WORLD HEALTH ORGANIZATION
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HEALTH AND CLIMATE CHANGE:

the "now and how"

A policy action guide

ENERGY, ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

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CASH

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ABSTRACT

This document presents a brief summary of the results of the research project “Climate change and adaptation strategies for human health in Europe” (cCASHh) (May 2001-July 2004), coordinated by WHO and supported by the Energy, Environment and Sustainable Development Programme in the frame of the Fifth European Union Framework Programme for Research and Development.

Current climate trends point to the likelihood that southern Europe will become drier in the future, while northern Europe is likely to become warmer and wetter. Extreme events are expected to increase in frequency and severity, particularly heat-waves, droughts and intense rainfall events. cCASHh identified a range of options that have been taken or could be taken by European policy-makers to prevent, prepare and respond to the effects of weather and climate variability on people’s health.

These measures are classified into general and specific. General measures include better cooperation between health and climate institutions, building capacity for action now and communication. The specific measures include information for the prevention of health effects from heat stress, floods, vector, rodent and food borne diseases.

Keywords
CLIMATE
GREENHOUSE EFFECT
METEOROLOGICAL FACTORS
NATURAL DISASTERS
DISEASE TRANSMISSION
RISK ASSESSMENT
POLICY MAKING
GUIDELINES

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Design and Layout: Emilio Dotto
English editing: Thomas Petruso
Cover photos: Dr Jürg Alean; Dan Chung, Reuters; Waltraud Grubitzsch, dpa.

FOREWORD I

It is now five years since the Intergovernmental Panel of Climate Change (IPCC) in 2001 concluded on the basis of new and stronger evidence, that not only was most of the global warming observed over the past 50 years attributable to human activities but that climate change could affect human health. The effects can be direct – due to increased heat stress, floods and storms – or indirect – causing changes in the ranges of disease vectors such as ticks and water-borne pathogens, water and air quality and food availability and quality.

Health authorities had already expressed concern about climate change and its impact on human health. Three years earlier, at the World Health Assembly in 1998, they had recognized that climate change could be a potential threat to human health. In 1999, at the Third Ministerial Conference for Environment and Health, ministers of health and environment from the WHO European Region had acknowledged that "human-induced changes in the global climate system and in stratospheric ozone pose a range of severe health risks and potentially threaten economic development and social and political stability". They also called for national action by all countries to reduce and prevent as far as possible these environmental changes and to limit the exposure of human populations in Europe to climate change and increased ultraviolet irradiation, thus addressing the likely health risks over the coming decades.

These statements posed a great challenge to WHO and to Member States. Scientific evidence showed very clearly that climate change was already starting to occur, and even in the best scenario the human population was going to face direct and indirect health effects over the coming decades. Adaptation strategies were needed based on thinking about the types of risks that European populations might face. With this in mind and in order to fill this knowledge gap, we developed the network and the content of the "Climate change and adaptation strategies for human health"(cCASHh) project. The WHO and its collaborators aimed to describe with facts and figures the early observed effects of climate change on health and to identify public health measures to cope with the additional risks. We also aimed to assess the benefits of acting sooner as opposed to later, and to develop the necessary policies to support decision-makers in addressing these issues.

During the project (2001–2004) the WHO European Region was hit by a major flood in 2002 and by a severe heat-wave in 2003. Experience seemed to confirm what models had predicted. Although one record heat-wave and flood do not prove that Europe is getting hotter or the weather more extreme, the impacts made by these events highlighted shortcomings in existing public health preparation and responses, particularly the lack of knowledge of effective preventive measures and the few mechanisms in place to predict or prevent the health effects, or even to detect them rapidly. I believe the cCASHh project has produced very important results, both in the content and in the methods used. It shows that the concurrent work of different disciplines in addressing public health issues can produce innovative and useful results, providing an approach that can be followed on other public health issues. The project has shown that information on potential threats and impacts can be developed and can be extremely useful in preparing the public for adverse events as well as facilitating the response when the events occur. This is a new dimension for public health which reverses the traditional thinking: from describing what has already occurred and identifying and reducing specific risk factors, to taking action on the basis of prediction and early warning to prevent health consequences in large populations. We hope this approach will be further developed and tested, particularly where emerging environmental risks are concerned.

We would like to take this opportunity to express our gratitude to the many scientists and stakeholders, including policy-makers at different levels, who contributed to the development of the project. Without this constructive and extremely collaborative critical mass the research results would have been less timely and perhaps less relevant. We would also like to thank the European Commission Directorate General for Research for its generous contribution and the attention and support with which it has followed the implementation of the project.

This research has generated a number of conclusions and recommendations for action by Member States and the international community. The challenge is now to translate these actions into policy and to monitor their effectiveness and impact. With this in mind we worked with Member States to include in the final Declaration of the Fourth Ministerial Conference on Environment and Health held in Budapest in June 2004 recommendations on the public health response to extreme weather events and a renewed commitment to address in a proactive and anticipatory manner the consequences on health of climate change.

We hope that the implementation of effective adaptation policies together with effective mitigation actions will limit the impact of climate change and protect the health of present and future generations. We believe this project has made a significant contribution to this vital endeavour.

Roberto Bertollini,
Director, Special Programme on Health and Environment
WHO Regional Office for Europe

FOREWORD II

It is an honour for me to write a few introductory lines for this publication, which represents the results of the research project "Climate change and adaptation strategies for human health in Europe" (cCASHh) (May 2001-July 2004), coordinated by WHO and supported by the Energy, Environment and Sustainable Development Programme in the frame of the Fifth European Union Framework Programme for Research and Development.

cCASHh aimed to:

- identify the vulnerability of human health to adverse impacts of climate change;
- review current measures, technologies, policies and barriers to improving the adaptive capacity of populations to climate change;
- identify the most appropriate measures, technologies and policies to successfully adapt European populations to climate change; and
- provide estimates of the health benefits of specific strategies or combinations of strategies for adaptation under different climatic and socioeconomic scenarios.

The flood events in 2002 and the heat-wave of August 2003 in Europe showed that no one is on the safe side when it comes to the impacts of climate change. Though some may dispute whether these extreme weather events are linked to global change, they revealed in a rather drastic way our vulnerability and unpreparedness. Preparedness for extreme weather events requires cooperation at all levels and throughout disciplines. The cCASHh project was able to contribute timely results on both occasions. I would like to take the opportunity to congratulate the consortium for this successful endeavour.

These types of research activities need an interdisciplinary approach, of which the cCASHh project was a good example. Projects supported during the Sixth Framework Programme and hopefully also during the Seventh Framework Programme continue and further develop this important work.

Karin Zaunberger,
Project Officer, European Commission,
DG Research
European Commission

EXECUTIVE SUMMARY – POLICY BRIEF

The longer that greenhouse gas reduction measures are slowing to be in place, the greater the need to understand how people and systems can effectively adapt to new climate patterns and potential threats, and what needs to be done now to avoid the human suffering and deaths that may result. This paper summarizes the findings of the Climate change and adaptation strategies for human health in Europe (cCASHh) project, coordinated by WHO to assess current health impacts of climate change and policy responses to it.

Current trends, discussed in the cCASHh studies, point to the likelihood that southern Europe will become drier in the future, while northern Europe is likely to become warmer and wetter. Extreme events are expected to increase in frequency and severity, particularly heat-waves, droughts and intense rainfall events.

During the cCASHh project (2001–2004) the WHO European Region was hit by a major flood in 2002 and by a severe heat-wave in 2003. Lessons learned point to a need for strengthening policies that will help societies better adapt to such extreme weather changes. cCASHh European surveys confirmed that while the characteristics of the population, access to health services and types of exposure are important determinants of health outcomes, effective policies can make a difference.

The findings are organized in two sections. The first addresses some prerequisites of adaptation, such as the need for better linkage between health and climate authorities and enhancing policy-makers' capacities to act and communicate. The second addresses some specific policy-driven action options (how) to reduce the health impact of heat-waves and floods, and changes in the ranges of vectors, allergens and foodborne diseases attributable to climate change (now).

Integration

Addressing the health impacts of climate change requires integration of public health and climate change knowledge. Integration requires reciprocal understanding of terminology, goals and methods. Beyond this it requires working together to achieve the goal of reducing deaths, disease and disabilities.

Action

A key message from the research is that the measures considered in adapting to future climate change are not generally new, and that most of them build on well-established public health approaches. In general, early action was found to be most possible and effective when: action measures have already been shown to be effective under current climate conditions; severe impacts are possible; multisectoral alliances, partnerships, and networks are in place; adaptation measures have a long lead time; decisions have long-term effects; and there is a need to reverse trends that threaten adaptive capacity.

