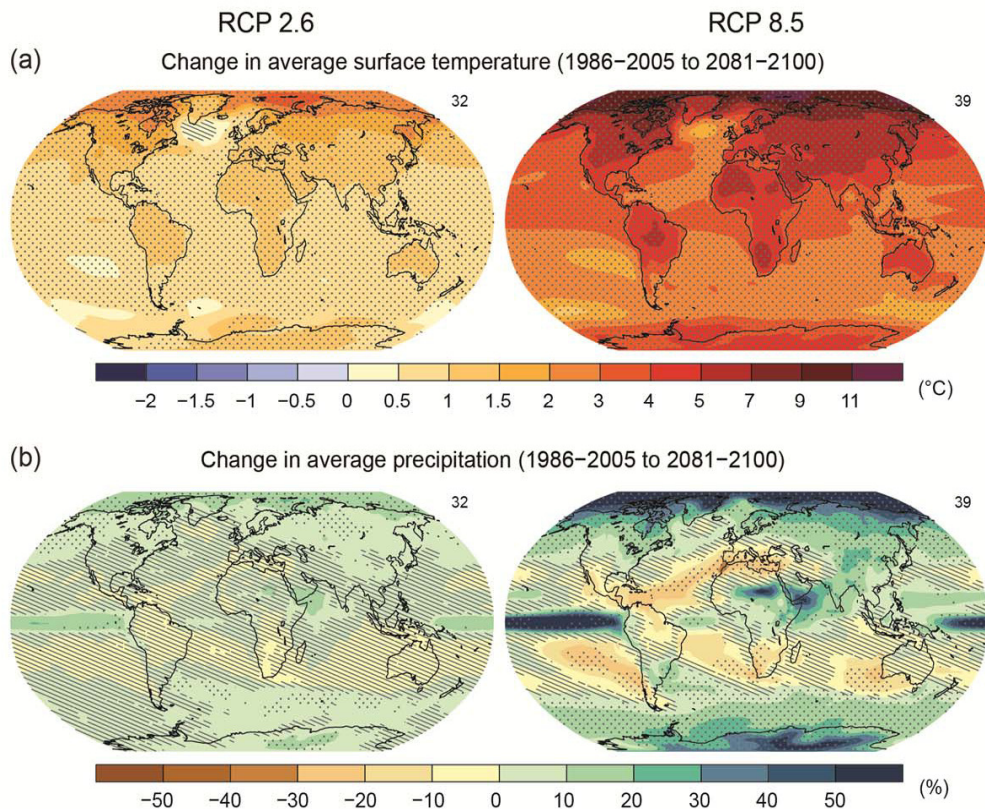
Within the comprehensive approach, a consensus is beginning to emerge on the health-systems functions that should be strengthened in order to increase resilience and adapt to a changing climate. The paper proposes a draft framework to organize these functions. This takes as a reference point the six generally recognized building blocks of health systems, and elaborates ten functions that map onto these, to add the additional dimensions of addressing climate risks.

There remain large challenges to strengthening health resilience to climate change, including deficits in awareness of climate and health linkages and governance mechanisms to manage them, institutional and technical capacity to design plans, and resources to implement them.

However, there are important opportunities in the near future. The parallel discussions on negotiating a new climate treaty under the UN Framework Convention on Climate Change (UNFCCC), and the definition of the post-2015 sustainable development and disaster risk reduction agendas within the next two years, can help to raise awareness and promote coherence between climate and health policy goals. The UNFCCC process also provides a series of technical and financial support mechanisms that could facilitate mainstreaming of climate change into traditional health programmes. There is a need for a more systematic and sustained approach, to make use of these opportunities, and to continue to make progress in protecting health from climate change.

## 1. Introduction

There is now a very large body of evidence that human actions, mainly the burning of fossil fuels, have caused significant changes in the global climate system, with effects that will persist for decades or longer. The degree and rate of future climate change will depend on amounts of emissions of greenhouse gases, and other climate pollutants such as black carbon. The Intergovernmental Panel on Climate Change (IPCC) has defined four scenarios of future emissions that it considers equally plausible, in order to describe the range of possible future climate conditions (1). Emissions of greenhouse gases are currently following the higher end of this range. By the end of the century, these are projected to lead to concentrations of greenhouse gases in the atmosphere that are almost four times pre-industrial levels. This would be expected to bring a 3.7–4.8°C rise in global mean surface temperatures (with a range of 2.5°C to 7.8°C), and severe disruptions to precipitation patterns, as well as the frequency and intensity of extreme weather events. If greenhouse gas emissions can be reduced, then climate change will be less severe. However, even with rapid reductions in emissions, the world is committed to significant changes in the coming decades (Figure 1).



**Figure 1:** Projected changes in average temperature and precipitation by the end of the current century, under the lower (RCP 2.6) and higher (RCP 8.5) of the range of four scenarios of greenhouse gas emissions assessed by the Intergovernmental Panel on Climate Change (1).

There is substantial evidence on the strong links between climate change and the social and environmental determinants of human health and wellbeing. The evidence has been assessed and summarized by a range of bodies over the last 20 years, including the WHO and the IPCC at the global level. These assessments conclude that health is already affected both by climate variability

and by climate change, and that the overall impact for nearly all populations and for the world as a whole is expected to be more negative than positive. This is likely to increase as climate change progresses, acting as a ‘force multiplier’, exacerbating existing threats and undermining progress in development and global health. Health impacts are expected at any level of warming, but the more that climate change progresses unabated, the larger the effects, eventually overcoming the limits of adaptation, resulting in unrecoverable damage to the social, environmental and economic determinants of health.

There is therefore a need for actions to reduce emissions of greenhouse gas emissions to avoid the more extreme climate change scenarios, and to ensure that human health is protected as far as possible from the negative effects of the climate variability and change that is already occurring. The necessity to mitigate and adapt to climate change has been recognized by the Parties to the UN Framework Convention on Climate Change, and in the case of health adaptation, through resolutions of the World Health Assembly and WHO Regional Committees. This paper provides a summary of the main health effects of climate change, and outlines the functions necessary to increase resilience.

