World Health Organization
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EUROPEAN ENVIRONMENT AND HEALTH PROCESS

Health in the latest assessment report of the Intergovernmental Panel on Climate Change (IPCC):

A discussion on findings for the European Environment and Health process

Report of a meeting in Bonn, Germany

27-28 May 2014

World Health Organization

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Health in the latest assessment report of the Intergovernmental Panel on Climate Change (IPCC): A discussion on findings for the European Environment and Health process

Meeting Report
27–28 May 2014

ABSTRACT

In May 2014, the WHO Regional Office for Europe organized a technical meeting to discuss Fifth Assessment Report of the Intergovernmental Panel on Climate Change, and its implications for population health in the WHO European Region. Participants agreed that the time for action is now and that delayed action in reducing greenhouse gas emissions will increase costs and its impact, including on human health. Four single overarching communication outcomes (SOCO) were identified to be developed into a communication strategy to feed back to the European Environment and Health Process.

Keywords

CLIMATE CHANGE
HEALTH
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List of abbreviations

AFOLU	Agriculture, forestry and other land use
AR4	Fourth Assessment Report of the Intergovernmental Panel on Climate Change
AR5	Fifth Assessment Report of the Intergovernmental Panel on Climate Change
BMUB	Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, Germany
CGS	Climate change, green health services and sustainable development programme
CLA	Coordinating Lead Author
COP	Conference of the Parties to the UNFCCC
EC	European Commission
EHP	European Environment and Health Process
EHTF	European Environment and Health Task Force
EU	European Union
FAR	First Assessment Report of the Intergovernmental Panel on Climate Change
GDP	Gross domestic product
GEA	Global Energy Assessment
GHG	Greenhouse gas
$GtCO_2eq$	Gigatonnes of carbon dioxide equivalent
HIC	Working Group on Health in Climate Change of the EHP
ICLEI	International Council for Local Environmental Initiatives
IPCC	Intergovernmental Panel on Climate Change
LWEC	Living with Environmental Change
NMT	Non-motorized-travel
POP	Persistent Organic Pollutant
RCP	Representative Concentration Pathway
SAR	Second Assessment Report of the Intergovernmental Panel on Climate Change
SBSTA	Subsidiary Body for Scientific and Technological Advice
SOCO	Single overarching communication outcomes
SPM	Summary for Policy-Makers
SREX	Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation
TAR	Third Assessment Report of the Intergovernmental Panel on Climate Change
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WGI	IPCC Working Group I (e.g. in AR5: The Physical Science Basis)
WGII	IPCC Working Group II (e.g. in AR5: Impacts, Adaptation, and Vulnerability)
WGIII	IPCC Working Group III (e.g. in AR5: Mitigation of Climate Change)
WHA	World Health Assembly
WHO	World Health Organization
WMO	World Meteorological Organization

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We would also like to thank the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) for co-sponsoring this meeting.

Executive Summary

A meeting held at the WHO European Centre for Environment and Health in Bonn on 27–28 May 2014 brought together around 45 experts and representatives from a number of European countries to examine the health implications of the latest assessment report of the Intergovernmental Panel on Climate Change (IPCC). The main discussion topics were to identify the key overarching communication objectives on climate change and health for environment and health officials, based on emerging evidence.

Result of the discussion

There is overwhelming evidence that:

- Our climate is changing;
- Health impacts of climate change and variability are happening now;
- Carbon dioxide (CO_2) remains the main driver of climate change;
- Our climate resilient future depends fundamentally on what we accomplish on mitigation; delays in mitigation or constraints on technological options increase the longer-term mitigation costs to hold climate change risks at a given level;
- Climate change will amplify existing risks and create new risks, with wide and profound effects on health and well-being;
- Limiting warming below 2°C is still possible, but requires major technological, institutional, political and behavioural changes;
- Reducing greenhouse gas emissions can have significant local and immediate benefits for human health, in particular through reducing noncommunicable diseases and improving universal health access;
- Sustainable development, population health and equity provide a basis for assessing climate policies;
- Our climate resilient future will depend on ability to manage and reduce the risks;
- Greater rates and magnitude of climate change increase the likelihood of exceeding adaptation limits.

Single overarching communication outcomes (SOCOs) were identified for four different target audiences:

1. For local governments: Make cities sustainable and climate resilient;
2. For European policy-makers: Mitigate greenhouse emissions to obtain immediate and local health gains;
3. For negotiators of the climate convention: Integrate health into negotiations of the United Nations Framework Convention on Climate Change;
4. For health policy-makers: Integrate climate change aspects into health strategies and policies.

Timing is crucial

Participants agreed that the time for action is now and the window of opportunity to mitigate these scenarios is narrowing by the day. Delayed action in reducing greenhouse gas emissions will increase costs and its impact.

Scope of the meeting

The Intergovernmental Panel on Climate change (IPCC) has launched its new assessment reports. They deal with health not only in a health chapter, but also refer to health, human security and well-being throughout the three thousand pages of the three working groups. The assessment provides important new insights into observed and projected developments, and thereby an important technical basis for the Mid-term Review of the Environment and Health process in Europe.

The objectives of the meeting are to:

- Discuss the implications of the findings for health in the WHO European Region;
- Discuss key messages for environment and health professionals in Europe; and
- Summarize the key messages.

Opening remarks

Dr Bettina Menne, Programme Manager, CGS, WHO Regional Office for Europe and Björn Ingendahl on behalf of the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, Germany (BMUB), opened the meeting and presented the scope and objectives. They outlined climate change as an unfinished concern for European Member States of the World Health Organization. The Parma "Commitment to act" is the bases of work in WHO European Member States to act in the face of climate change. The Working Group on Health in Climate Change (HIC) currently supports the implementation of the Parma Commitment. The participants were asked during the two days meeting, to consider the following questions:

- What is the size/magnitude of the health problem/impact/risk?
- Which solutions will improve people's health and lives now?
- How do the solutions improve people's health now and in the future?
- How can we tackle it with the available resources?
- How do we make this an issue that will attract collaboration?

Renate Christ, Secretary of the IPCC, gave an overview on the IPCC and the various assessment reports. The Intergovernmental Panel on Climate Change (IPCC) is the international body for assessing the science related to climate change. The IPCC was set up in 1988 by the World Meteorological Organization (WMO) and United Nations Environment Programme (UNEP) to provide policy-makers with regular assessments of the scientific basis of climate change, its impacts and future risks, and options for adaptation and mitigation. Today the IPCC's role is as defined in Principles Governing IPCC Work, "*...to assess on a comprehensive, objective, open and transparent basis the scientific, technical and socioeconomic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation. IPCC reports should be neutral with respect to policy, although they may need to deal objectively with scientific, technical and socioeconomic factors relevant to the application of particular policies.*" The IPCC gained the Nobel peace prize *"for their efforts to build up and disseminate greater knowledge about man--made climate change, and to lay the foundations for the measures that are needed to counteract such change"*. IPCC produces assessment reports, special reports, and methodological reports, which are elaborated through a complex process of author selection, writing, expert review, government review and government approval.

Health impacts were mentioned for the first time in the IPCC First Assessment Report (FAR)[1], emphasizing ozone depletion and UV damage. The Second Assessment Report (SAR)[2], described potential health impacts arising from extreme weather events, changes in infectious disease distribution and the risks of health effects from disruption in major life on earth sustaining systems, such as agriculture. It concludes, that "*the impacts of global climate change, particularly if sustained in the longer term, could include a multitude of serious—but thus far underrecognized—impacts on human health*". The SAR notes "*Impacts are difficult to quantify, and existing studies are limited in scope; Detection [of climate-induced changes] will be difficult*". The Third Assessment Report *(*TAR)[3] made the first strong conclusion on attributing impacts to climate change "*recent regional climate changes, particularly temperature increases, have already affected many physical and biological systems"* The chapter on human health concluded, that *"there is little published evidence that changes in population health status actually have occurred as yet in response to observed trends in climate over recent decades*". It identified extreme weather events, changes in infectious disease distribution, and reduced agricultural capacity and potential changes in air quality as risks to population health. In addition it mentions the need to consider the impacts on population health of social disruption, economic decline, and displacement of populations, as large scale risks.