Communication

cCASHh surveys reveal a limited public or policy-maker appreciation of the risks of climate change and variability and what to do about them, partly because of the perception that the problem is too big to manage, lies outside of the health sector and its impacts are long-term. In particular there is a need for a more strategic approach to those at risk and those who can play a part in enhancing adaptability. Crisis and risk communication experiences point to the counter-intuitive aspects of uncertainty communication, namely, if one does not convey clarity and candour one risks losing trust and worsening fear and insecurity.

Specific threat adaptation

Heat-waves

Surveys show that Europe is not well-prepared to cope with "unexpected" extreme thermal stress events. In western Europe alone, 35 000 excess deaths were reported in the 2003 heat-wave. There is some evidence that mortality can be reduced by strengthening and implementing early warning systems, strengthening health system preparedness and response, planning cities and housing better and advising citizens.

Floods

Floods are among the most common natural events in Europe – causing deaths, injuries, and diseases – and their frequency and magnitude are expected to increase. Infectious disease outbreaks are rare; however, there is incomplete information collection on short and long-lasting health effects. Structural and non-structural flood protection measures in many European countries have significantly reduced associated deaths over recent decades.

Vector-borne diseases

Lyme borreliosis and tick-borne encephalitis (Ixodes ricinus)

cCASHh data and other studies have shown that the tick transmitting Lyme borreliosis and tick-borne encephalitis (TBE) (*Ixodes ricinus*) has spread into higher latitudes (in Sweden) and altitudes (in the Czech Republic) in recent decades and has become more abundant in many places. Some specific measures might need to be strengthened in risk areas, such as TBE vaccination and raising awareness of collective and individual protection measures, like wearing suitable clothing, and self-inspection after outdoor activities to remove ticks early.

Malaria

Although several models predicted a potential increase of malaria in Europe, there is agreement that the risk is very low under current socioeconomic conditions.

Leishmaniasis

There are some hypotheses that point to a considerable potential for climate-driven changes in Leishmaniasis distribution in the future. Important control strategies include local control of sand fly populations, the use of insecticide-impregnated dog collars, and information targeted to populations at risk as well as to public health personnel. In order to detect early signs of climate induced changes, active collaboration between veterinary services and health services is essential. The measures currently available to control vector-and rodent-borne diseases are disease-specific and can be broadly classified into diagnosis and treatment, vaccination, vector control, reservoir host control, information and health education and disease surveillance and monitoring.

Foodborne diseases

Salmonellosis

cCASHh studies on foodborne diseases show that, in general, cases of salmonellosis, increase by 5% to 10% for each one-degree increase in weekly temperature, for ambient temperatures above about 5º C. The number of cases of salmonella can be reduced by controlling and monitoring along the food chain. The level of implementation varies by countries. High levels of control measures and more information on food handling and storage would be needed to confront the potential climatic risks.

Allergic diseases

Evidence is growing that climate change might facilitate the spread of particular plant species to new climatically suitable areas. Warming is likely to facilitate the earlier onset and possibly longer duration of flowering and pollen seasons for some grasses and weeds.

The way forward

Political will and support for public health approaches may be seen as a prerequisite to reducing health risks and instability. Identifying ways to reduce the causal factors of climate change – mitigation – and effectively help populations and systems deal with risks and threats posed by climate change – adaptation – especially for vulnerable populations, can lead to a greater sense of security and control and result in improved population health. The health sector can and should be at the heart of this.

INTRODUCTION

Whether it is climate change, avian flu, chemical safety, bio-terrorism or violence, people across Europe and beyond are being bombarded with images and information that cause fear and insecurity. Policymakers are challenged to develop responses that not only identify priority risks and how they can be minimized but also to communicate uncertainties and proposed actions to their populations in ways that enhance people's sense of security and health.

This document addresses public health policy challenges posed by climate change. While some people "quietly" enjoy what they perceive as the benefits of climate change, concerns and fears raised by extreme weather conditions and uncertainty about future impacts add to global feelings of insecurity. This guide identifies a range of options that have been taken or could be taken by European policy-makers to prevent, prepare and respond to the effects of weather and climate variability on people's health. As opposed to

many other publications on climate change and health, the focus here is on "now and how." What effects are we actually seeing now? How can policy-makers help their people and systems effectively adapt to new climate threats and reduce associated human suffering and deaths? What needs doing now and what can be safely delayed? How can public health approaches help facilitate early warnings, shape effective responses, learn from each other's interventions and reframe public perceptions of climate change risk and insecurity in the process?

This guide summarizes the findings and recommendations of the "Climate change and adaptation strategies for human health" (cCASHh) project[1] ***(1)*** (Box 1). cCASHh, funded by the European Commission and coordinated by the World Health Organization Regional Office for Europe, European Centre for Environment and Health (ECEH) Rome, studied health impacts and policy implications of heat stress related mortality and morbidity, foodborne (salmonellosis and campylobacteriosis), and vector-borne diseases.

A section on allergic disorders ***(2)*** is also included, drawing upon the work of the European Phenology Network (EPN). Surveys, workshops, stakeholder consultations, epidemiological studies, policy analysis, economic valuation and scenario development

[1] *Presented at the 11th meeting of the Parties to the Climate Convention in Montreal, December, 2005*

were carried out to learn the best ways for health systems to adapt to the new risks posed by climate change.

The findings are organized in two sections. The first addresses some prerequisites of adaptation, such as the need for better linkage between health and climate authorities and enhancing policy-makers' capacities to act and communicate. The second addresses some specific policy-driven action options (how) to reduce the health impact of heat-waves and floods, and changes in the ranges of vectors, allergens and foodborne diseases attributable to climate change (now).

Box 1. The cCASHh study questions

The cCASHh project aimed to describe with facts and figures the early observed effects of climate change on health and to identify the available public health measures to cope with the additional risks *(3)*. Activities focused on answering the following 5 questions:

- What can be learned from observed health impacts of climate change and vulnerabilities?
- What strategies, policies and measures are currently available to reduce impacts of climate variability and change?
- What are the damages/benefits?
- What are the projected health impacts?
- Which policy responses need to be strengthened or developed?

WHAT IS CLIMATE CHANGE?

Climate change refers to a statistically significant variation in either the mean state of the climate or its variability that persists for extended periods (decades or longer). The earth's climate system has demonstrably changed on both global and regional scales since the pre-industrial era, with some of these changes attributable to human activities, particularly those that have increased the atmospheric concentrations of greenhouse gases and aerosols. The atmospheric concentrations of anthropogenic greenhouse gases – carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and tropospheric ozone (O_3) – reached their highest recorded levels in the 1990s, primarily due to the combustion of fossil fuels, agriculture and land-use changes[2]. An increasing body of observations gives a collective picture of a warming world and other changes in the climate system *(4–6)* (Figure1).

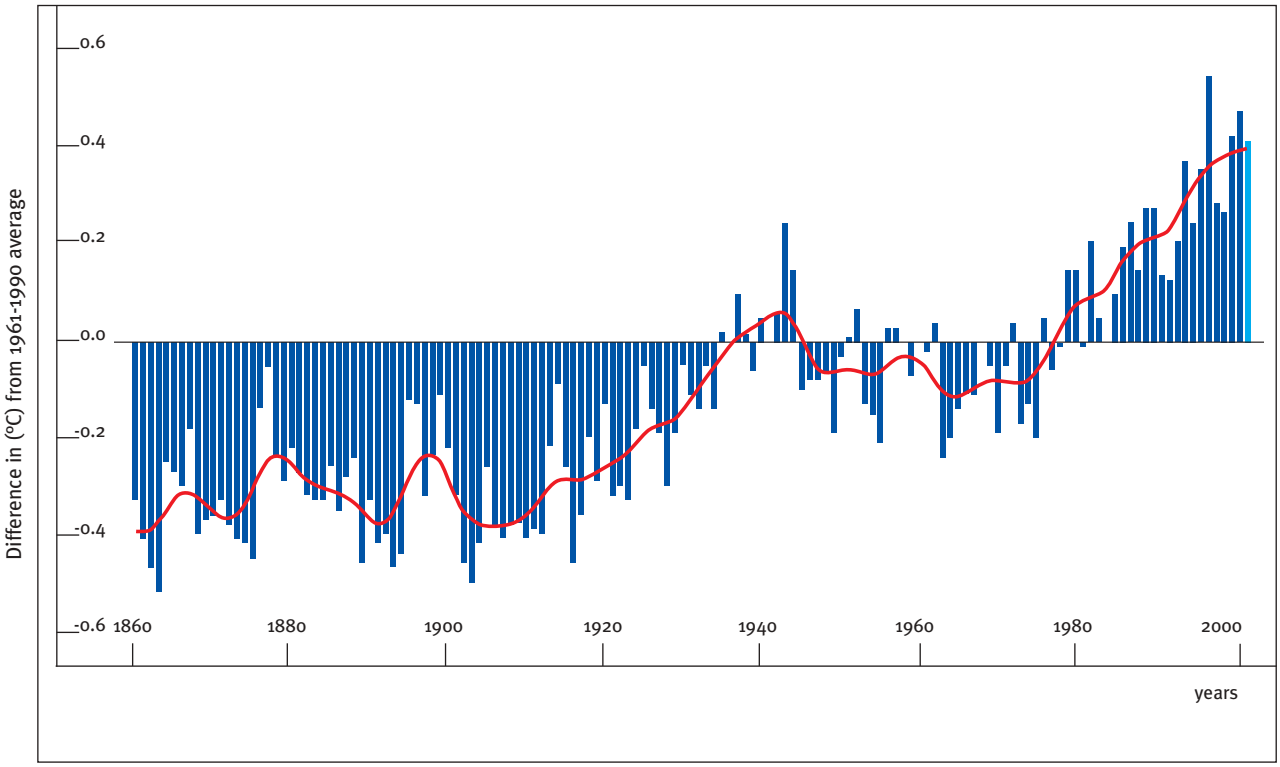
WHAT CLIMATIC CHANGES MIGHT EUROPE BE FACING?