## 2. Health impacts of climate change

### 2.1 Potential health impacts with confidence assessments

There are multiple connections between climate and health. The health chapter of the most recent report of the IPCC (2) – divides these into three main groups:

- 1) The direct impacts on human health, such as those which arise from damages and illness from increased frequency and severity of extreme weather events;
- 2) Impacts mediated through other environmental systems. These include rising air pollution, and changing patterns of vector-, food- and water-borne diseases;
- 3) Socially mediated effects, which occur via climate change’s interaction with social and human systems. These include health effects resulting from undernutrition, occupational heat stress and mental illness, as well as potential increases in population displacement and risks of violent conflict, and slowing of economic growth and poverty reduction.

Climate change therefore affects health directly, undermines the social determinants of health, and threatens the viability of a number of environmental services provided by natural systems. It can present multiple hazards, which interact with pre-existing vulnerabilities, to cause substantially worse health outcomes. Importantly, almost all of the health impacts are moderated by the strength of the health system, and its capacity to manage and adapt to climate-sensitive health risks.

The health risks of climate change occur through gradual changes in average conditions, but also in variability, such as more frequent and/or severe heat waves, floods and storms. These are of particular concern, as they are often far less predictable than changes in mean conditions; they have the potential to cripple health facilities, social systems and key infrastructure; and they may result in irreversible shifts, for example through storm surges flooding both natural ecosystems and inhabited areas.

	Exposures affected by climate change	Health risks	Health impacts	Confidence rating
Direct effects	Increased numbers of warm days and nights; increase in frequency and intensity of heat waves; increased fire risk in low rainfall conditions	Excess heat-related mortality; increased incidence of heat exhaustion and heat stroke, particularly for outdoor labourers, athletes, elderly; exacerbated circulatory, cardio-vascular, respiratory, and kidney diseases; increased premature mortality related to ozone, and air pollution produced by fires, particularly during heat waves	<b>Greater risk of injury, disease, and death due to more intense heat waves and fires</b>	<b>Very high</b>
	Decreased numbers of cold days and nights	Lower cold-related mortality, reduced cardiovascular, and respiratory disease, particularly for the elderly in cold and temperate climates	<b>Modest improvements in cold-related mortality and morbidity</b>	<b>Low</b>
Effects mediated through natural systems	Higher temperatures and humidity, changing and increasingly variable precipitation, higher sea surface and freshwater temperatures	Accelerated microbial growth, survival, persistence, transmission, virulence of pathogens; shifting geographic and seasonal distributions of e.g. cholera, schistosomiasis, and harmful algal blooms; lack of water for hygiene; flood damage to water and sanitation infrastructure, and contamination of water sources through overflow	<b>Increased risks of food- and water-borne diseases</b>	<b>Very high</b>
	Higher temperatures and humidity, changing and increasingly variable precipitation	Accelerated parasite replication and increased biting rates; prolonged transmission seasons; re-emergence of formerly prevalent diseases; changing distribution and abundance of disease vectors; reduced effectiveness of vector control interventions	<b>Increased risks of vector-borne diseases</b>	<b>Medium</b>
Effects heavily mediated by human systems	Higher temperatures and changes in precipitation	Lower food production in tropics; lower access to food due to reduced supply and higher prices; combined effects of undernutrition and infectious diseases; chronic effects of stunting and wasting in children	<b>Increased risk of under-nutrition resulting from diminished food production in poor regions</b>	<b>High</b>
	Higher temperatures and humidity	Outdoor and unprotected workers obliged to work in physiologically unsafe conditions, or to lose income or livelihood opportunities	<b>Consequences for health of lost work capacity and reduced labour productivity in vulnerable populations</b>	<b>High</b>
<b>Combined effect</b>	<b>Overall climate change</b>	<b>Combination and interactions of risks above</b>	<b>Negative health effects will outweigh positive effects worldwide</b>	<b>High</b>

**Table 1: Summary of the main expected health impacts of climate variability and climate change globally by the middle of the current century.** The final column refers to the level of confidence in the evidence for expected health impacts, as assessed in the 5<sup>th</sup> Assessment report of the IPCC (2). Other health impacts are possible (see text), but were not assigned an evidence grading by the IPCC.



Table 1 summarises some of the most important expected impacts of climate change by the middle of the current century. Some of these effects are being experienced today, will worsen as climate change continues unabated, and are truly global in reach, with no populations exempt. However, due to the geographical distributions of the climate hazard, and in the underlying socioeconomic determinants of vulnerability, and weaknesses in government and community capacity to respond, the effects will be felt hardest in low- and middle-income countries and populations, including in sub-Saharan Africa, South Asia and Small Island Developing States. They will also disproportionately affect vulnerable groups within each country, including the poor, children, elderly, and those with pre-existing medical conditions.

## 2.2 Additional reasons for concern

In addition to the main health impacts assigned an evidence grading by the IPCC, there is an emerging body of evidence for a range of other risks. Some of these have been highlighted in the IPCC 5<sup>th</sup> Assessment Report, which outlines a number of key 'reasons for concern' – effects of climate change which are either particularly severe or irreversible (3). The health-relevant components of these include:

- the potential for increasing severity and frequency of extreme weather events including storms and floods, threatening the viability of the health system by damaging critical services and infrastructure networks;
- mass displacement and disruption of livelihoods in low-lying coastal zones and small island states due to storm surges and sea-level rise;
- inland flooding in particularly vulnerable urban centres, causing severe ill-health and adverse social outcomes;
- breakdown in food systems from drought, flooding, and extremes in precipitation, resulting in food shortages and volatile prices, disproportionately affecting those in low- and middle-income countries;
- potentially increased risk of violent conflict associated with resource scarcity and population movements;
- slow-down in economic growth and exacerbation of poverty, with the IPCC concluding that “poor people in urban areas in low- and lower middle-income countries in Africa, Asia and Latin America may slip from transient to chronic poverty”;
- associated reversal of global health progress, including achievement of the Millennium Development Goals, and the objectives of the forthcoming post-2015 development agenda.