The Fourth Assessment Report (AR4)[4] included health throughout the whole of WGII, namely in a health chapter, as well as in all regional and sectoral chapters. AR4 for the first time concluded that "*climate change currently contributes to the global burden of disease and premature deaths. At this early stage the effects are small but are projected to progressively increase in all countries and regions*". It also described emerging evidence that "*climate change has altered the distribution of some infectious disease vectors, altered the seasonal distribution of some allergenic pollen species, and increased heatwave-related deaths*" and concluded in the summary for policy-makers, that "*projected climate change-related exposures are likely to affect the health status of millions of people, particularly those with low adaptive capacity, through: increases in malnutrition and consequent disorders, with implications for child growth and development; increased deaths, disease and injury due to heatwaves, floods, storms, fires and droughts; the increased burden of diarrhoeal disease; the increased frequency of cardio-respiratory diseases due to higher concentrations of ground-level ozone related to climate change; and, the altered spatial distribution of some infectious disease vectors*".[5]

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[1] IPCC, 1990: *Climate Change: The IPCC Impacts Assessment.* McG. Tegart, WJ., G.W. Sheldon and D.C. Griffiths eds. Australian Government Publishing Service, Canberra, Australia, 275 pp.

[2] IPCC, 1996: *Climate Change 1995: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Second Assessment Report of the Intergovernmental Panel on Climate Change*, R.T. Watson, M.C. Zinyowera and R.H. Moss, Eds., Cambridge University Press, Cambridge, 880 pp.

[3] IPCC, 2001*: Climate Change 2001: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change,* J.J. McCarthy, O.F. Canziani, N.A. Leary, D.J.Dokken and K.S.White, eds., Cambridge University Press, Cambridge, 1032pp.

[4] IPCC, 2007: *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change,* M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, eds., Cambridge University Press, Cambridge, UK, 976pp.

[5] Confalonieri, U., Menne, R. Akhtar, K.L. Ebi, M. Hauengue, R.S. Kovats, B. Revich and A. Woodward, 2007: Human health. *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change,* M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 391-431.

Two special reports include also references to human health, namely: The IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation (SRREN)[6], and the IPCC Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX)[7].

Between September (2013) and November 2014, the Intergovernmental Panel on Climate Change (IPCC) released the 5th Assessment Report (AR5)[8]. For the first time health is mentioned not only throughout working group II (impacts, vulnerability and adaptation) chapters, but also throughout working group III (mitigation)[9]. More than 830 coordinating lead authors and review editors from over 80 countries produced the three working group contributions, supported by over 1000 contributing authors and drawing on the insights of over 2000 expert reviewers in a process of repeated review and revision. The authors assessed more than 30,000 papers.

Summary of presentations from the AR5

In this session, we summarize the various presentations given at the meeting. We started with presentations on mitigation and co-benefits for human health (WGIII), followed by a description of the main climate science (WGI) and impacts, adaptation, and vulnerability (WGII) relevant to human health.

For the purpose of this report, direct quotations from the IPCC report are italicised (with the corresponding section referenced). These have been mainly taken from the summaries for policy-makers and executive summaries of chapters. Literature has been included, where relevant, or where otherwise not cited in the IPCC reports, and is referenced directly.

Mitigation of climate change

Jan Minx, Head of Technical Support Unit of IPCC Working Group III, presented **key findings on mitigation of climate change of the IPCC WGIII in the Fifth Assessment Report**. He outlined that human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. This has led to

[6] IPCC, 2011: *IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation. Prepared by Working Group III of the Intergovernmental Panel on Climate Change* O. Edenhofer, R. Pichs-Madruga, Y. Sokona, K. Seyboth, P. Matschoss, S. Kadner, T. Zwickel, P. Eickemeier, G. Hansen, S. Schlömer, C. von Stechow (eds). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1075 pp.

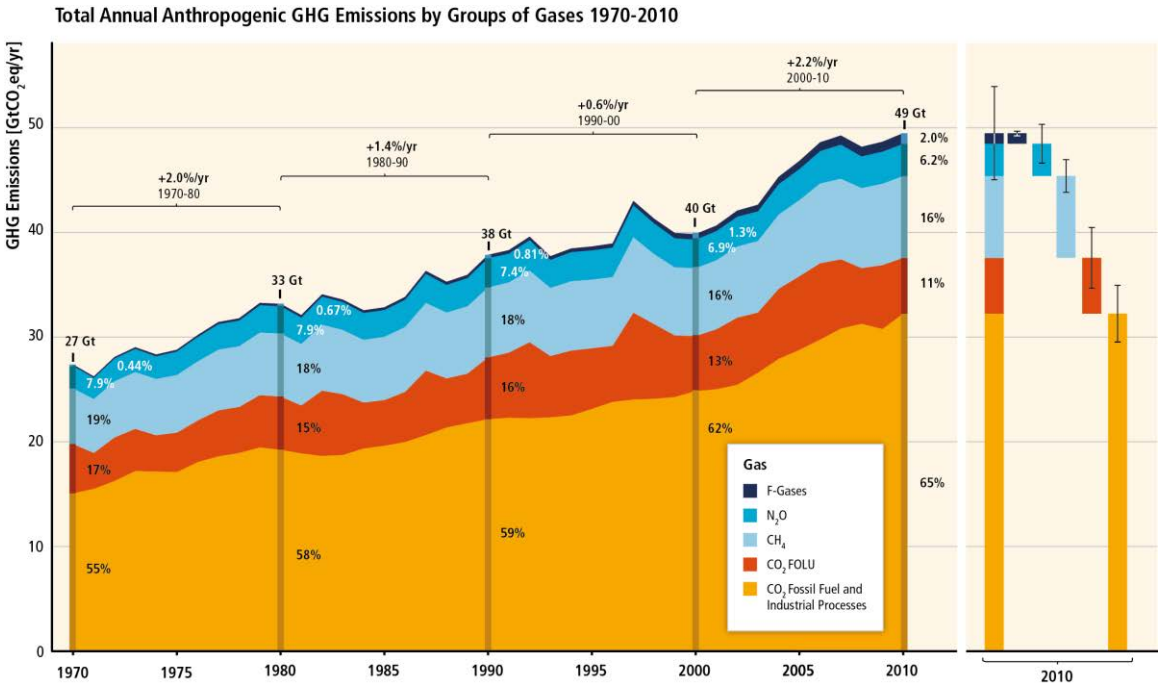
[7] IPCC, 2012: *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change* Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.). Cambridge University Press, Cambridge, UK, and New York, NY, USA, 582 pp.

[8] IPCC, 2014*: Summary for Policymakers. In: 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* Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1-32.

[9] According to the glossary of the IPCC AR5, mitigation is "a human intervention to reduce the sources or enhance the sinks of greenhouse gases."

atmospheric concentrations of carbon dioxide, methane and nitrous oxide that are unprecedented in at least the last 800 000 years. Anthropogenic greenhouse gas emissions in 2010 have reached 49±4.5 $GtCO_2eq/yr$. (Fig. 1).

Fig. 1: Total annual anthropogenic GHG emissions by groups of gases 1970–2000

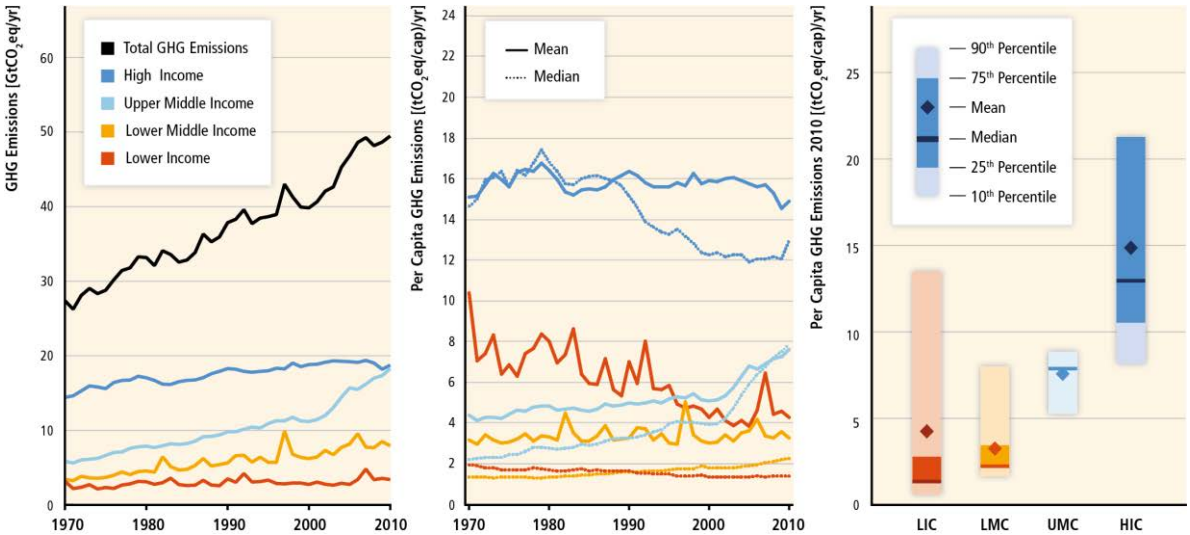


Note: Total annual anthropogenic GHG emissions (in $GtCO_2eq/year$) by groups of gases: CO_2 from fossil fuel combustion and industrial processes; CO2 from Forestry and Other Land Use (FOLU); methane (CH_4); nitrous oxide (N_2O); fluorinated gases covered under the Kyoto Protocol (F-gases). At the right side of the figure GHG emissions in 2010 are shown again broken down into these components.[10]