Over the last 50 years there has been an increase in Europe's minimum and maximum temperatures *(7)*, changes in precipitation characteristics and increases in the magnitude and frequency of extreme events such as high temperatures, heavy precipitation and persistent drought *(8)*.

Current trends, discussed in the cCASHh studies, point to the likelihood that southern Europe will become drier in the future, while northern Europe is likely to become warmer and wetter. Extreme events are expected to increase in frequency and severity, particularly heat-waves, droughts and intense rainfall events. During the cCASHh project (2001–2004) the WHO European Region was hit by a major flood in 2002 and by a severe heat-wave in 2003. Although one record heat-wave and flood do not prove that Europe is getting hotter or the weather more extreme, the impacts made by these events can be considered an early test of current coping strategies (Box 2). Lessons learned point to the need for strengthening policies that will help societies better adapt to such extreme climatic changes. Lack of preparedness and weak response systems in the 2003 heat-wave resulted in more than 35 000 excess deaths in Europe. In contrast, structural and non-structural flood protection measures in many European countries have significantly reduced associated deaths over recent decades.

[2] *Glossary of the Intergovernmental Panel of Climate Change*

FIGURE 1. PAST AND FUTURE CHANGES IN GLOBAL MEAN TEMPERATURE
GLOBAL AVERAGE NEAR-SURFACE TEMPERATURES, 1860–JULY 2003 FROM 1961 TO 1990 AVERAGE[3]



Box 2: Lessons from the 2003 heat event in France

A severe heat event in August 2003 resulted in an estimated 14 800 excess deaths in 13 French cities. Metéo France issued warnings to the media, but authorities' awareness of the heat-wave's health impacts was delayed. The common heat-related causes of this large number of deaths, mostly in the elderly, were not detected promptly because data from emergency and medical services and from death certificates were not commonly used for rapid detection. An inquiry by the General Directorate of Health (DGS) concluded that the 2003 heat event was unforeseen and only detected belatedly, and highlighted deficiencies in the French public health system, including too few experts, lack of preparation for a heat event, poor definition of responsibility across public organizations and weak information exchange mechanisms.

It was further noted that health authorities and crematoria and cemeteries were overwhelmed by the influx of patients and bodies; few nursing homes were equipped with air-conditioning; and a large number of elderly people were living alone without a support system and without guidelines for appropriate responses to a heat event *(9–10)*.

Since 2003, the French government has formulated short and medium-term actions to reduce health impacts from heat events, including the development of a national heat health warning system, sponsoring research on the risk factors associated with heat-event-related mortality, implementing a health and environmental surveillance programme, and developing national and local action plans for heat events *(9)*.

[3] *"Hadley Centre for Climate Research, Exeter, United Kingdom"*

CONCERNS AND RECOMMENDATIONS FOR POLICY ACTION: THE "NOW AND HOW"

Every epidemiologist knows that climatic factors are important determinants of human health and well-being. Rising ambient temperatures, outside a population's comfort range may lead to thermal stress and weather-related disasters – such as floods and storm surges – with significant loss of life and alter the range of many infectious diseases. Climate change can have direct impact via exposure to hazardous meteorological conditions and indirect impact via vector/rodent/water/or foodborne diseases and allergic disorders *(11*). The history of human adaptation to climatic factors comprises great successes as well as disastrous failures. On the one hand humans have successfully managed to live in nearly every climatic zone on earth; on the other hand, regional climatic shifts have been linked to the rise and fall of many great civilizations, including the establishment of the first Chinese dynasty, the collapse of ancient civilizations in Egypt, the Indus watershed and Mesopotamia, the discontinuity in ancient Greek civilization, and the decline of Mayan culture *(11*). cCASHh European surveys confirmed that disease outcomes due to extreme weather events in any given country were strongly dependent on the policy measures and actions in place to prevent, adapt to and address climate-related threats *(12)*. While the characteristics of the population, access to health services and types of exposure are important determinants of health outcomes (see table 3 on adaptive capacity), effective policies can make a difference. The large differences in outcome from one country to another point to the potential to learn from successful policy implementation and adapt effective policy responses *(13)* (see figure 3).

PREREQUISITE CAPACITIES: LINKING, ACTING AND COMMUNICATING

The cCASHh studies identified the need for certain core public health competencies and capacities as prerequisites for effective health/climate policy-making. They include strengthening collaboration and teamwork between health and climate professionals and enhancing the capacity of decision-makers to act and communicate on climate change-related threats. These activities can be carried out at different levels and time scales: from international to local, from short-term to long-term (Box 3).

Box 3. Summary of prerequisite capacities: Linking, acting and communicating

Climate-health linkage: Many tables, one agenda

Capacity to take action

- **When to act**
- **Overcoming obstacles to action**
- **International support and solidarity – "We are all in the same boat"**

Communication- "Many voices, one song-sheet"

Climate-health linkages: Many tables one agenda

Public health and climate change stakeholders share the goal of increasing the ability of countries, communities and individuals to cope with the challenges likely to arise because of climate variability and change (Box 4).

Addressing the health impacts of climate change requires integration of public health and climate change knowledge. For the integration to be successful, the climate change community must understand how health is different (what distinguishes it from other climate-sensitive systems or sectors), and the public health community must understand how climate change is different (what distinguishes anthropogenic climate change from other risk factors to human population health) *(14)*. Integration requires reciprocal understanding of terminology, goals and methods. Beyond this it requires working together to achieve the goal of reducing deaths, disease and disabilities. Lessons learned from some successfully implemented early warning revealed how effective joint working is *(15)*.

Early warning systems are most effective with:

- sufficiently accurate forecasts available for the population of interest;
- robust understanding of the effects of climate on health;
- effective response measures within lead-time provided by the warning;
- a community that is able to provide the needed infrastructure and action;
- integration of "end-users" into planning and communication; and
- monitoring, evaluating and adjusting of systems as needed.




Box 4. Mitigation and adaptation

In the terminology of climate change, mitigation refers to actions that limit the amount and rate of climate change (the exposure) by constraining the emissions of greenhouse gases or enhancing their sinks. Adaptation, in contrast, refers to any actions undertaken to avoid, prepare for or respond to the detrimental impacts of observed or anticipated climate change. Mitigation and adaptation vary significantly in their scope, types of actions, characteristic spatiotemporal scales and principal actors. Mitigation is the only strategy that can reduce impacts of climate change on all systems and on a global scale but it requires international cooperation and takes a long time to become fully effective because of the inherent inertia of the climate system. Adaptation is limited to specific climate-related risks in human systems on a local or regional level and over a shorter time.

Adaptation also refers to the process by which adaptive measures are implemented: it can be immediate and intuitive (for example, buying a fan to cope with the heat), but it can also involve a long process of information collection, planning, implementation and monitoring (for example, setting up early-warning systems). The terms "autonomous adaptation" and "planned adaptation" are generally used to distinguish between these two types, even though the distinction is not always sharp *(14)*.