From a public health perspective, the lack of conclusive evidence is not a justification for ignoring the potential risks. Instead, it requires a risk management approach, with an emphasis on “no regrets” measures, including inter-sectoral action to protect the environmental determinants of health such as availability of water and food, emergency and disaster risk management, or improved surveillance and response for infectious diseases. Such actions would both improve health now, and reduce vulnerability to uncertain risks from future climate change.

### 3. Equity, gender and vulnerable populations

The impacts of climate change will disproportionately affect those who are already vulnerable to health effects due to other factors, such as socioeconomic status, age, gender, ethnicity, displacement or disability. Those who are at the intersection of multiple vulnerabilities may be adversely affected by several exposures. For instance, many rural internally displaced people (IDP), migrant or nomadic populations from low resource areas are very susceptible to changes in climate due to a greater dependency on natural cycles and resources. These individuals are often vulnerable not only to acute food shortages due to damage to crops and livestock, but are also susceptible to food price increases, precarious living situations and livelihoods, restricted mobility and violence. Rising rates of urban poverty are a particular reason for concern, due to the ongoing migration from rural areas, often to poor quality housing in high-risk, insecure, and physically exposed locations (e.g. at low elevation, in floodplains or on exposed slopes) in unplanned developments in cities. Many inhabitants are therefore at a disproportionately high risk of flooding, weather extremes, and poor sanitary conditions as well as social tension and discrimination. Climate change strains existing health systems and social structure and amplifies already existing social inequities (4).

#### 3.1 Child health and climate change

Children are at particularly high risk from climate change, due to their developmental susceptibility and their anticipated long-term exposure to environmental changes. WHO's quantitative assessment of the health impacts of human-induced climate change for the year 2000, concluded that almost 90% of the deaths attributable to climate change at that time were of children, overwhelmingly in developing countries, principally due to high pre-existing burdens of climate-sensitive health outcomes, including the effects of undernutrition, malaria and diarrhoea (5). Several important health outcomes were not included in the assessment, and many of these also disproportionately affect children. These include, for example, heat stroke and dehydration, drowning and trauma from thermal extremes and natural disasters, malnutrition, growth retardation and developmental delays as well as increased risks of infectious disease, environmentally driven respiratory problems, immunosuppression and skin cancers due to air pollution and UV exposure. There is therefore a need for health adaptation programmes to place an emphasis on integrated approaches to protect and promote the health of children.

In addition, the combination of the long-term nature of climate change, and the long life expectancy of children, presents an issue of intergenerational equity. Each generation of children will be subject throughout their lives to the environmental damage caused by previous generations. This presents a strong argument for engaging younger age groups in decisions on climate change policy.

#### 3.2 Promoting gender equity while responding to climate change

Women represent some 70% of the 1.3 billion people currently living in extreme poverty, and are disproportionately affected by climate change, with many of its implications working to exacerbate existing gender disparities in health. This gender-gap is larger in situations where women are of low socioeconomic status and where the environmental impact is more severe. For example, there is evidence that in some of the poorest populations, female mortality associated with flooding events is several times higher, and has a younger mean age, than equivalent statistics for men.

Women and girls are also more likely to have nutritional deficiencies from food insecurity and, in low-resource settings, are more likely to experience health problems associated with the burdens of travelling further to collect water. Similarly, pregnant women are particularly vulnerable to infectious diseases and pre-eclampsia which is influenced by seasonal variation and climate variability. Conversely, some climate-related conditions affect men more than women, such as in the

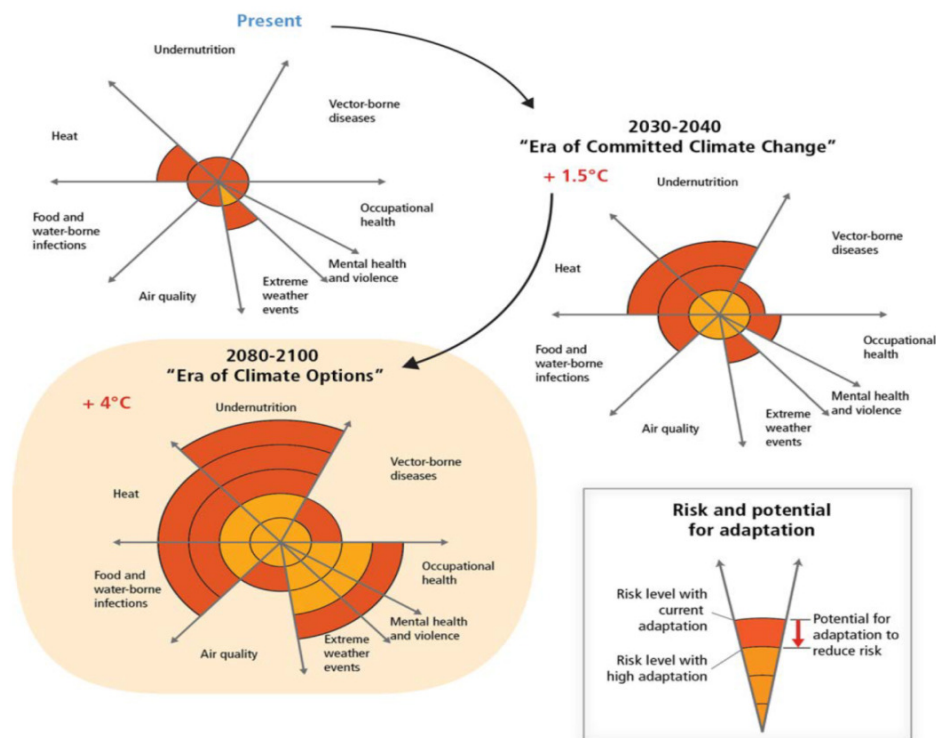
case of rural farmers in Australia and India, who are more susceptible to suicide in face of drought. It is therefore apparent that traditional and culturally influenced gender roles play a role in mediating the health effects of climate change.

This calls for a gender perspective to be mainstreamed into health and climate policy, including the systematic consideration of gender differences in vulnerability and adaptation assessments, routine monitoring of sex-disaggregated data for health outcomes, and inclusion of gender-responsive elements such as ensuring that activities and budgets engage both women and men in all levels of the decision-making process (6).