European per person emissions are between 12–15 tonnes carbon dioxide equivalent per person per year – about seven times higher than median per person emissions in low income countries (1.34 tonnes carbon dioxide equivalent per person per year) (Fig. 2). However, GHG emissions are highly variable within (and between) income groups.

10 *Source:* IPCC, 2014: *Summary for Policymakers, In: Climate Change 2014, Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.). Figure SPM.1. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

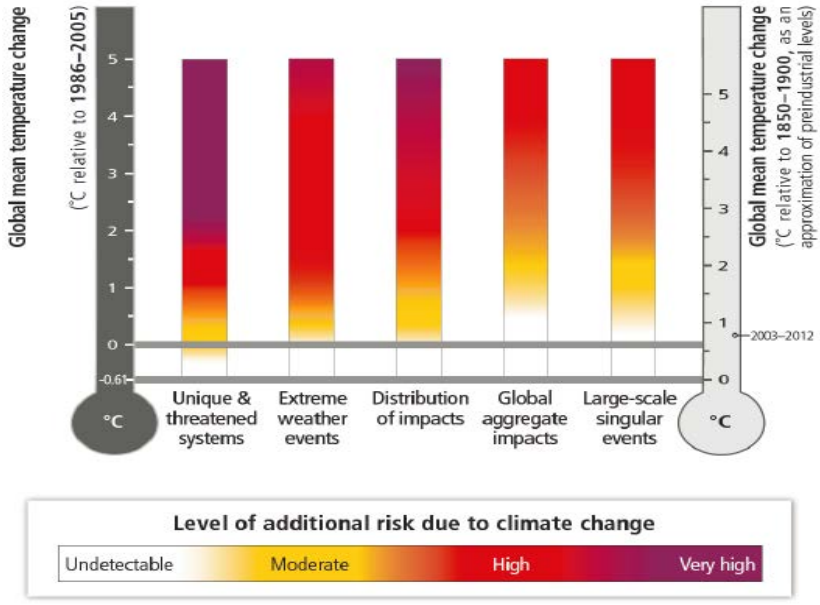
Fig. 2: Trends in GHG emissions by country income groups



Note: Left panel: Total annual anthropogenic GHG emissions 1970–2010 ($GtCO_2eq/yr$). Middle panel: Trends in annual per capita mean and median GHG emissions from 1970–2010 ($tCO_2eq/cap/yr$). Right panel: Distribution of annual per capita GHG emissions in 2010 of countries within each country income group ($tCO_2/cap/yr$).[11]

Without additional mitigation, global mean surface temperature is "more likely than not to exceed 4°C above pre-industrial levels by 2100. The risks associated with temperatures at or above 4°C include substantial species extinction, global and regional food insecurity, consequential constraints on common human activities, and limited potential for adaptation in some cases." (Fig. 3 and Fig. 4).

Fig. 3: A global perspective on climate-related risks.

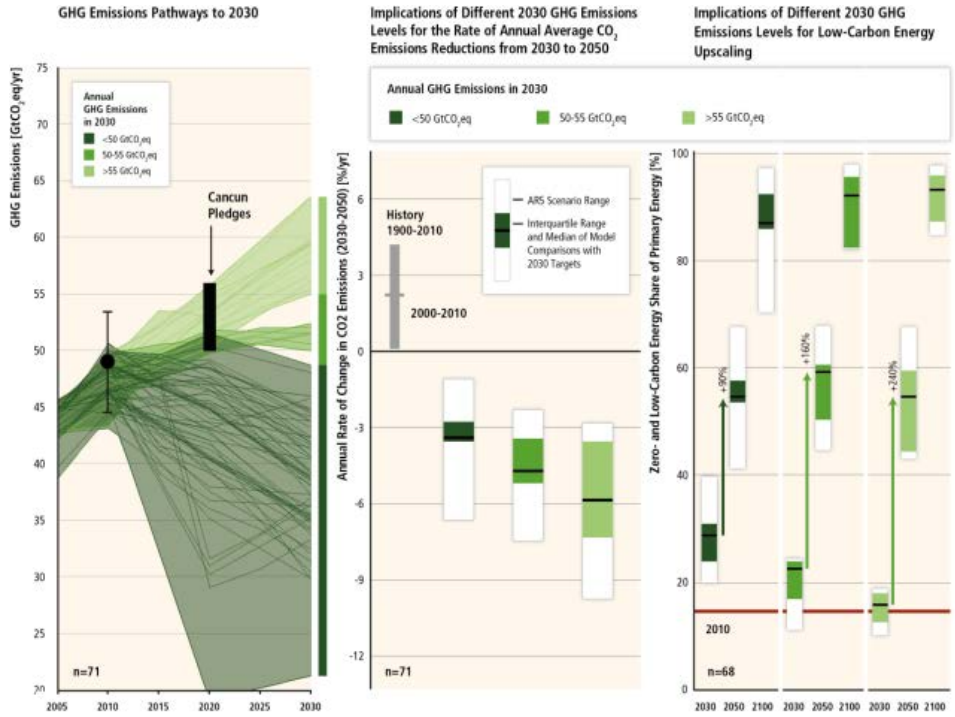


Note: Risks associated with reasons for concern are shown for increasing levels of climate change. The colour shading indicates the additional risk due to climate change when a temperature level is reached and then sustained or exceeded. Undetectable risk (white) indicates no associated impacts are detectable and attributable to climate change. Moderate risk (yellow) indicates that associated impacts are both detectable and attributable to climate change with at least medium confidence, also accounting for the other specific criteria for key risks. High risk (red) indicates severe and

11 *Source: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J. C. Minx (eds.). Figure TS.4. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

widespread impacts, also accounting for the other specific criteria for key risks. Purple, introduced in this assessment, shows that very high risk is indicated by all specific criteria for key risks.[12]

Fig. 4: The implications of different 2030 GHG emissions levels for the rate of CO_2 emissions reductions from 2030 to 2050 in mitigation scenarios reaching about 450 to about 500 (430 – 530) ppm CO_2eq concentrations by 2100



Note: The scenarios are grouped according to different emissions levels by 2030 (coloured in different shades of green). The left panel shows the pathways of GHG emissions ($GtCO_2eq/yr$) leading to these 2030 levels. The black bar shows the estimated uncertainty range of GHG emissions implied by the Cancún Pledges. The middle panel denotes the average annual CO_2 emissions reduction rates for the period 2030–2050. Annual rates of historical emissions change (sustained over a period of 20 years) are shown in grey. The arrows in the right panel show the magnitude of zero and low-carbon energy supply up-scaling from 2030 to 2050 subject to different 2030 GHG emissions levels.[13]

Limiting global temperature rise to 2°C over pre-industrial levels will require substantial emissions reductions over the next few decades and near zero emissions of carbon dioxide and other long-lived greenhouse gases by the end of the century. Mitigation cost estimates vary, but do not strongly affect global GDP growth (reaching 450ppm CO_2eq entails consumption losses of 1.7% (1%-4%) by 2030, 3.4% (2% to 6%) by 2050 and 4.8% (3%-11%) by 2100; this is equivalent to a reduction in consumption growth over the 21st century by about 0.06 (0.04-0.14) percentage points a year (relative to annualized consumption growth that is between 1.6% and 3% per year)). Cost estimates exclude benefits of mitigation (reduced impacts from climate change) and other benefits (e.g. improvements for local air quality). Mitigation costs increase with mitigation ambition,

12 *Source:* IPCC 2014: *Technical summary. In: 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* Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.). Figure TS.5. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 35-94.