Capacity to take action

Commonly posed policy-maker questions are "when should I act?" and "how safe is safe enough?" *(13)*. The answer is, of course, that it depends upon the existing risk criteria, the magnitude of the threat, the applicable local social norms and the availability of cost-effective interventions. Many things need to be considered when contemplating taking action to reduce health risks posed by different climate change factors. To make decision-making even more complicated, these factors are not static. Existing risk management policies and measures might appear sufficient at the current levels of risk, but might become insufficient at higher levels or when faced with more frequent and intense events.

A key message from the research is that the measures considered in adapting to future climate change are, in general, not new, and that most of them build on well-established public health approaches.

Likely responses include:

- strengthening of effective surveillance and prevention programmes;
- sharing lessons learned across countries and sectors;
- introducing new prevention measures or increasing existing measures;
- development of new policies to address new threats *(16,17)*.

When to act?

The cCASHh study provides some guidance here. In general, early action was found to be most possible and important when:

- action measures have already been shown to be effective under current climate conditions;
- severe impacts are possible (for example, high mortality from heat-waves);
- multisectoral alliances, partnerships and networks are in place;
- adaptation measures have a long lead time (for example, changing infrastructure to reduce the extent of an urban heat island effect);
- decisions have long-term effects (for example, building settlements in areas that are at risk of flooding); and
- there is a need to reverse trends that threaten adaptive capacity.

Delaying action can be a rational adaptation strategy if the risks are moderate and response measures can be introduced quickly when most needed or if the cost of adaptations are exceedingly high given the level of uncertainty.

Overcoming obstacles to action

Key obstacles to action include lack of awareness of the potential health impacts of climate change, a perception that the problem is too big and distant, a perception that solutions are outside of health sector competence and response control, competing priorities, the lack of a strategic framework and disorganized top-down initiatives. cCASHh studies identified some ways different policy-makers have overcome these obstacles, including raising awareness, prioritizing action based on differential impact on vulnerable populations, now and how arguments for five key action areas (see discussion below), practical advice on integrating health and climate action, risk management and communication and community-based interventions.

The cCASHh assessments identified several effective community and neighbourhood level interventions aimed at reducing the risks from climate change, including taking care of the elderly during heat-waves *(15)*, neighbourhood flood evacuation plans *(18)*, community-based risk communication of specific infectious disease protection measures *(19)* and consideration of local knowledge and perspectives in the planning process.

photo by AP

International support and solidarity: "We are all in the same boat"

National and local action can be stimulated, learned from and supported from the outside. There are numerous international legal and moral frameworks that allow direct or indirect action to reduce the health impacts of climate change. The most direct way of action is through the United Nations Framework Convention on Climate Change (UNFCCC), which recognizes the need for adaptation policies, stipulating that developed countries will assist in paying the adaptation costs of the most vulnerable countries. At the European level, it is recognized that there is a need to decrease vulnerability and increase resilience to the effects of climate change. Adaptation will require additional research to predict the impacts at regional levels in order to enable local and regional public and private sector actors to develop cost-effective options.[4] This has been addressed in the 2nd European Climate Change Programme, which expects to develop a Green Paper on adaptation to climate change for the European Union.

There are numerous important indirect instruments that might further enhance adaptation to climate change. For example the Convention on the Protection and use of Transboundary Watercourses and International Lakes has developed guidance for flood prevention and a protocol on water and health.

Communication: many voices, one song-sheet

Awareness-raising and information activities will be needed to better communicate "real" threats and preventive actions that can be taken by individuals to reduce their risk of climate-sensitive diseases. An important pan-European need is accurate and timely information for citizens. In particular there is a need for a more strategic approach to those at risk and those who can play a part in enhancing adaptability. cCASHh surveys reveal a limited public or policy-maker appreciation of the risks of climate change and variability and what to do about them, partly because of the obstacles noted above, that is, the perception that problem is too big to manage, outside of the health sector and the impacts are long-term. There are many uncertainties, both scientific and political, that must also be communicated effectively. Policy-makers often avoid this because it is seen as revealing ignorance and weakness. Crisis and risk communication experiences (Box 5) point to the counter-intuitive aspects of uncertainty communication; namely, if one does not deal with uncertainties with clarity and candour one risks losing trust and worsening fear and insecurity.

The choice of which polices and measures to implement and the timing of their implementation is best shaped by responsible authorities with active participation of civil society, especially those likely to be affected by the policy choice.

[4] *Communication from the European Commission to the Council of Europe, the European Parliament, the European Economic and Social Committee, and the Committee of the Regions on Winning the Battle Against Global Climate Change (COM (2005) 35, Brussels 9.2.2005).*

Box 5. Climate change and health: communicating risk and uncertainties (adapted from WHO Outbreak communication guidelines, 2005)

Communication, generally through the media, is a key feature of the climate change/health environment. Unfortunately, examples abound of communication failures which have delayed action, undermined public trust and compliance and unnecessarily prolonged economic, social and political turmoil. Some key considerations, based on best practice examples are listed below.

Trust

The overriding goal is to communicate with the public in ways that build, maintain or restore trust. This is true across cultures, political systems and levels of development. Trust in communicating with the public is critical in both directions. Evidence shows that public panic is rare and most rare when people have been candidly informed.

Announcing early

The parameters of trust are established in the first official announcement. This message's timing, candour and comprehensiveness may make it the most important of all communications.

Transparency

Maintaining the public's trust throughout an event requires transparency (communication that is candid, easily understood, complete and factually accurate). Transparency characterizes the relationship between the event managers and the public. It allows the public to view the information-gathering, risk-assessing and decision-making processes associated with outbreak control.

The public

Understanding the public is critical to effective communication. It is usually difficult to change pre-existing beliefs unless those beliefs are explicitly addressed. And it is nearly impossible to design successful messages that bridge the gap between the expert and the public without knowing what the public thinks.

- Early risk communication was directed at informing the public about technical decisions (known as the "decide and tell" strategy). Today, risk communicators teach that crisis communication is a dialogue.
- It is the job of the communicator to understand the public's beliefs, opinions and knowledge about specific risks. This task is sometimes called "communications surveillance".
- The public's concerns must be appreciated even if they seem unfounded.
- Risk communication messages should include information about what the public can do to make themselves safer.

Planning

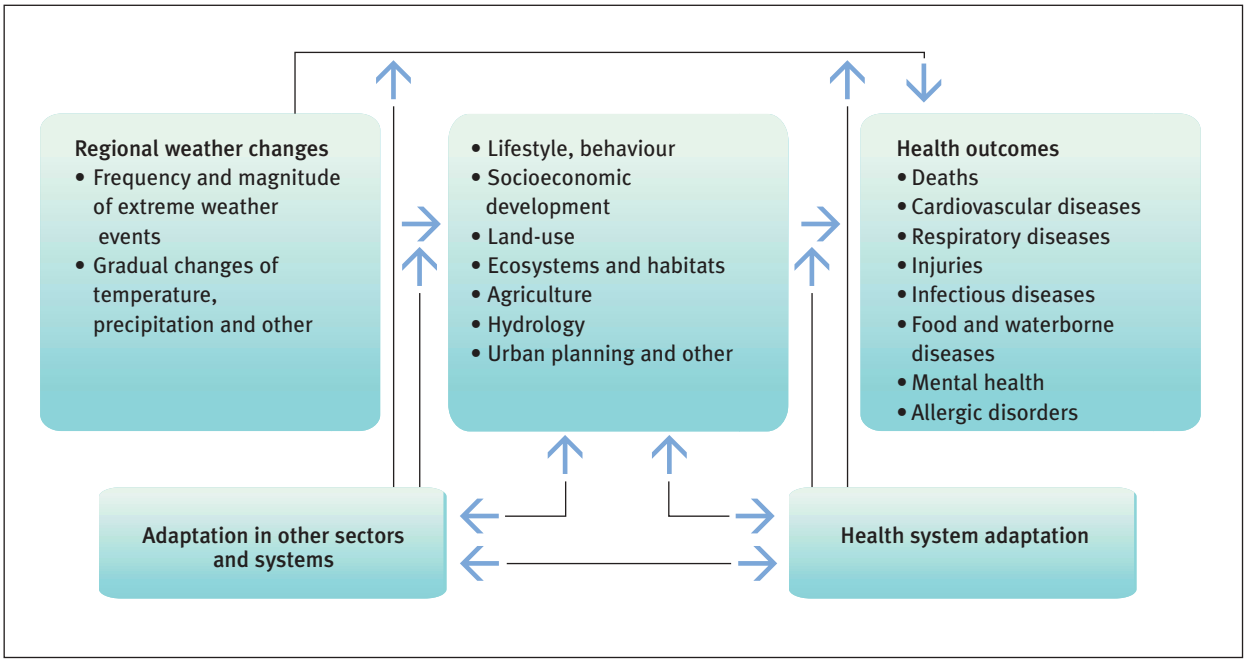
Risk communication should be incorporated into climate change/health activities, whether extreme planning for major events, advice on behavioural measures to prevent infectious diseases or all aspects of an outbreak response.

photo by WHO

THREAT-BASED CONCERNS AND POLICY RECOMMENDATIONS

The cCASHh study assessed the impacts of heat-waves and extreme events on human health and the impacts of climate change on vector/rodent/foodborne diseases and allergic disorders (Figure 2). This section summarizes the results and describes "now" and "how" strategies.