## 4. Protecting human health in a changing climate – the role of the health sector

Climate change is already presenting risks to health, and these will continue in the future. However, much of the potential health burdens of climate change, at least for the next 2-3 decades, can be avoided, through acting on the environmental and social determinants of climate-sensitive diseases, strengthening the climate resilience of both preventive and curative aspects of health systems, and adapting to changing climate conditions. Figure 2 shows a qualitative assessment from the health chapter of the most recent IPCC report (2) of the comparative burden of the different health outcomes affected by climate change, and illustrates the degree to which they could be reduced by health adaptation measures.

The health sector has the pivotal role in protecting the health and wellbeing of populations from the impacts of climate change. This includes both the preventive and curative functions that are under direct control of the formal health sector, as well as the leadership, guidance and regulatory roles that it can play with regard to health-determining sectors, such as water resources, emergency planning or agriculture. The health sector contributes to protection from climate risks both through its overall capacities, and also through its ability to adjust and adapt these services to changes in climate, and in other determinants of health.



**Figure 2: Qualitative assessment of the health impacts from climate change, with and without adaptation measures.** The width of the slices gives an indication of the attributable burden for each health impact, and the dark orange area indicates the proportion that could be avoided through strong adaptation measures. Assessments are shown for the period 2030–2040, for which human actions have effectively committed the world to warming of approximately 1.5°C above preindustrial levels; and the period 2080–2100, in which vigorous mitigation efforts could potentially avoid part of the 4°C temperature increase that would otherwise be expected from current emissions trends (2).

#### 4.1 A public health approach to protecting populations from climate change

Over the last 25 years, WHO has developed and scaled up its programme on climate change and health, with an increasing focus on working with national Ministries of Health, and other partners, to support and guide implementation of protective measures. Through regional implementation mechanisms, and pilot projects across all regions, the Organization is now outlining a more systematic and comprehensive approach to health protection from climate change.

Climate change differs from many traditional health issues, in that it acts over long periods, is subject to multiple uncertainties, is strongly mediated by social and economic determinants, and causes diverse and interacting health impacts. It therefore requires a response that builds on core health system functions, but also works with actors outside the health sector to ensure coordination and synergies, and address the root causes of health risks.

Building resilience to climate risks and adapting to climate change is therefore part of the wider effort to improve and sustain the social and environmental determinants of health. Progress in alleviation of poverty, reduction of inequities in the social and environmental determinants of health, and strengthening of public health systems to extend services for hard-to-reach populations are therefore critical to health protection from climate change, even though they are not specific to it. These broad-based responses enhance an individual and community's own capacity to respond to a changing climate, and improve their ability to respond to social and environmental shocks.

#### 4.2 Health engagement in iterative, multi-sectoral adaptation

In addition to general improvements in health determinants, there is a need for more specific efforts to protect health from changing climate risks. The long-term and diverse nature of climate risks means that this needs to be carried out through a continuing and iterative process of assessing health risks, identifying, prioritizing, and implementing adaptation options, and following this up through monitoring and evaluation.

Climate change also presents a requirement, and an opportunity, to work more closely with other sectors. In most countries, responding to climate change is a cross-Government priority, requiring the health sector to work in a coordinated manner with other actors, often under a single climate change strategy and coordinating mechanism. It also presents an entry point to implement a "health in all policies" approach. Opportunities to advance health and resilience to climate change include: conducting impact assessments of sectors which are critical for vulnerable populations, such as employment, health, energy, small-scale farming, migration, gender and children; promoting inter-ministerial policy dialogue; ensuring policies are socially inclusive; and ensuring that new infrastructure and budgeting prioritisation does not exacerbate social inequity. Taking into account the specific needs of vulnerable populations through meaningful community engagement and open-ended social and environmental impact assessments are essential in addressing and minimizing disparities in health in general, and vulnerability to climate risks in particular.

#### 4.3 Building climate-resilient health systems

Within the comprehensive approach, it is also necessary to be specific about the health systems functions that should be strengthened in order to increase resilience and adapt to a changing climate. These will vary between regions, countries and communities depending on local circumstances, but consultations with Member States, and the experience of pilot projects, suggest that there is a strong convergence on a core set of functions. In order to support a comprehensive approach to Universal Health Coverage, and to ensure that efforts to address climate change are aligned as closely as possible with other activities of the health system, the following tables take as a

reference point the six “building blocks” used to describe the various functions of health systems (7). Under these, they outline a total of ten functions that build on these pillars, adding the additional actions required specifically to increase resilience to climate change. Each of these is interdependent on the others as part of the overall strengthening the climate resilience of the health system. The aim is to provide an organizing framework that is comprehensive at the level of functions and links to the pillars of the health system, with examples of interventions that may be adapted depending on local circumstances.

#### 4.3.1 Health governance and policy

Health governance and policy acts as an overarching response, which recognises the need for adequate accountability and risk management of climate-related threats. It aims to ensure a framework for policy engagement for responding both within and beyond the health sector, under the leadership of the Ministry of Health.

Health Governance and Policy	
Resilience Goals and Objectives	Examples of Interventions
<p><b>Governance: Establish agreements between the Ministry of Health and other government departments, on their roles with respect to health protection from climate risks</b></p>	<p>Designate a national focal point for climate change and health within the Ministry of Health</p>
<p><b>Policy: Develop a national climate and health strategy which addresses health risks and opportunities in health policy</b></p>	<p>Ensure there is a health component to a country’s National Adaptation Plan (H-NAP) and to national communications to the UN Framework Convention on Climate Change (UNFCCC)</p>
<p><b>Cross-Sectoral Collaboration: Strengthen partnerships with health-determining sectors such as water and agriculture to promote the public health benefits of climate mitigation and adaptation</b></p>	<p>Ensure monitoring, evaluation and accountability mechanisms within the Ministry of Health, and between relevant Ministries.</p> <p>Conduct health impact assessments on new mitigation and adaptation policies</p>

## **Climate change and health governance in Europe and Africa**

The WHO European region has a long-standing process of interministerial conferences on environment and health. Since the third conference in 1999 in London, this has included prominent consideration of the links between climate change and health. At the Fifth Ministerial Conference on held in Parma, Italy, all WHO European Member States and the European Commission declared their commitment to: protecting health and wellbeing, natural resources and ecosystems; and promoting health equity, health security and healthy environments in a changing climate. The working group of Member States to address health in climate change (HIC) was created to sustain progress in this area, and is composed of 38 Member States and 5 UN and EU agencies. This facilitates the implementation of the Regional Committee resolution and the Parma Commitment to Act at the national level, and shares experiences between countries (8,9). WHO-Euro supports the HIC, and its Member States in general, through the provision of tools, methods, guidelines and capacity development, pilot initiatives, as well as providing a platform for sharing experiences.