13 *Source:* IPCC, 2014: *Summary for Policymakers. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.). Figure SPM.5. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

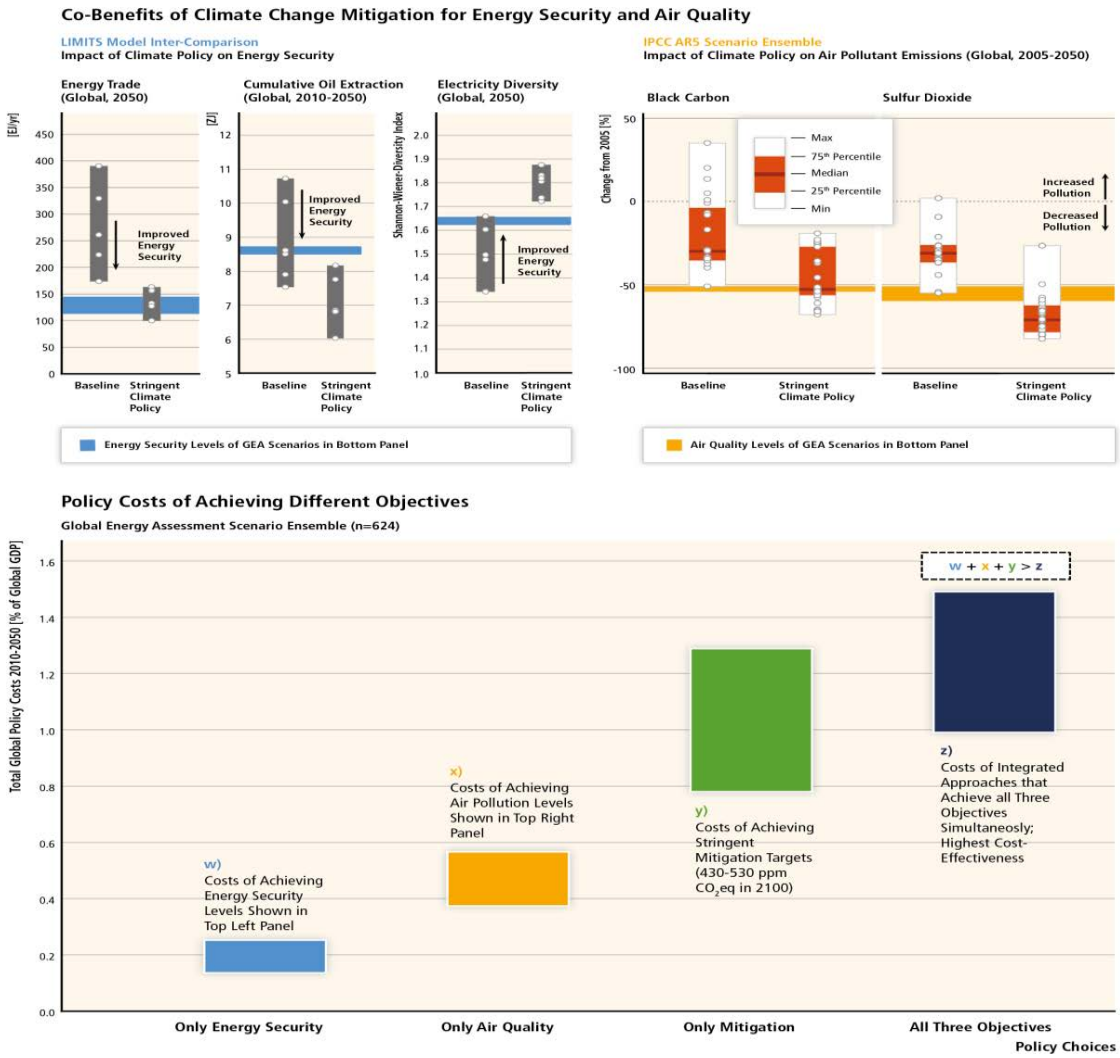
limited availability of technologies and delays in mitigation efforts. Delaying mitigation is estimated to increase the difficulty and narrow the options for limiting warming to 2°C.

Limiting global temperature rise poses substantial technological, economic, social, and institutional challenges. There will a need for (a) all countries cooperate and begin to mitigate immediately; (b) introducing a globally uniform price on all GHG emissions and (c) allowing the use of all key mitigation technologies. Mitigation can result in large near term and immediate co-benefits for human health and other societal goals.

Keywan Riahi, International Institute for Applied Systems Analysis, Graz University of Technology, summarized **the co-benefits and adverse side-effects of mitigation**, highlighting that the co-benefit effect is dependent on local circumstances and implementation practice. IPCC WGIII carried out a systematic mapping of possible co-benefits & adverse side-effects in the energy supply, transport, buildings, industry AFOLU[14] and human settlements and infrastructure chapters. The key message was: 'potential co-benefits for energy end-use measures outweigh the potential for adverse effects whereas the evidence suggests this may not be the case for all energy supply and AFOLU measures' and "Stringent mitigation measures can lead to major cuts of air pollution emissions (aggregate effect). Mitigation scenarios reaching about 450 or 500 ppm CO_2 show reduced costs for achieving air quality [...], with significant co-benefits for human health [and] ecosystem impacts. The benefits [...] are particularly high where currently legislated and planned air pollution controls are weak". (Fig. 5)

[14] agriculture, forestry and other land use

Fig. 5: Co-Benefits of Climate Change Mitigation for Energy Security and Air Quality



Note: Co-benefits of mitigation for energy security and air quality in scenarios with stringent climate policies reaching about 450 to about 500 (430–530) ppm CO_2eq concentrations in 2100. Upper panels show co-benefits for different security indicators and air pollutant emissions. Lower panel shows related global policy costs of achieving the energy security, air quality, and mitigation objectives, either alone (w, x, y) or simultaneously (z). Integrated approaches that achieve these objectives simultaneously show the highest cost–effectiveness due to synergies (w + x + y > z).[15]

He also added, that the Global Energy Assessment (GEA) [16] highlighted, that "currently planned climate change legislation is not sufficient in many regions" and that "Climate policies can contribute in major ways to reach WHO guidelines".

Oliver Lah, Transport Chapter of IPCC Working Group III presented **common cross-sector key messages,** 'strong, mutually supportive policies are required to decarbonize and achieve co-benefits' *and* 'properly designed policies can generate synergies between health and climate related objectives.' Sector-specific key messages were presented (see

[15] *Source:* IPCC, 2014: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.). Figure TS.14. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA

[16] GEA, 2012: *Global Energy Assessment – Toward a Sustainable Future*, Cambridge University Press, Cambridge UK and New York, NY, USA and the International Institute for Applied Systems Analysis, Laxenburg, Austria.

Table 1). Examples of trade-off- and synergy-inducing measures from the transport sector were outlined, including fuel and vehicle tax, and environmental protection zones.

Table 1. Draft table on health and other benefits and/or impacts of several GHG emission reduction measures[17]

Measures	Potential health co-benefits	Potential adverse impact
Energy supply		
Renewable energy (wind, solar, geothermal) replacing coal	Reduced air pollution (except bioenergy); reduced coal mining accidents and potentially less cancer. (Coal was classified as carcinogenic by IARC[18].)	Occupational dust and toxic exposures associated with solar PV panel production; Occupational injuries; Increased threat of displacement (for large hydroelectric installations) and ecosystem disruption.
	Social benefit: off- grid energy access at points of greatest need, and as substitutes for stand-alone diesel generators and kerosene lighting.	
Nuclear replacing coal	Reduced air pollution and occupational hazards from coal mining. Increased energy security (resulting from reductions in fuel price volatility).	Public health risks from potential nuclear accidents; occupational health risks of radiation exposure, and long-term public health and occupational health risks from nuclear waste storage and treatment. Security risks associated with nuclear proliferation, and nuclear sabotage and terrorism.
Methane leakage prevention, capture and treatment	Reduced air pollution; occupational safety at coal mines.	Increased natural gas extraction through for example hydraulic fracturing: concerns about long-term contamination of surface and ground water sources with benzene and other health-damaging carcinogens, either through poor wastewater disposal or the fracking process itself. Increasing rates of methane, BETEX chemicals (benzene, toluene, ethyl benzene, and xylene), and radon, which are known to cause chronic respiratory disease and lung cancer in these settings.
Transport		
Reduction of fuel carbon intensity	Reduced urban air pollution – in particular, from use of electricity, hydrogen fuel; compressed natural gas and biofuels (unclear) In the case of electrified vehicles, there is significantly less urban noise exposure, which may lead to less noise-related stress, mental health and cardiovascular disease (among other things). There is no improvement in physical activity or risks of traffic injury and no improvement in access for groups without cars.	Adverse impacts: via increased urban air pollution from use of diesel fuel;
		Reduced road safety (silent electric cars at low speed)
Reduction of energy intensity	Reduced urban air pollution; increased road safety	
Compact urban form, improved transport infrastructure, modal shift	For non-motorized modes: can reduce obesity as well as risks of diseases related to physical inactivity, including diabetes, cancer, and cardiovascular disease.	Increased active transport may see potentially higher exposures to urban air pollution and traffic by pedestrians and cyclists if not accompanied by lower levels of car use and