FIGURE 2. THE REALTIONSHIP BETWEEN REGIONAL WEATHER CHANGES, EXPOSURES AND HEALTH OUTCOMES



Thermal stress: heat-waves

Why action now?

cCASHh surveys show that Europe is not well-prepared to cope with "unexpected" extreme thermal stress events (see table 1 and Box 2) *(20)*. In western Europe alone, 35 000 excess deaths were reported in the 2003 heat-wave. There appears to be a

TABLE 1. EXCESS MORTALITY IN AUGUST OF 2003 IN SELECTED AREAS AND COUNTRIES *(11)*[*]

Country	Excess mortality
Baden-Württemberg, Germany	1410
Belgium	Not significant
England and Wales	2091
France	14802
Italy	9704
Portugal	1854
Spain	3166
Switzerland	960
The Netherlands	650

[*] *Studies used different denominators and reference periods to estimate excess mortality*

direct relationship between death rates and thermal stress that differs by climatic zone, geographic area and demographic situation *(15)*. In the United Kingdom a 250% increase in heat mortality has been estimated for the 2050s, and in Portugal, it was estimated that by 2020s, heat mortality would range between 5.8-15.1 deaths per 100 000 in comparison to a baseline of 5.4-6 deaths per 100 000 *(21)*.

Risk groups and factors are identifiable.

Deaths from heat stroke, cardiovascular, renal, respiratory and metabolic disorders were reported in the over 65 age group. People most at risk suffer from chronic diseases, take certain medications and are not physically fit. Several environmental, social and health-care-related risk factors, contribute to higher levels of mortality, most importantly living in the city, being alone, living on high floors. Early-summer heat-waves are associated with higher mortality than late season heat-waves. The increasing number of older people in Europe and their increasing social isolation are likely to increase the size of the population at risk from heat *(20, 22–43)*.

Housing with no cross ventilation or shading devices is associated with excess mortality. One strong trend over the past 20 years is a decrease in ventilation – people close their windows due to the fear of crime, outdoor noise and air pollution, especially at night when ventilation is important. Interestingly, there is little evidence that morbidity is rising during heat-waves although some increased emergency admission for renal and respiratory diseases has been observed in the elderly and children in London *(44)*. Stressful weather and high levels of air pollutants have independent adverse effects on daily mortality. The atmospheric conditions during the 2003 heat-wave contributed to increase of tropospheric ozone and particulates concentration in many areas of Europe and a part of the increased mortality in that period has been attributed toair pollution *(45, 46)*. There is some evidence that mortality can be reduced by strengthening and implementing early warning systems, strengthening health system preparedness and response and planning cities and housing. Only a few countries[5] have implemented heat-wave prevention and response plans including strategies for identifying vulnerable subgroups, health monitoring, population advice, and financial incentives to encourage vulnerability reduction. Studies carried out in the Czech Republic and Italy have shown that people who are ill are particularly willing to pay more to reduce their exposure to heat-related impacts *(15, 47, 48)*. Climatologists now consider it very likely that human influence on the climate system has at least doubled the risk of heat-waves like that of 2003, of which associated mortality could have been an early signal of the health impacts of climate change for which Europe is probably insufficiently prepared *(49–51)*.

The costs of inaction are large.

A contingent valuation survey was carried out to estimate the benefits of reducing the risk of dying during heat-waves. The survey questionnaire was administered to adults 30–75 years old in the Czech Republic and Italy. It was estimated for the city of Rome, that the monetized mortality damages of the heat-waves in the absence of planned adaptation programmes would be € 281 million for the year 2020 (in 2004 Euros) *(52, 53)*.

Policy action options: "How" strategies

Policy options include early warning systems, health system preparedness and response, urban planning and housing improvements.
A comprehensive early warning system should involve multiple agencies, such as city management, public health and social services and emergency medical services *(54)*. Poor communication between

[5] *A heat warning survey of meteorological agencies found that with the exception of Lisbon and Rome, no heat health warning systems were in place before 2003. After 2003, cities in France, Germany, Hungary, Italy, Spain and the United Kingdom introduced or developed heat-wave warning systems. A survey carried out with ministries of health throughout Europe found that only a few countries have implemented heat-wave prevention and response plans including strategies for identifying vulnerable subgroups, health monitoring, population advice, and financial incentives to encourage vulnerability reduction. In 2004, France, Italy, Portugal and the United Kingdom began to include heat-related health indicators in computerized rapid surveillance systems.*

meteorological services and the health agencies can prevent implementation of effective systems. Hospitals, primary care clinics and nursing homes should all be prepared for heat-waves. An emergency plan should be drafted and piloted, including education of doctors, nurses and other staff to identify heat problems and the most appropriate treatments. A personnel plan could also be developed so that extra staff is in place if needed. Education to advise people of appropriate behaviour during hot weather is an essential component of heat-death prevention. Many governments in Europe have issued advice on how to avoid heat-related illness. Evidence points to the importance of combining practical advice on action with risk warnings. Air pollutant reduction measures might need to be taken during heat-waves. Future climate should be taken into account in the construction of new buildings and planning of new parts of cities in order to provide as much thermal comfort and protection against extreme events as possible. An important component of this is to use optimum methods and materials for space cooling. The reliance on energy-intensive technologies such as air-conditioning is unsustainable and can be considered a maladaptation.

photo by STR, Reuters

Floods

Why action now?

Floods are among the most common natural disasters.

They cause loss of life and economic damage in Europe. The frequency of great floods increased during the twentieth century, underscoring the need for measures to prevent their negative health impacts (55): deaths, injuries, diseases and mental disorders during the flood event and restoration, along with additional effects brought about by major infrastructure damage, displacement of populations. Furthermore, there are indirect effects such as waterborne and vector-borne diseases, exposure to chemical pollutants released into floodwaters and food shortages *(55*). Interventions before, during and after floods can reduce short and long term health impacts (see table 3).

Chronic health effects are possible but rarely quantified.

Exposure to flooding reportedly results in long-term problems including increased rates of anxiety and depression stemming from the experience itself, troubles brought about by geographic displacement, damage to the home or loss of with family possessions and stress in dealing with builders and other repair people in the aftermath. The persistence of flood-related health effects is directly related to flood intensity. Hospitals, ambulances, retirement homes, schools and kindergartens in flood-prone areas are at risk and evacuation of patients and vulnerable groups might represent a further risk.

A cCASHh survey with ministries of health throughout Europe found that although all the respondent countries had emergency intervention plans, no governments had strategies to prevent long-lasting health impacts from flooding or offered financial incentives for citizens to increase their ability to resist them *(54)*. Adverse health impacts from floods arise from:

- characteristics of the flood itself
- the amount and type of property damage
- whether flood warnings were received and acted upon
- the victims' previous flood experience and risk awareness
- relocation and other household disruption
- difficulty in dealing with builders and insurance companies
- pre-existing health conditions and susceptibility
- anxiety over a flood recurrence
- financial concern
- loss of security in the home and
- disruption of community life.

Although the extent to which climate change will affect the frequency and intensity of extreme weather events is still a subject of debate, there is no doubt that changes in land use and hydrology create multiplying effects when natural protection has disappeared.

Policy action options: "How" strategies

Prevention of floods and flood damage is mainly based on structural (dams, room for the river, etc.) and non structural (early warning, risk communication, etc.) measures. Flood prevention plans normally include environmental impact assessments (flood plains), communications strategies and land-use regulations *(56)*.

photo by NASA

Providing accurate information on safe management of flood water during evacuation and clean-up is essential. There is a need to shift emphasis from disaster response to risk management, to improve flood forecasting, to establish early warning systems and to include health actors in the communication flow. Risk management in this area must cover a broad field, including health impact assessment of flood structural measures, regulations concerning building in flood prone areas, insurance policies, etc. The harmful effects of flooding can be reduced by building codes, legislation to relocate structures away from flood-prone areas and planning appropriate land use

and migration measures. Short and long-term health impacts can be reduced by appropriate interventions (see table 2). In the recent floods in Europe no major outbreak of communicable disease has been observed. This may be attributable to the prompt response of public health authorities in ensuring safe drinking water, medical assistance and an effective emergency infrastructure. In countries where such are not available infectious disease outbreaks have been observed.