This mechanism has been effective in both supporting and monitoring progress on health protection from climate change. Thirty-two of the Member States have developed national health vulnerability, impact and adaptation assessments (VIAs) and 24 have developed national adaptation strategies (NAPs) with a health component. Most of the WHO European Region Member States are engaged in strengthening their health systems: in particular on infectious disease surveillance, environmental health services, early warning and disaster response for extreme events, the International Health Regulations, and planning for climate change in public health policies. This progress in increasing health resilience is part of a wider approach which also included actions to reduce greenhouse gas emissions, including within the healthcare sector (10).

Africa has also established a regional interministerial health and environment process, beginning in 2008, in Libreville, Gabon. At the second interministerial conference, in Luanda, Angola, Ministers of Health and of Environment from across the continent committed to implement a regional framework for Public Health Adaptation to Climate. The specific objectives are to: identify country-specific health risks associated with climate change in all African countries; strengthen core national capacities that enable health systems to prepare for and effectively respond to climate change threats to human health; facilitate the implementation of essential public health and environment interventions for the management of both acute and long-term health risks resulting from climate change; facilitate operational and applied research on local health adaptation needs and solutions; and disseminate lessons learnt and country experiences in order to facilitate implementation of adaptation strategies in other sectors.

Under the same process, countries also committed to a plan of action, which specifies an essential public health package of interventions to strengthen health resilience to climate change – which has helped to shape WHO's approach to an operational framework for health resilience to climate change at the global level. In September 2011 the recommendations of the interministerial process were formally adopted through the regional governing bodies for both health, through the WHO Regional Committee for Africa, and environment, through the African Ministerial Conference on Environment.

### 4.3.2 Human resources for health

The second component highlights the importance of strengthening health systems and organizational capacity to manage climate risks, as well as the need to develop the technical and clinical capacity of health professionals. This may take the form of a health workforce which has the capacity, balance of skills and adequate training to meet the changing health needs of its population, or the social capacity and resilience of a local community, taking account of the changing nature both of climate-related risks, and of non-climatic determinants of health.

Capacity Development	
Resilience Goals and Objectives	Examples of Interventions
<p><b>Human Resources: The provision of enough appropriately trained professionals for health and other relevant disciplines to respond to changes in climate-sensitive health risks</b></p> <p><b>Organizational Capacity: Adequate system flexibility to direct resources, information, knowledge and health interventions to communities which need them most</b></p> <p><b>Communications and Awareness: Communicating links between climate change and health to a variety of audiences (policy-makers, the media, health professionals, and the public), focussing on solutions</b></p>	<p>Integration of climate risks and management measures to health curriculum</p> <p>Employ strategies to address human resource and institutional capacity gaps, for example by developing response plans in case of new disease outbreaks, and protecting financial reserves and investments</p> <p>Implement an internal and external communications strategy, which raises awareness about climate change and health, and begins a process of stakeholder engagement to establish entry-points for health adaptation in other sectors</p>

### 4.3.3 Information systems

Ensuring adequate information services and early warning systems has three components with related functions: research; integrated risk monitoring and early warning systems; vulnerability, capacity and adaptation assessments.

Research	
Resilience Goals and Objectives	Examples of Interventions
<p>Research Agenda: National research agenda on climate change and health defined and implemented by different stakeholders</p> <p>Support Research: Research on climate change and health promoted at national level by supporting relevant networks, making available financial resources and creating training opportunities</p> <p>Connect to Policy: Research findings on climate change and health disseminated to and used by policy-makers</p>	<p>National research agenda on climate change and health defined through the organization of a stakeholder forum which involves representatives from the MoH, research institutions, NGOs and private sector</p> <p>Establish databases on climate change and health, rosters of local experts, and knowledge management experts</p> <p>Engage in research co-production with government, and ensure efforts are policy-relevant</p>



<b>Integrated Risk Monitoring and Early Warning Systems</b>	
<b>Resilience Goals and Objectives</b>	<b>Examples of Interventions</b>
<p><b>Disease Surveillance and Early Warning: Data on climate-sensitive environmental risks and epidemiological trends collected, analysed and interpreted on a continuous basis and timely response to risks promoted, including implementation of IHR when required</b></p> <p><b>Monitoring: Information on climate change impacts, vulnerability, response capacity, and emergency preparedness capacity is monitored and reported over time</b></p> <p><b>Communication: Timely warnings are communicated to health decision-makers, the media and the public and translated into effective action to prevent negative outcomes</b></p>	<p>Make use of early detection tools (i.e. rapid diagnostics) to identify changing disease incidence, geographic and seasonal risk mapping, and climate-informed early warning systems</p> <p>Development of indicators for climate impacts and vulnerabilities, and periodic monitoring of the health impacts of the main environmental determinants of health</p> <p>Effective climate risks to health communication strategy developed and implemented</p>
<b>Vulnerability, Capacity and Adaptation Assessment</b>	
<b>Resilience Goals and Objectives</b>	<b>Examples of Interventions</b>
<p><b>Vulnerability: A sound understanding of the main health impacts and of the main vulnerable groups and regions</b></p> <p><b>Capacity: Baseline information on capacities and gaps within the health system to face the challenges posed by climate change exists</b></p> <p><b>Adaptation Options: Information on available adaptation options, their benefits, costs and efficiency, is available to the health system</b></p>	<p>Health impact assessments for key adaptation and mitigation policies and programmes of health-determining sectors conducted</p> <p>Baselines on existing health infrastructure and capacity established</p> <p>Define adaptation plan based on assessed population vulnerabilities and comparative advantages of prioritised adaptation policies</p>