[17] *Source:* Compiled and adapted from IPCC, 2014: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. pp. 72, 77, 80, 86, 89 and Smith, K.R., A. Woodward, D. Campbell-Lendrum, D.D. Chadee, Y. Honda, Q. Liu, J.M. Olwoch, B. Revich, and R. Sauerborn, 2014: Human health: impacts, adaptation, and co-benefits. In: *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* Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 709-754. Reproduced with permission.

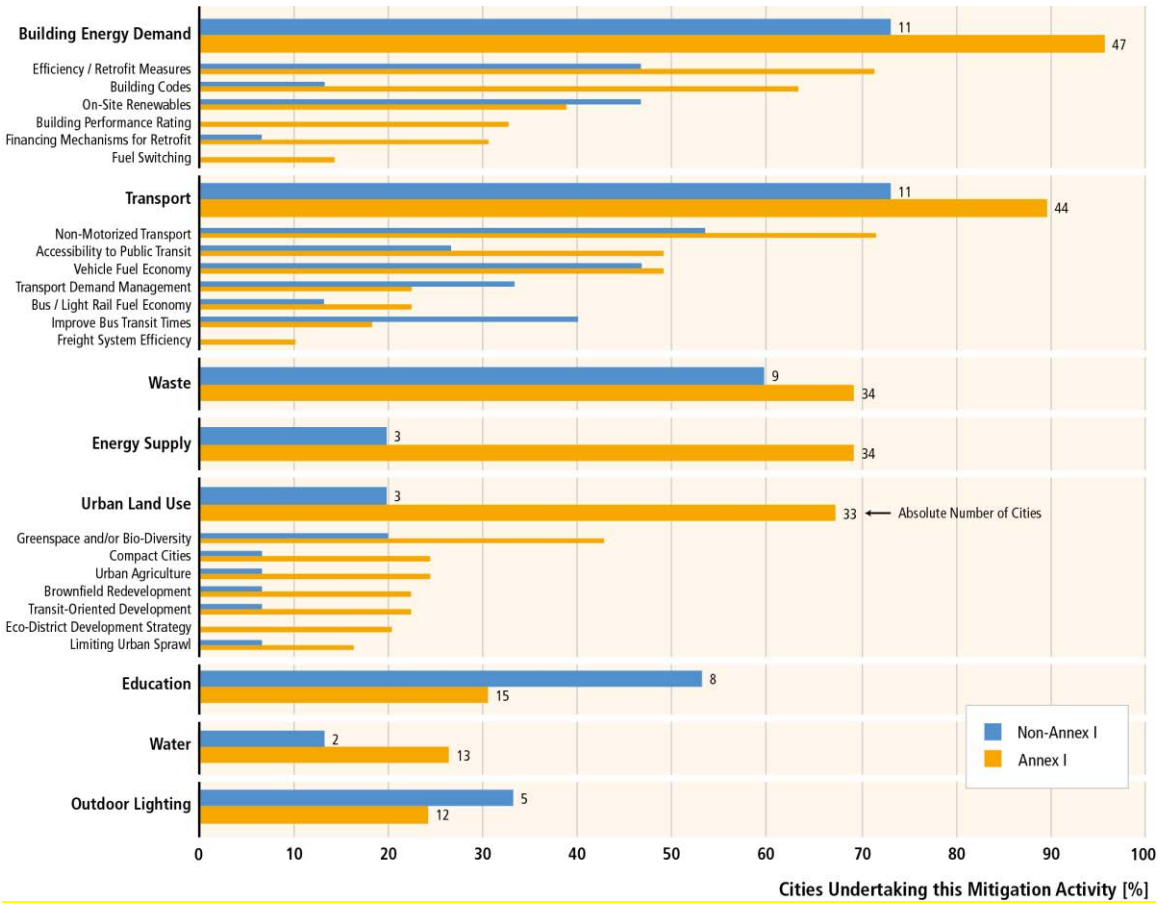
[18] Straif K, Cohen A, Samet J, eds. Air pollution and cancer. IARC Scientific Publication No. 161. Lyon, France; International Agency for Research on Cancer; http://www.iarc.fr/en/publications/books/sp161/index.php (accessed 2 December 2014).

	reduced urban noise (modal shift and travel reduction), reduces stress and sleep-related illness, and may improve mental health and well-being.	investments in safe non-motorized networks.
	Other co-benefits include equitable mobility access to services, jobs, education and leisure opportunities, particularly in developing countries	
	Increased road safety (via modal shift and/or infrastructure for pedestrians and cyclists) and less risk of injury.	
Journey reduction and avoidance	Reduced levels of air pollution, increased physical activity: through non-motorized transport modes	
Buildings		
Fuel switching, renewable energy source incorporation, green roofs, and other measures that reduce emission intensity	Clean fuels: have lower emissions of health-damaging CO, PM pollution, including black carbon, resulting in fewer premature deaths. The use of biogas can lead to improved sanitation waste management due to anaerobic digestion of household and animal excrement. Improved solid fuel stoves that meet WHO guidelines emission rate standards, reduce air pollution.	Appropriate equipment and containers are needed to ensure safety (ethanol and liquefied petroleum gas (LPG) could lead to explosions, fires and burns).
Retrofits of existing buildings	Health co-benefits via reduced air pollution. reduced heat stress and risk of heat-related stroke; less cold-related disease risks; less exposure to damp.	Insufficient ventilation. (Better ventilation can reduce indoor air pollution exposure to a range of toxic chemicals, as well as radon and reduce risks of airborne disease transmission and asthma)
Behavioural changes reducing energy demand	Less outdoor air pollution; improved indoor environmental conditions	
Industry		
Carbon dioxide and/or non-carbon dioxide emission intensity reduction	Health co-benefit via: reduced local air pollution and better work conditions	
Energy-efficiency improvements via new processes and/or technologies	Health co-benefit via: reduced local pollution improved water availability and quality safety, better working conditions and job satisfaction	
	Other co-benefits: new business opportunities	
Material efficiency of goods, recycling	Other co-benefits: new business opportunities and potential reduced local conflicts	Concerns for safety of new products or recycled products
Product demand reductions	Other co-benefits: reduced inequity in consumption; new diverse lifestyle concept	
Agriculture, forestry and other land use (AFOLU)		
Supply side: forestry, land-based agriculture, livestock, integrated systems, and bioenergy	Other co-benefits include:increased food-crops production through integrated systems and intensified sustainable agriculture Incineration of fuels such as biogas produced through anaerobic digestion (e.g. of animal or human waste) further reduces both the pollution and GHG impacts.	Reduced food production (locally) due to large-scale monocultures of non-food crops; Questions arise regarding true long-term sustainability of biomass, because of deforestation impacts.
Demand side: reduced losses in the food supply chain, changes in human diets, changes in demand for wood and forestry products	Human health and animal welfare benefits: through reduced use of pesticides and reduced burning practices. Shifting to diets richer in fresh, in-season vegetables, fruits and legumes: reduces risks of obesity, heart disease and cancers associated with excessive consumption of red meat and some processed foods. Important biodiversity of food systems, for healthy dietary diversity..	

Nick Watts, Director of The Global Climate & Health Alliance, built on this and presented the health and mitigation considerations by sector, including energy, transport, buildings, industry, and agriculture forestry and other land use. He concluded that there is need for public health professionals feeling more confident with the proposed measures. This requires engagement of public health professionals in sectorial policy formulation and implementation. He further stressed the need for a transformational change.