TABLE 2. HEALTH-SPECIFIC INTERVENTIONS TO REDUCE THE POTENTIAL IMPACTS OF FLOODS

Health outcome and preventive measures	Intervention
Pre-flood activities	Pre-flood awareness-raising campaigns, with messages targeted to different groups
	Emergency planning
	Inter-institutional coordination activities
Infectious diseases and other physical health effects	Treatment of respiratory problems and skin rashes
	Treatment for mould and other exposures
	Treatment for strains and other effects of physical exertion
	Vaccination (e.g. hepatitis A) of general population
	Boil water notices and general hygiene advice
	Outbreak investigations where appropriate
	Enhanced surveillance
Mental health outcomes (anxiety and depression, etc.)	Post-flood counselling
	Medical assistance
	Visits by health workers or social workers to vulnerable people

Source: *(18)*

Vector-borne diseases

photo by WHO

Why action now?

Lyme borreliosis and tick borne encephalitis

Climate is an important determinant of the geographic range of disease vectors, such as mosquitoes or ticks. cCASHh data and other studies have shown that the tick transmitting Lyme borreliosis and tick-borne encephalitis (*Ixodes ricinus*) has spread into higher latitudes (in Sweden) *(19,57)* and altitudes (in the Czech Republic) *(58–66)* in recent decades and has become more abundant in many places.

Based on the results of the extended cCASHh reviews, it seems likely that climate change in Europe will: facilitate the spread of Lyme borreliosis and tick-borne encephalitis (TBE) into higher latitudes and altitudes and contribute to an extended and more intense Lyme borreliosis and TBE transmission season in some areas.

Leishmaniasis

While there is not current compelling evidence that sand fly and visceral leishmaniasis distributions in Europe have altered in response to recent climate change, cCASHh analysis points to a considerable potential for climate-driven changes in leishmaniasis distribution in the future. Sand fly vectors already have a wider range than the pathogen (*L. infantum*), and imported dogs infected with it are common in central and northern Europe. Once conditions make transmission possible in northern latitudes, the imported dog cases could act as a

source of new endemic foci. Climate-induced changes in sand fly abundance thus may increase the risk of the emergence of new diseases in the region *(67)*.

Malaria
Although several models predicted a potential increase of malaria in Europe (see box 6), there is agreement that the risk is very low under current socioeconomic conditions. Probably the greatest risk is in those eastern European countries where per capita health expenditure is relatively low, so that health services are less efficient at detecting and treating malaria cases and environmental measures to control mosquito distribution are poorly implemented *(68)*.

West Nile fever
There have been several hypotheses that climate change contributes to the re-emergence of West Nile fever in Europe. However, it seems most likely that this re-emergence is the result of a combination of factors including favourable weather conditions, abundant mosquito vectors, infected migrating birds, local avian hosts, bridge vectors able to feed on both birds and mammals and susceptible population of equines and/or humans (as "dead-end" or occasional hosts) *(69)*.

Hantavirus
Hantavirus causes a rare infection that can cause haemorrhagic fever with renal syndrome (HFRS). It is transmitted from rodent to rodent through body fluids and excreta and only occasionally are humans infected. Theory suggests that changing climates have influenced rodents' migration patterns and the physiological viral adaptation processes. However, further research is needed to elucidate the relationships among climate change, rodents, viruses and humans *(70)*.

Box 6. Malaria in Europe: is it really a threat?

From a policy perspective, it is important to understand the various drivers of disease expansion and retreat. A variety of recent modelling efforts have shown that, assuming no future human-imposed constraints on malaria transmission, changes in temperature and precipitation could alter its geographic distribution and intensity, with previously unsuitable areas of dense human population becoming suitable for transmission *(71,72)*.

Projected changes include an expansion in latitude and altitude, and, in some regions, a longer season during which malaria may be present. Such changes could dramatically increase the number of people at risk. The potential for malaria and other "tropical" diseases to invade southern Europe is commonly cited as an example of the territorial expansion of risk. However, many of these diseases existed in Europe in the past and have been essentially eliminated by public health programmes. For example, in the early part of the twentieth century, malaria was endemic in many parts of southern Europe *(68,73,74)*, but its prevalence was reduced primarily via improved land drainage, better quality of housing construction and higher levels of socioeconomic development, including better education and nutrition. Any role that climate played in malaria reduction would have been small.

Note that this does not provide assurance that climate will not play a larger role in determining the future range and intensity of malaria transmission.

Policy action options: "How" strategies

The measures currently available to control vector and rodent-borne diseases are disease-specific and can be broadly classified into diagnosis and treatment, vaccination, vector control, reservoir host control, information and health education and disease surveillance and monitoring.

Some specific measures might need to be strengthened in risk areas, such as TBE vaccination and raising the awareness on collective and individual protection measures, like wearing suitable clothing, and self- inspection after outdoor activities to early remove ticks. Leishmaniasis control strategies have varied little for decades, but in recent years there have been exciting advances in diagnosis, treatment, and prevention. Important control strategies include local control of sandfly populations, the use of insecticide-impregnated dog collars, and targeted information to populations at risk as well as to public health personnel.

In order to capture early signs of climate induced changes active collaboration between veterinary services and health services is essential.

The European Region needs to be vigilant on new potential climate sensitive diseases and the expansion of existing once, also in relation with other environmental changes.

Foodborne and waterborne diseases

Why action now?

Diarrhoeal diseases are one of the most important causes of ill health in Europe in children, from foodborne and waterborne infections. They are recognized to be highly sensitive to climate, showing strong seasonal variations in numerous sites *(75)*. However, it is not possible to generalize the effects of weather on the transmission of pathogens, which depend upon the local situation, the pathogen and numerous environmental pathways. The effectiveness of national control programmes varies across countries, providing opportunities for decreasing current burdens of foodborne diseases.

Salmonellosis

cCASHh studies on foodborne diseases show that, in general, cases of salmonellosis, the most common food-borne disease, raise by 5-10% for each one-degree increase in weekly temperature, for ambient temperatures above about 5º C. The effect of temperature is most apparent when the temperature in the week before the onset of the illness is considered, thus indicating that inappropriate food preparation and storage rather than time of consumption is the most important factor. It was estimated that temperature influences the transmission of infection in about 35% of cases of salmonellosis in England and Wales, Poland, the Netherlands, the Czech Republic, Switzerland and Spain. Rates of salmonellosis are declining in most countries in Europe, suggesting that improvement of current measures will be an effective adaptation to controlling salmonella under warmer climate conditions *(76–78)*.

Campylobacter infections

The role of weather in triggering short-term increases in campylobacter infections has yet to be resolved. There are various potential transmission routes (water supplies, bird activity, fly activity and recreational contact) that could be affected by weather. However, the effect of short-term increases in temperature on campylobacter transmission is, at most, weak, in contrast to that consistently observed with salmonella transmission *(76)*.

Cryptosporidiosis

Some notable outbreaks of waterborne diseases such as cryptosporidiosis have been associated with heavy rainfall *(79)*.

photo by Emilio M. Dotto

Policy action options: "How" strategies

Important mechanisms to prevent foodborne and waterborne diseases are surveillance and monitoring, microbiological risk assessment, risk management and risk communication. The number of cases of salmonellosis can be reduced by controlling and monitoring along the food chain. The level of implementation varies by countries. High level of control measures would need to be achieved with the potential climatic risks and potentially information on storage and food handling strengthened *(75)*.

The drinking-water and recreational protocol of the United Nations Economic Commission for Europe (UNECE) Convention on the Protection and Use of Transboundary Watercourses and International Lakes calls upon countries to take all appropriate measures towards achieving:

- adequate supplies of wholesome drinking-water
- adequate sanitation sufficiently protective of human health and the environment
- effective protection of water resources used as sources of drinking-water and their related ecosystems from pollution
- adequate safeguards for human health against water-related diseases
- effective systems for monitoring and responding to outbreaks or incidents of water-related diseases.