## **Vulnerability and adaptation assessments in the Western Pacific, vulnerability indices in South East Asia**

An essential step in building health resilience to climate change is to carry out a health vulnerability and adaptation assessment, in order to identify and assess the range of health challenges that may be presented by climate change, and possible measures to reduce them. The WHO Office for the Western Pacific Region (WPRO) has extensive experience in supporting Member States in this field. Over the last five years, the office has supported assessments in a total of 20 countries, including 13 Pacific Island Countries (PICs), which are among those considered most at risk. The process made use of WHO guidance on health vulnerability and adaptation assessment, and was carried out in three stages, namely inception workshops, stakeholder consultation and examination of available local data on climate and climate-sensitive diseases, and drafting of National Climate Change and Health Action Plans, including a country-specific situation analysis and recommendations for action. The vulnerability assessments yielded a list of high-priority climate-sensitive health risks for each country, which led, in turn, to the prioritisation of adaptation strategies to address health risks. The Regional Office is producing a synthesis of Evidence, Profiles of Selected Countries and Policy Direction, in order to identify common challenges but also provides policy direction for the health sector's role in climate change. One of the outcomes of this synthesis is that many countries, particularly the PICs, face very similar challenges, and would benefit from a coordinated regional approach to make best use of the expertise and capacity which is distributed among the various countries .

In the poorest countries of the WHO South East Asia Region (SEAR), the impacts of climate change in terms of burden of disease and mortality are next only to the African region. The region is particularly vulnerable because amongst other factors it consists of disaster-prone (high exposure), densely populous (high sensitivity), developing economies with resource-constrained health systems (low adaptive capacity). The health impacts of climate change in the region are likely to increase substantially over time.

In the light of this background, it is essential for policy planners and programme managers to develop decision-making tools which take climate vulnerability into account in the context of health interventions. In many cases, it is useful to complement overall health vulnerability and adaptation assessments with more detailed assessments of particular health risks, in specific regions. The WHO Regional Office for South-East Asia (SEARO) has supported the piloting of two new tools for subnational assessment. The first prototype of the Climate Vulnerability Index for the Health Sector was developed for 31 districts in the east coast of India in relation to high risk for cyclone damage. With that exposure factor in common, a simple vulnerability index was compiled using population density and the human development index.

A further pilot tool has been developed at the subnational level in India. The final version takes into account malaria, diarrhoea and heat stress (11). The process has identified several limitations that need to be addressed before it can be up-scaled to the national and regional level, including:

- stakeholder involvement has to be through a wider engagement process, taking into account multidisciplinary inputs
- data sources should be preferably cross-sectional rather than horizontal and available for the same time period for all indicators
- a limited number of responses were considered; of note, malnutrition and disaster-related outcomes were not considered
- equal weight need not be assigned for exposure, sensitivity and coping capacity.

This experience illustrates some of the technical challenges, requiring further multidisciplinary research and development.

#### 4.3.4 Essential products and technologies

New technologies are already transforming the way healthcare is managed in many countries around the world, from innovative eHealth data management systems, tele-health practices, personalised data monitoring, and medical technologies with lower energy requirements. Some of these technologies have the added benefit of improving the climate resilience of the health system, decreasing its environmental impact. Health systems can contribute to climate resilience and sustainability by including these considerations alongside the traditional measures of cost-effectiveness, and improvement of patient quality of care.

Essential Products and Technologies	
Resilience Goals and Objectives	Examples of Interventions
<p><b>Low-Carbon Health Operations: Low environmental impact technologies are used and promoted by the health sector to ensure sustainability of operations</b></p>	<p>Health facilities at all levels have access to sustainable energy and water supplies where appropriate (e.g. solar energy for vaccine cold chains, lighting for surgery, water pumping)</p>
<p><b>Better Delivery of Interventions: The use of new technologies or processes improves the way health interventions are delivered to increase climate resilience</b></p>	<p>New technologies such as eHealth or satellite imagery used to improve health system performance</p>
<p><b>Adaptation of Current Technologies and Procedures: Revision and improvement to respond to the risks posed by climate change</b></p>	<p>Training in pharmaceutical use during extreme heat conditions provided</p>

#### 4.3.5 Service delivery

Steps are also needed to ensure that preventive health services, patient pathways, and clinical practice are adequately climate resilient. Three components cover this area of the health system: management of the environmental determinants of health; climate-informed health programmes; and emergency preparedness and management.

Management of the Environmental Determinants of Health	
Resilience Goals and Objectives	Examples of Interventions
<p><b>Regulation: Health-related implications and required quality standards to protect health from climate change understood and developed for environmental determinants of health</b></p>	<p>Quality standards and regulations on key environmental determinants of health (air quality, water quality, food quality, housing safety, waste management) revised and enforced to reflect broader ranges of expected climate conditions</p>
<p><b>Coordinated Management: Environmental determinants of health managed in a coordinated way and clear roles and responsibilities defined</b></p>	<p>Joint multi-sectoral risk management approaches to health risks related to disasters, water, waste, food, and air pollution (e.g. food safety, diarrhoeal disease control, Integrated Vector Management, joined up risk communication) undertaken</p>

Climate-Informed Health Programmes	
Resilience Goals and Objectives	Examples of Interventions
<p><b>Health Programming: Climate-sensitive health programmes integrate climate information into their planning efforts</b></p> <p><b>Delivery of Interventions: Public health programmes revise their service delivery practices to respond to the risks posed by climate variability and change in their operations</b></p>	<p>Information gathered on seasonal trends used to plan preventive measures for those most at risk (e.g. diarrhoeal diseases or vector-borne diseases)</p> <p>Relevant public health programmes and activities reviewed and updated to consider short-term influences (i.e. seasonal trends) and long-term climate change (10+year climate projections) in their operations (e.g. vector control in new malaria endemic areas)</p>