Felix Creutzig presented the **co-benefits of mitigation in an urban environment**. In 2011, more than half of the world population (52%) live in urban areas and each week the global urban population increases by 1.3 million[19]. In 2006 these urban centres were response for some 71 – 76% of energy-related CO_2 emissions. Aware of this, many cities in the World have started to take action. (Fig. 6)

Fig. 6: Common mitigation measures in Climate Action Plans.[20]



Air pollution was highlighted as a driver of inequality, with the potential for non-motorized-travel (NMT) and urban design to provide public health benefit. Tools such as cool roofs and 'greening' were presented as opportunities for mitigation and adaptation (to offset climate change and reduce risk to public health from heat waves). He concluded by saying, that "*Local health benefits of integrated urban mitigation policies vastly outperform climate benefits. Transport & urban planning emerge as crucial long-term public health/ climate mitigation domains; health-concerned cities could drive climate mitigation; but the global prisoner's dilemma is mirrored in an urban prisoner's dilemma (it is the individual advantage to use cars); an integrated urban strategy*

[19] Seto K. C., S. Dhakal, A. Bigio, H. Blanco, G. C. Delgado, D. Dewar, *et al.* 2014: Human Settlements, Infrastructure and Spatial Planning. In: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, *et al.* (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

[20] *Source:* IPCC, 2014: *Technical Summary In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.). Figure TS.34. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

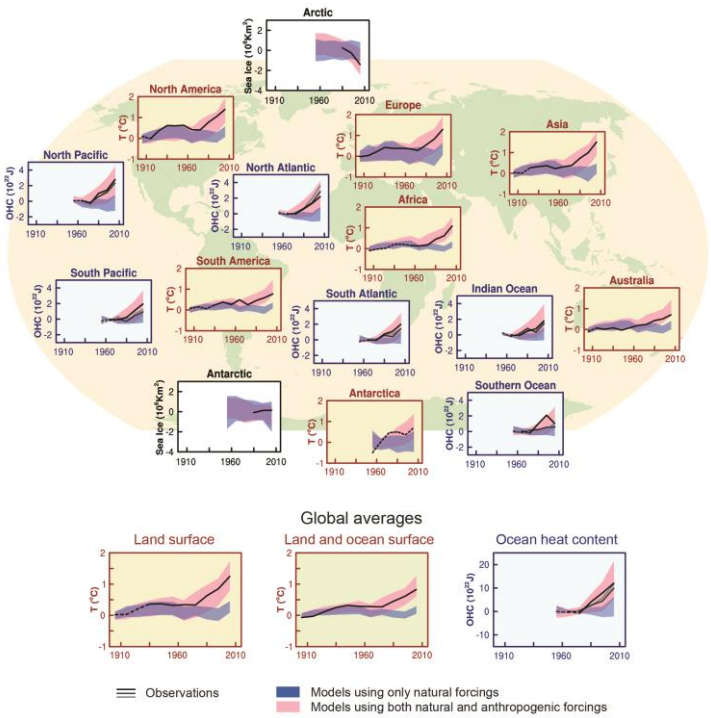
department on Quality of Life, Public Health and Climate change could direct long-term urban planning processes"

Hilary Graham, University of York, delivered a presentation framing future **generations as a springboard for public behaviour change**. Lifestyle and behavioural change have been identified as a crucial measure to reduce GHG emissions. Her findings challenge the perception that the public is inclined to 'discount the future', as proposed by standard economic and policy appraisals. The potential for information-based interventions is fundamentally limited; as much human behaviour is influenced by environmental stimuli and cues. Therefore, there is a need for multilateral and comprehensive approaches to behaviour change. Graham presents the fate of future generations as a powerful motivator in initiating behaviour change, with levels of United Kingdom smoking cessation during pregnancy as an example of increased behaviour change with respect to background quitting rate (six-fold higher). Evidence suggests that the public are preferentially inclined to support policy decisions with an equal cost–benefit to future generations versus present population. Harnessing this commitment to future generations could provide a platform for changing behaviours to address climate change.

The physical science and impacts, adaptation and vulnerability

Gian-Kasper Plattner, Head of the IPCC WGI outlined current observations in the climate system; how understanding is changing and what the future impacts of climate change might be. He stressed that "warming of the climate system is unequivocal and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased. Changes in many extreme weather and climate events have been observed since about 1950. It is likely that the frequency of heat waves has increased in large parts of Europe, Asia and Australia. The frequency or intensity of heavy precipitation events has likely increased in North America and Europe" and" that heat waves will likely occur with higher frequency and duration, with continuing occasional cold winter. He added that "Human influence has been detected in warming of the atmosphere and the ocean, in changes in the global water cycle, in reductions in snow and ice, in global mean sea level rise, and in changes in some climate extremes. It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century". (Fig. 7)

Fig. 7: Comparison of observed and simulated climate change based on three large-scale indicators in the atmosphere, the cryosphere and the ocean



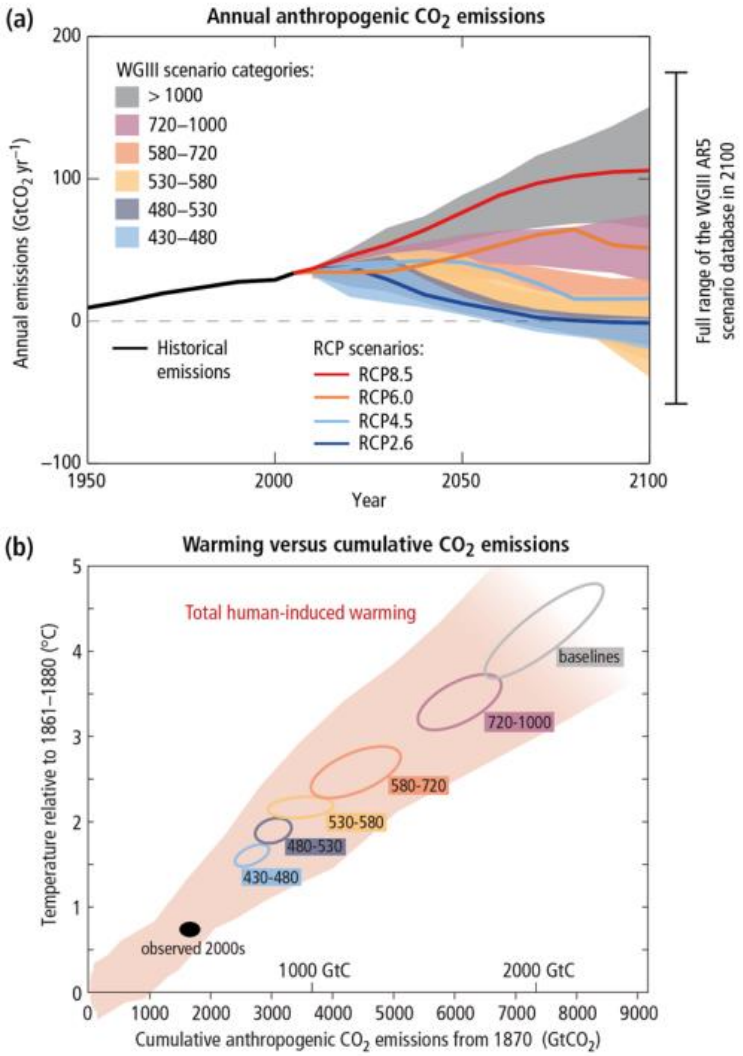
Note: Comparison of observed and simulated climate change based on three large-scale indicators in the atmosphere, the cryosphere and the ocean: change in continental land surface air temperatures (yellow panels), Arctic and Antarctic September sea ice extent (white panels), and upper ocean heat content in the major ocean basins (blue panels). Global average changes are also given. Anomalies are given relative to 1880–1919 for surface temperatures, 1960–1980 for ocean heat content and 1979–1999 for sea ice. All time-series are decadal averages, plotted at the centre of the decade. For temperature panels, observations are dashed lines if the spatial coverage of areas being examined is below 50%. For ocean heat content and sea ice panels the solid line is where the coverage of data is good and higher in quality, and the dashed line is where the data coverage is only adequate, and thus, uncertainty is larger. Model results shown are Coupled Model Intercomparison Project Phase 5 (CMIP5) multimodel ensemble ranges, with shaded bands indicating the 5 to 95% confidence intervals.[21]