Allergic disorders

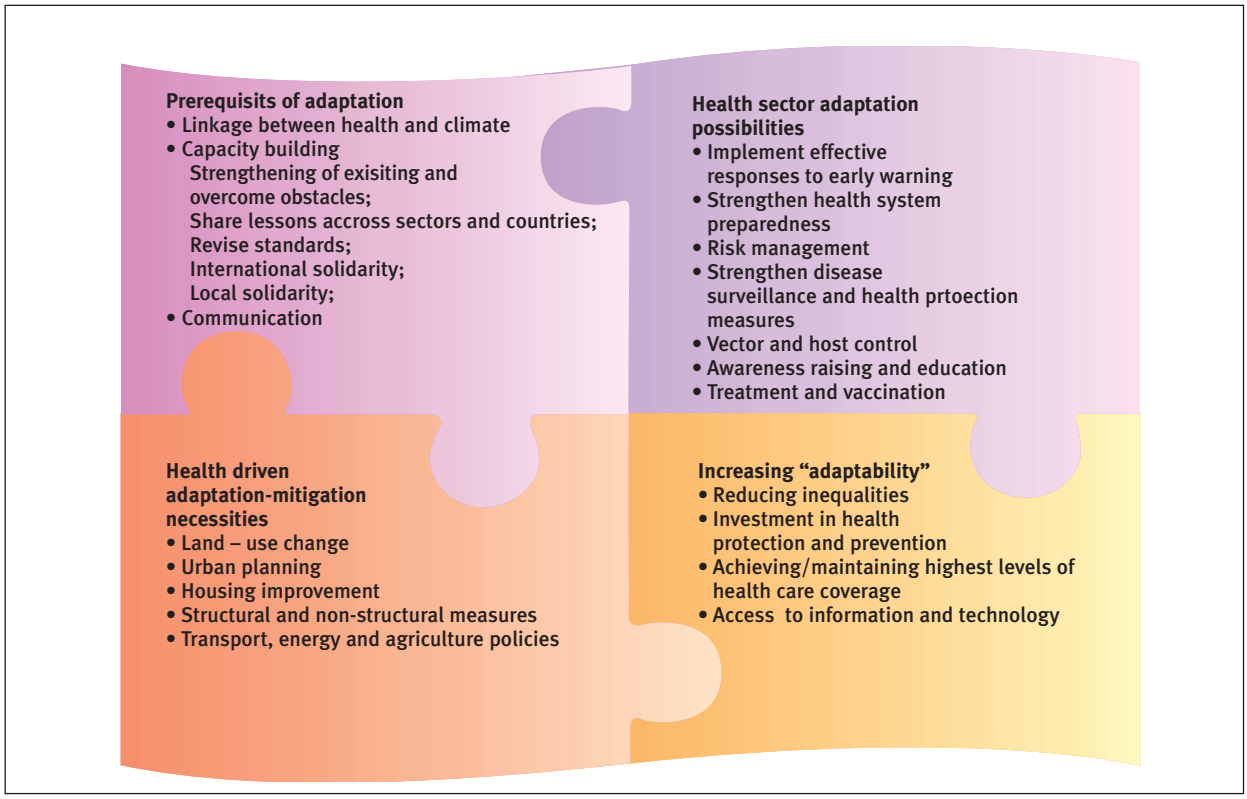
Why action now?

The prevalence of asthma, allergic rhinitis, allergic conjunctivitis and eczema in Europe increased during the second half of the twentieth century. Sensitivity to pollen allergens has also increased in many areas. The geographical distribution of plants with allergenic pollen and allergic sensitivity to it varies greatly across Europe, but the average length of the growing season in Europe has increased by 10 or 11 days over the last 30 years. An earlier start and peak of the pollen season are more pronounced in species that start flowering earlier in the year. The duration of the season is extended in some summer and late-flowering species. Evidence is

growing that climate change might facilitate the geographical spread of particular plant species to new climatically suitable areas. Warming is likely to facilitate earlier onset and may extend the duration of flowering and pollen seasons for some grasses and weeds. Some species, such as ragweed and mugwort, present particular risks for health, and require land use measures, maintenance of public areas or eradication.

The relationships among changing climate, allergens and allergic disorders need to be further clarified, but precautionary action in improving pollen forecasting is advisable. Initial suggestions include setting up a working group to look at the potential impact of global change on allergic disorders in order to strengthen and systemize early warning systems *(80–83)*.

FIGURE 3. PREREQUISITS, ADAPTABILITY, ADAPTATION POSSIBILITIES AND NECESSITIES



IS EUROPE READY TO ADAPT TO THE CHANGING CLIMATE?

Experts surveyed within the cCASHh study ranked income, equality, type of health care system, and quick access to information as most important factors enabling effective response to climate change. Countries in the WHO European Region vary tremendously in their response capacities *(84)*. Those with the highest adaptive capacities tend to have high incomes, universal health care coverage and high access to information. Concerns were raised about a negative impact on "adaptability" in parts of Europe with rising inequalities, falling prevention investment and aging populations (Table 3; Figure 3).

TABLE 3. ADAPTIVE CAPACITY INDEX FOR 22 EUROPEAN AND CENTRAL ASIAN COUNTRIES. HIGHER INDEX VALUES MEAN HIGHER ADAPTIVE CAPACITY[6] *(84)*

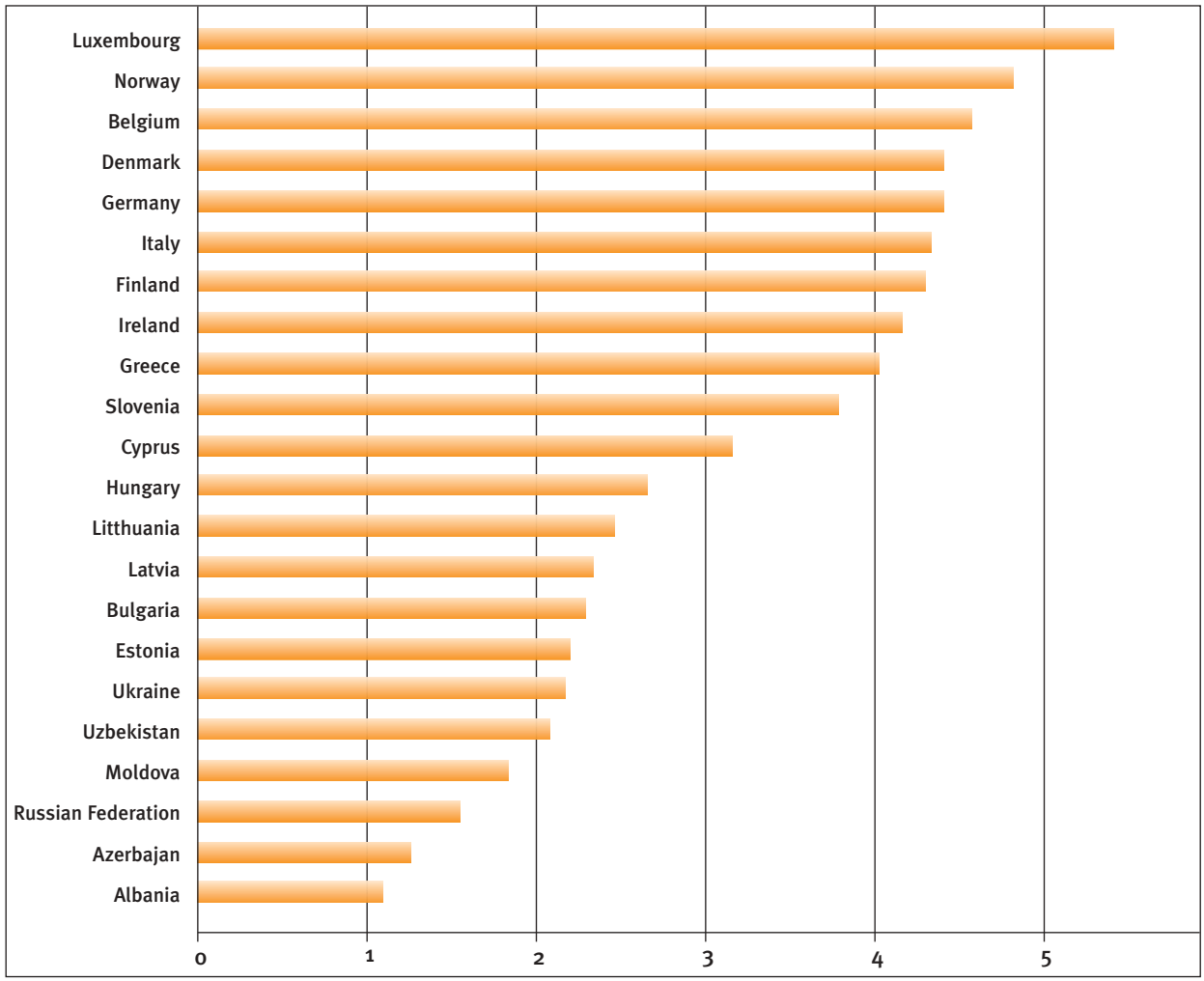


photo by AP

[6] *For detailed information please access: http://www.feem.it/NR/rdonlyres/43C8E8E0-DDC1-402C-AA08-A62694C97FB7/1712/10606.pdf*

CONCLUSION

The cCASHh project has provided timely and critical information on "now and how" strategies for health threats from climate change. Many conclusions have been drawn from analysis of the health impacts of the 2002 floods and the 2003 heat-wave. This information is being used to design new policies and improve measures to address morbidity and mortality due to flooding and heat-waves. It is not apparent that improvements are taking place quickly enough in those risk areas where no recent disasters or emergencies have occurred.