Emergency preparedness and disaster risk management	
Resilience Goals and Objectives	Examples of Interventions
<p><b>Policies and Protocols: Emergency and disaster risk management protocols and policies are adequately informed by current and likely future climatic conditions</b></p> <p><b>Risk Management: Strengthened health system's capacity to manage risks so that overall vulnerability and exposure to hazards are reduced and residual risks and uncertainties are effectively managed</b></p> <p><b>Climate-Resilient Infrastructure and Services: New health and public health infrastructure are built and operated to minimize loss and damage caused by climate risks and existing health infrastructure is retrofitted to deal with the risks posed by extreme weather events</b></p> <p><b>Empowerment of Communities: Communities are empowered to effectively prevent and respond to the health risks posed by extreme weather events</b></p>	<p>Climate-sensitive health risks included under national disaster reduction strategy and plans, across all sectors including health, and implementation of the International Health Regulations</p> <p>Emergency response plans, evacuation procedures and emergency management coordination measures to anticipate and respond to events affecting public health</p> <p>Current healthcare and public health infrastructure, including water supply and waste disposal and sanitation, are appropriately located and adequately robust to be safe and remain functional under the stress of extreme weather</p> <p>Civil society and community groups empowered through participation, dialogue, and information exchange, thus strengthening community-based risk reduction</p> <p>Develop and implement national all-hazards health emergency and disaster risk management programmes, based on risk and capacity assessments which account for short- and long-term climate trends</p>

## **From protecting the environmental determinants of health to emergency preparedness in hospitals: Examples from the Eastern Mediterranean and the Americas**

The WHO Eastern Mediterranean Region faces serious water-scarcity issues, with adverse health effects of climate variability and change including water-borne diseases, food-borne diseases, and food insecurity contributing to malnutrition. Jordan presents an example of protecting the environmental determinants of health from climate risks. The Health Ministry has been pro-active in identifying its own role within the overall national climate change strategy. It has identified health risks associated with water scarcity as a top priority, and worked to ensure that health agencies play a lead role, through their mandate in the governance, regulation, monitoring and surveillance of environmental health interventions, and in close collaboration with other sectors, in developing and mainstreaming diverse adaptation measures to water scarcity. These include:

- Water resource governance ensuring the allocation of sufficient water supplies for domestic purposes. Health agencies develop national public health policies on minimum domestic water requirements for health protection.
- Proactive and preventative water safety management (water safety management plans). Health agencies develop regulations on water safety management and undertake monitoring and surveillance of their application and impacts on water safety and public health.
- Integrated management systems for production of safe food and agricultural produce using wastewater (wastewater safety management plans). Health agencies develop national regulations on wastewater use in food production and undertake monitoring and surveillance on compliance and impacts on food safety and health.

The WHO Region for the Americas (AMRO) presents an example that is more focused within the healthcare sector. The Caribbean is prone to a wide variety of natural hazards and at risk from the impact of climate change, putting the safety of health facilities at risk when damage to structural and non-structural elements leave the facilities unable to function. At the same time, health care facilities are also leading consumers of energy, with a large environmental footprint. In AMRO, a Plan of Action on Safe Hospitals was adopted in October 2010, which seeks to facilitate Member States' adoption of "Hospitals Safe from Disaster" as a national risk reduction policy and urges them to work toward the goal of building all new hospitals with a level of protection that better guarantees that they will remain functional in disaster situations. It also calls for appropriate mitigation measures in existing health facilities through the SMART initiative. Health care facilities are 'smart' when they link their structural and operational safety with green interventions, at a reasonable cost-to-benefit ratio. A SMART hospital toolkit was developed offering a variety of instruments, including: the Hospital Safety Index, which many countries are currently using to help ensure that new or existing health facilities are disaster-resilient; a Baseline Assessment Tool to collect reliable information on the building's performance and operations and how it measures up against current code, regulatory requirements and zoning regulations; and a Green Checklist that outlines feasible areas in which to introduce 'SMART' measures.

In addition to this emergency preparedness initiative, key processes have also been initiated. These include the creation of the Climate Change and Health Community of Practice for Latin American and the Caribbean (CoPSaCC), as part of the UNEP REGATTA initiative, which is being coordinated by the Mexican National Public Health Institute (INSP) with the support of WHO AMRO. In Brazil a Climate and Health Observatory is being managed by the Oswaldo Cruz Foundation (Fiocruz), the Institute of Communication and Scientific and Technological Information on Health (ICICT), the Sergio Arouca National School of Public Health (ENSP), and the National Institute of Spatial Research (INPE). These initiatives help to ensure that information is available to guide the climate-resilient service delivery.

### 4.3.6 Financing

Finally, financial management of the finite resources available to enact adaptation policies is particularly important in already over-burdened health systems. At the international level, a number of sources provide limited funding for low-income countries, through mechanisms such as the UNFCCC’s Green Climate Fund, the Global Environmental Facility’s Least Developed Countries Fund, and the Kyoto Protocol’s Adaptation Fund. These can supplement health-specific funding mechanisms.

Financing	
Resilience Goals and Objectives	Examples of Interventions
<p><b>Climate Change Funding Streams: Climate change funding mechanisms available at national level accessed</b></p> <p><b>Health-Specific Funding Mechanisms: Climate change considerations included in proposals related to climate-sensitive diseases submitted to and funded by health funding mechanisms</b></p> <p><b>Funding for Sectors Influencing Health: Health and climate change considerations incorporated in projects and programmes funded through development funding available for main health-determining sectors</b></p>	<p>Projects and programmes on building health systems’ resilience submitted to and granted by the main international climate change funds (e.g. the GEF, Adaptation Fund, bilateral donors)</p> <p>Improved health sector access to diversified financial resources</p> <p>Health impacts of climate change monitored in programmes funded through financial mechanisms specific to health-determining sectors</p>

## 5. Challenges and opportunities to strengthen health protection from climate change

Despite growing knowledge and understanding of climate-related health impacts and the technical measures available to combat these, the scale of the response is currently inadequate to address the health challenges presented by climate change. Some of the reasons for this are well described and apply to greater or lesser extent in most Member States. These include: (i) Lack of sufficient awareness and understanding, and weaknesses in inter-sectoral governance mechanisms, to address the links between climate change and health; (ii) limited technical, organizational and institutional capacity to develop strategies and plans to protect health from climate risks; (iii) limited availability of financial resources, particularly from the public sector, to make the necessary long-term investments to address health and climate change, either separately, or as overlapping and synergistic priorities.