He concluded that *"limiting total human-induced warming to less than 2°C relative to the period 1861–1880 with a probability of >66% would require cumulative CO_2 emissions from all anthropogenic sources since 1870 to remain below about 2900 $GtCO_2$ (with a range of 2550–3150 $GtCO_2$ depending on non-CO_2 drivers). About 1900 $GtCO_2$ had already been emitted by 2011*".[22]

[21] *Source*: IPCC, 2013: *Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.). Figure SPM.6. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1–30

[22] IPCC, 2014. Summary for Policymakers. In: Climate Change 2014: Synthesis Report. R. Pachauri, L. Meyer et al. (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA

Fig. 8: Annual anthropogenic CO2 emissions and warming versus cumulative CO2 emissions



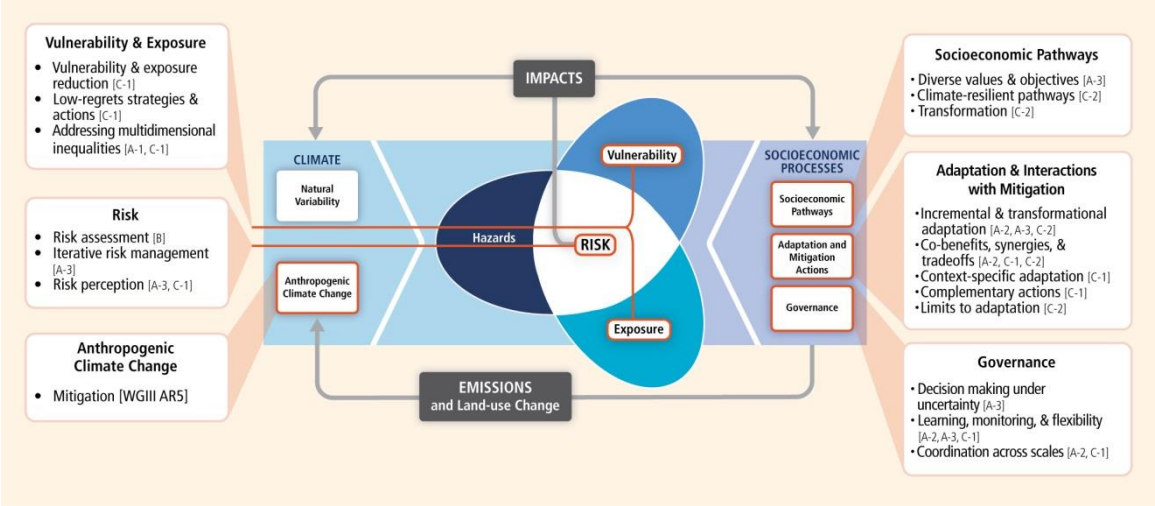
(a) Emissions of CO_2 alone in the Representative Concentration Pathways (lines) and the associated scenario categories used in WGIII (coloured areas show 5–95% range). The WGIII scenario categories summarize the wide range of emission scenarios published in the scientific literature and are defined on the basis of CO_2eq concentration levels (in ppm) in 2100.
(b) Global mean surface temperature increase at the time global CO_2 emissions reach a given net cumulative total, plotted as a function of that total, from various lines of evidence. Coloured plume shows the spread of past and future projections from a hierarchy of climate–carbon cycle models driven by historical emissions and the four RCPs over all times out to 2100, and fades with the decreasing number of available models. Ellipses show total anthropogenic warming in 2100 versus cumulative CO_2 emissions 1870–2100 from a simple climate model (median climate response) under the scenario categories used in WGIII. The width of the ellipses in terms of temperature is caused by the impact of different scenarios for non-CO_2 climate drivers. The filled black ellipse shows observed emissions to 2005 and observed temperatures in the decade 2000–2009 with associated uncertainties.

José Moreno, Vice Chair of WGII, University of Castilla-La Mancha Toledo, Spain, delivered a presentation on the **key findings of the WGII in relation to impacts, adaptation and vulnerability**. It was outlined that WGI is the starting point of work in this area, that human interference with the climate system is occurring and climate change poses risks for human and natural systems[23]. He stressed that WGII used a risk

[23] A "human system" is defined in the glossary to AR5 WGII as "*Any system in which human organizations and institutions play a major role. Often, but not always, the term is synonymous with society or social*

based approach. By focusing on risk, decision-making can be supported through people and society. (see Fig. 9)

Fig. 9: Illustration of the core concepts of the WGII AR5



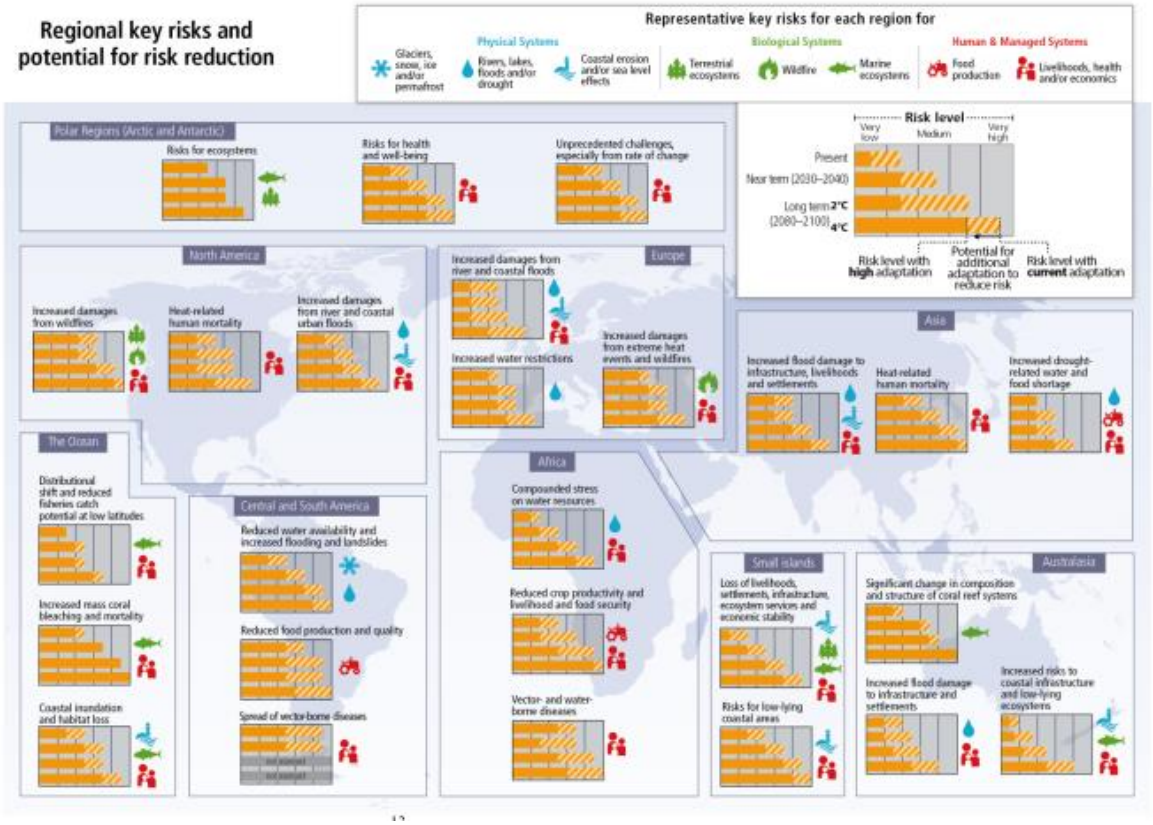
Note: Risk of climate-related impacts results from the interaction of climate-related hazards with the vulnerability and exposure of human and natural systems. Illustrating overlapping entry points and approaches, as well as key considerations, in managing risks related to climate change.[24]

The presentation outlined the impacts of climate change, including the physical, social, and geopolitical impacts as well as changes to biodiversity. Sectors highlighted were agriculture and food, species and ecosystems, coastal and low-lying areas, marine systems, urban areas, rural areas, economic sectors, and human security. The presentation noted that vulnerability to climate change has no single cause and that inequality is a fundamental principle in the progression of climate change. Fig. 10 describes the different key risks in specific regions.

system. Systems such as agricultural systems, political systems, technological systems, and economic systems are all human systems in the sense applied in this report."

[24] Source: IPCC, 2014: Summary for Policymakers. In: 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 Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.). Figure SPM.8. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1-32.