While the "now and how" strategies outlined above have the potential to reduce the health risks associated with global climate change, they are clearly no panacea. For some diseases, no effective response measures are available now. Even if effective responses do exist, the availability of financial and other resources and the cultural acceptability of required behavioural changes often pose insurmountable barriers to implementation. Countries that already suffer from a considerable burden of climate-sensitive diseases will generally be unable to successfully adapt to the increased risks associated with climate change on their own. Hence any comprehensive long-term strategy for minimizing the risks associated with global climate change requires the combination of planned adaptation (now and how) and mitigation of climate change. International burden-sharing is needed to distribute costs of adaptation according to the vulnerability of countries to climate change.

The Ottawa Charter[7] identified peace and security as a prerequisite for health. Current experience points to the need to rethink this relationship. Political will and support for public health approaches may be seen as requisites to reducing fear and insecurities. Identifying ways to reduce the causal factors of climate change (mitigation) and effectively help populations and systems deal with risks and threats posed by climate change (adaptation), especially for vulnerable populations, can lead to a greater sense of security and control and result in improved population health.

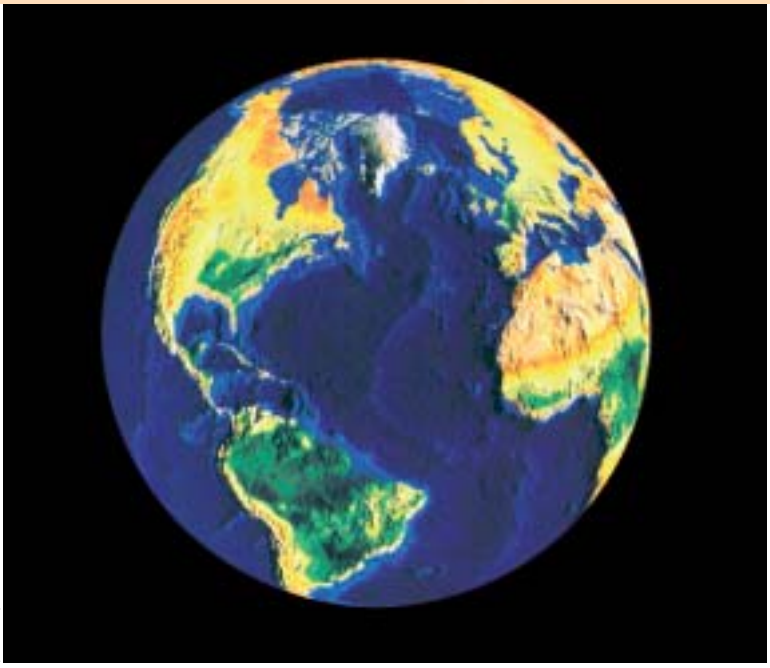


photo by NASA

[7] *Ottawa Charter for Health Promotion, First International Conference on Health Promotion, Ottawa, 21 November 1986 WHO/HPR/HEP/95.1*

ACKNOWLEDGEMENTS

This publication was developed by Franklyn Apfel and Bettina Menne based on the information received from Anna Alberini, Roberto Bertollini, Aline Chiabai, Milan Daniel, Vlasta Danielova, Hans-Martin Füssel, Kristie L. Ebi, Gerd Jendritzky, Christina Koppe, Tom Kosatsky, Sari Kovats, Bohumir Kriz, Elisabet Lindgren, Michael van Lieshout, Tanja Wolf and Karin Zaunberger, and is based on the book *Climate change and adaptation strategies for human health* edited by B. Menne and K. Ebi. It summarizes the final results of the project Climate Change and Adaptation Strategies for Human Health (cCASHh-EVK2-2000-00070), funded by the European Commission and coordinated by Bettina Menne and Roberto Bertollini from WHO ECEH .

Many experts have directly contributed to this project by steering the work, writing background reports and articles and providing information and comments essential to its development. We would like to thank very much Ben Armstrong, Matteo Albrizio, Martha Anker, Annmaria Asp, Jürgen Baumüller, Cestmir Benes, Arieh Bitan, Ian Burton, Diarmid Campbell-Lendrum, Carlo Carraro, Dominique Charron, John Cowden, Clive Davies, Philippe Desjeux, Julio Díaz, Sally Edwards, Michael Ejov, Jan Erhart, Michele Faberi, Marzio Galeotti, Gretel Gambarelli, Andy Haines, Shakoor Hajat, George Havenith, Gloria Hernández, Jaroslava Holubova, Zdenek Hubalek, Charmaine Gauci, Peter Gerner-Smidt, Norman Gratz, Simon Hales, Daniela Janovska, Thomas G.T. Jaenson, Adam Jirsa, Ricardo Jorge, Richard J.T. Klein, Ivan Kott, Jan Kopecky, Zuzana Kristufkova, Katrin Kuhn, Kuulo Kutsar, Milan Labuda, Gudrun Laschewski, Alberto Longo, César López, Lena Malmström, Wieslaw Magdzik, Andreas Matzarakis, Pim Martens, Pierre Marty, Jan Materna, Fergus Nicol, Glenn McGregor, Anthony McMichael, Paul McKeown, Rennie M D'Souza, Kassiani Mellou, Torsten Naucke, Antonio Navarra, Fergus Nicol, Paulo Jorge Nogueira, Sarah O'Brien, Anna Paldy, Milan Pejcoch, Edmund Penning Rowsell, Hans Schmid, Scott Sheridan, Paul Sockett, Sue Tapsell, Hiroko Takasawa, Christina Tirado, Jaroslav Valter, Antti Vaheri, Theresa Wilson, Linda Wirén, Wilfrid van Pelt and Kamil Zitek.

Many experts participated in the several workshops and through their contributions allowed the project to grow. The coordinators would like to thank Lucien Abenhaim, Roger Aertsgeert, Bastien Affeltranger, Ingvar Andersson, Peter Baxter, Elena Borisova, Nick Brooks, Rui Calado, Sergio Castellari, Tanja Cegnar, Claude Chastel, Jean-Claude Cohen, Susanna Conti, Carlos Corvalan, Thomas Downing, Peter Duchaj, Andrea Ellis, Pascal Empereur-Bissonnet, Agustín Estrada-Peña, Veronique Ezratty, Vytautas Gailius, Benedek Goncz, Duane Gubler, Paolo Guglielmetti, Debarati Guha-Sapir, Cağatay Güler, Katarina Halzlova, Juhani Hassi, Madeleen Helmer, Marika Hjertqvist, Sona Horvathova, Michael Hübel, Lyubomir Ivanov, Ilze Jansone, Geoff Jenkins, Anne-Marie Kaesbohrer, Wilhelm Kirch, Victor Kislitsin, Silvia Kostelna, Zbigniew W Kundzewicz, Jan Kyncl, Marco Leonardi, Otto Malek, Alexander Malyavin, Merylyn McKenzie Hedger, Paola Michelozzi, Thierry Michelon, Matthias Niedrig, Buruhani Nyenzi, Mikko Paunio, Armin Petrascheck, Günter Pfaff, Florin Popovici, Paul Reiter, Stefania Salmaso, Christiana Salvi, Darina Sedlakova, John Simpson, Jolanta Skrule, Alfred Spira, Jochen Süss, Viv Taylor Gee, Richard Tol, Jaroslav Valter, Els Van Cleemput, Thomas Voigt, Jaroslav Volf, Gary Yohe and Rudolf Zajac.

The coordinators would particularly like to thank Blessy Corda and Nicoletta di Tanno for their continuous efforts in managing the project and developing and updating the website. A warm thanks is also extended to all those institutions that supported the project, namely, the London School of Hygiene and Tropical Medicine, the National Institute of Public Health of the Czech Republic, Stockholm University, Fondazione Eni Enrico Mattei, Deutscher Wetterdienst, the Potsdam Institute for Climate Impact Research and the International Centre for Integrative Studies.

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