These are serious barriers, requiring strong political leadership, and sustained public outreach to support the case for addressing both the short- and long-term benefits of sustained investment in addressing climate risks. There are, however, important opportunities to make progress within the next few years.

## 5.1 Raising awareness and ensuring policy coherence

Surveys from around the world have shown that, when presented with the evidence of links between climate change and health, there is a high degree of public recognition. Health is also central to The UN Framework Convention on Climate Change, the central justification for which (Article 1) refers to the need to limit the adverse effects of climate change, defined as those which damage the “resilience or productivity of natural and managed ecosystems, [the] operation of socio-economic systems [and] human health and welfare.” This provides a strong basis and justification for raising awareness and understanding of health protection as part of an overall response to climate change, as countries prepare to negotiate a new international agreement under the UNFCCC in December 2015.

The political processes charged with arriving at a post-2015 development agenda run in parallel to the work of the UNFCCC. These intend to arrive at consensus on a set of global goals to replace the Millennium Development Goals by the end of 2015. Whilst the content is still under discussion, the current outcome document refers to the need to “take urgent action to combat climate change and its impacts”. This presents the opportunity to ensure alignment of the overall health goal of ensuring healthy lives and universal health coverage, alongside climate change objectives, within a more comprehensive approach to sustainable development.

Negotiations for the post-2015 framework on disaster risk reduction are currently ongoing, with the expectation that Member States will reach agreement on the new international framework in Sendai, Japan in March 2015. In the development of the new framework, Member States have stressed the need to consider this within the context of climate change adaptation. This would ensure the link between the immediate need for emergency preparedness, integrated risk monitoring, and early warning systems to reduce the impacts of extreme weather events on health, and the longer-term challenge of increasing resilience to climate change.

## 5.2 Building technical, organizational and institutional capacity

There is a range of mechanisms to build capacity for more systematic health protection from climate change. Under the UNFCCC, countries are developing cross-sectoral National Adaptation Plans (NAPs), with Least Developed Countries and Small Island Developing States as priorities for international support. Health is routinely identified as one of the sectors that should be included within a NAP. The UNFCCC also provides additional technical support mechanisms, including the Nairobi Work Programme (NWP) to improve understanding and assessment on impacts, vulnerability and adaptation to climate change, and inform adaptation decisions. Parties to the UNFCCC have recently requested the further development of work on health adaptation under the NWP.

Under the mandate of WHO Health Assembly Resolution 61.19, and associated Regional Committee Meeting Resolutions and action plans, WHO has scaled up its policy and technical support to Member States, in partnership with other UN agencies and development partners. This includes, for example, provision of specific guidance to the health sector on developing the health components of National Adaptation Plans; and technical tools to support vulnerability and adaptation assessment and estimation of health adaptation costs. The Organization is also working with the World Meteorological Organization and national meteorological services to support the provision of climate services for health (i.e. tailored climate information products and associated support). This is further supported by a rapidly expanding number of projects around the world on piloting health adaptation to climate change.



There is now a need to widen coverage and sustain technical support and capacity development, to facilitate the mainstreaming of climate change adaptation into health programmes.

### 5.3 Mobilizing resources and supporting implementation

Although financial resources are always limited, scale-up is both necessary and possible. There are already very large investments in programmes to address climate-sensitive health risks, and in health-determining sectors such as water and sanitation, or agriculture and food security. In addition, there are now funding streams available to support climate change adaptation, including health protection. Access to funding varies depending on the country, but can include national funding sources, or (particularly for developing countries), the multilateral climate funds managed under the UNFCCC, development banks, and bilateral development agencies.

These sources are not currently being utilized effectively for health protection. A recent review of the main adaptation funding source for least developed countries suggests that less than 1% of funds were allocated to health, apparently due to a lack of submission of health projects.

There is a need for a more systematic and sustained approach, to make use of these opportunities, and to continue to make progress in protecting health from climate change.

## References

1. IPCC. Summary for Policymakers. In: Stocker TF, D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley, editor. Climate Change 2013: The Physical Science Basis Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.2013.
2. Smith KR, Woodward A, Campbell-Lendrum D, Chadee D, Honda Y, Liu Q, et al. Human health; Impacts Adaptation and co-benefits. In: Field CB, Barros VR, Dokken DJ, Mach KJ, Mastrandrea MD, Bilir TE, et al., editors. Part A: Global and Sectoral Aspects Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press; 2014.
3. IPCC. Summary for Policymakers. In: Field CB, Barros VR, Dokken DJ, Mach KJ, Mastrandrea MD, Bilir TE, et al., editors. Climate Change 2014: Impacts, Adaptation, and Vulnerability Part A: Global and Sectoral Aspects Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.2014.
4. WHO. Protecting Health From Climate Change: Connecting Science, Policy and People. Geneva: World Health Organization, 2009.
5. WHO. The World Health Report 2002. Geneva: WHO; 2002.
6. WHO. Gender, climate change and health. Geneva: World Health Organization, 2009.
7. WHO. Everybody's business : strengthening health systems to improve health outcomes : WHO's framework for action. Geneva: World Health Organization, 2007.
8. WHO Regional Committee for Europe. Resolution EUR/RC60/R7 on the future of the European environment and health process. Copenhagen 2010; Available from: [http://www.euro.who.int/\\_data/assets/pdf\\_file/0011/122231/RC60\\_eRes7.pdf?ua=1](http://www.euro.who.int/_data/assets/pdf_file/0011/122231/RC60_eRes7.pdf?ua=1).
9. WHO Regional Office for Europe. Parma Declaration on Environment and Health. Copenhagen. 2010; Available from: <http://www.euro.who.int/en/health-topics/noncommunicable-diseases/cancer/publications/2010/parma-declaration-on-environment-and-health>.
10. Wolf T, Martinez GS, Cheong HK, Williams E, Menne B. Protecting health from climate change in the WHO European Region. Int J Environ Res Public Health. 2014;11(6):6265-80
11. Dogra N, Taneja P, Srivastava S, Patel S. Pilot Tool for Assessment of Health Vulnerability to Climate Change at the Sub-National Level in India. New Delhi: IIMR, 2013.