Fig. 10: Regional key risks and potential for risk reduction

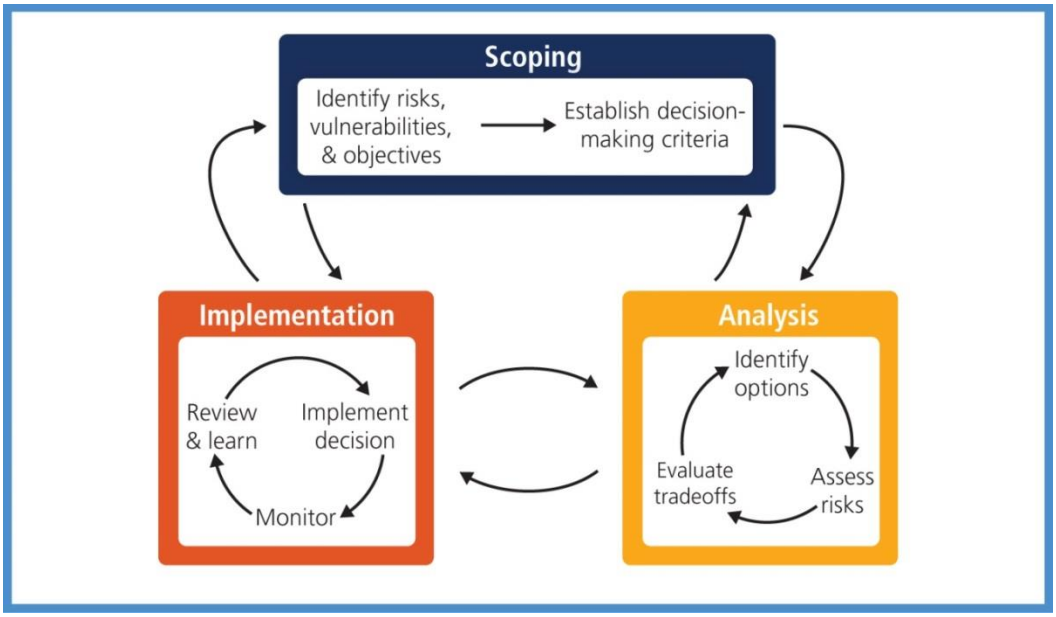


Note: Representative key risks for each region, including the potential for risk reduction through adaptation and mitigation, as well as limits to adaptation. Each key risk is assessed as very low, low, medium, high, or very high. Risk levels are presented for three time frames: present, near term (here, for 2030–2040), and long term (here, for 2080–2100). In the near term, projected levels of global mean temperature increase do not diverge substantially across different emission scenarios. For the long term, risk levels are presented for two possible futures. For each timeframe, risk levels are indicated for a continuation of current adaptation and assuming high levels of current or future adaptation. Risk levels are not necessarily comparable, especially across regions.[25]

He concluded by saying that "responding to climate-related risks involves decision-making in a changing world, with continuing uncertainty about the severity and timing of climate-change impacts and with limits to the effectiveness of adaptation" Iterative risk management is a useful framework for decision-making in complex situations characterized by large potential consequences, persistent uncertainties, long timeframes, potential for learning, and multiple climatic and non-climatic influences changing over time. Fig. 11 illustrates this continuous process.

25 *Source:* IPCC, 2014: *Summary for Policymakers. In: Climate Change 2014: Synthesis Report. Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Figure SPM.8. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1-32.

Fig. 11: Climate-change adaptation as an iterative risk management process with multiple feedbacks.[26]



George Luber, Associate Director of Climate Change, Climate Change and Health Program, National Centre for Environmental Health, Centers for Disease Control and Prevention summarized **key emerging risks and key vulnerabilities.** Chapter 19's objectives were to "assesses climate-related risks in the context of Article 2 of the United Nations Framework Convention on Climate Change (UNFCCC)"[27] and 'recognizing and reassessing arising risks[28] and vulnerabilities[29] from complex socioecological and climatological systems.' A risk that arises from the interaction of phenomena in a complex system was defined in the chapter as an emergent risk. An example provided was the Arctic where thawing and sea ice loss disrupt land transportation, buildings, other infrastructure, and are projected to disrupt indigenous culture. Differences in vulnerability and exposure arise from non-climatic factors and from multidimensional inequalities often produced by uneven development processes. "People who are socially, economically, culturally, politically, institutionally, or otherwise marginalized are especially vulnerable to climate change and also to some adaptation and mitigation responses." Newly assessed health risks mentioned included "those high ambient CO_2 concentrations in the atmosphere will affect human health by increasing the production and allergenicity of pollen and allergenic compounds and by decreasing nutritional quality of important food crops".

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[26] Source: IPCC, 2014: Summary for Policymakers. In: 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 Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.). Figure SPM.3. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1-32.

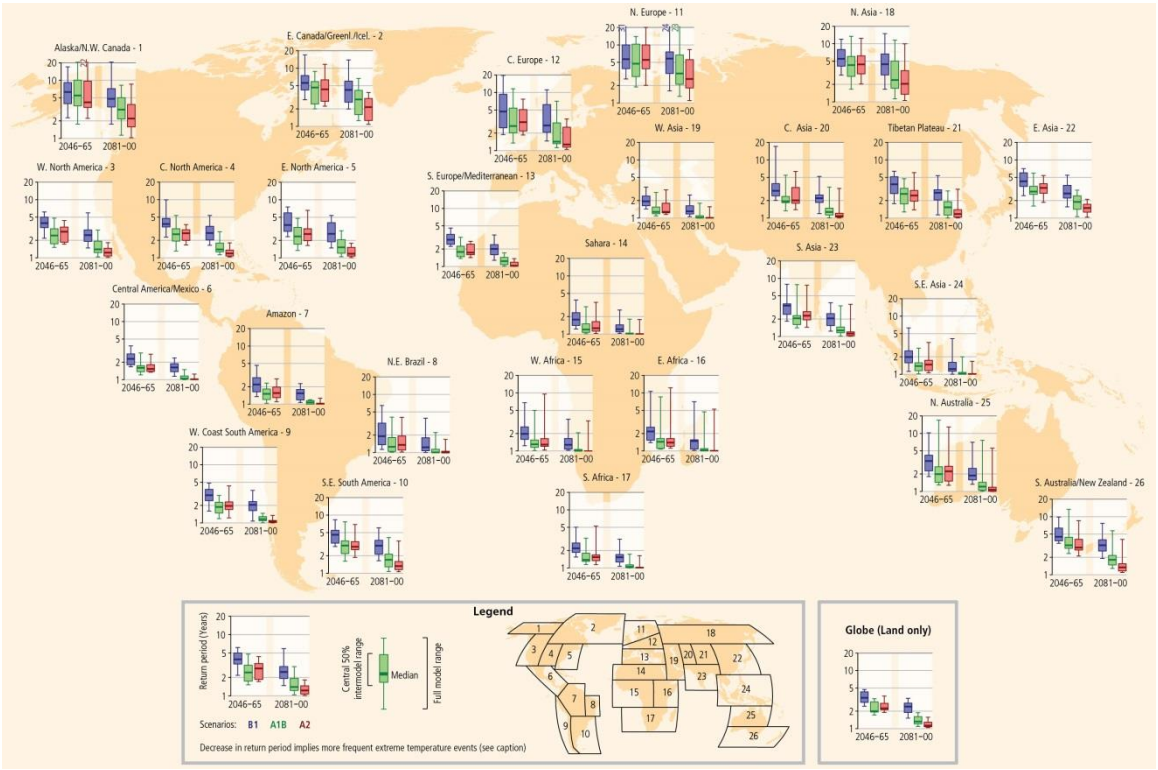
[27] Article 2 of the UNFCCC establishes the objective of the convention as being "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."

[28] Risks are considered "key" due to high hazard or high vulnerability of societies and systems exposed, or both vulnerabilities are considered "key" if they have the potential to combine with hazardous events or trends to result in key risks. Vulnerabilities that have little influence on climate-related risk, for instance, due to lack of exposure to hazards, would not be considered key

[29] Vulnerability – the propensity or predisposition to be adversely affected. It encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

Maarten van Aalst, Red Cross/Red Crescent Climate Centre, presented the main **Lessons on extremes and disasters from IPCC WGII and SREX**. Economic losses from climate-related disasters have increased, with large spatial and inter-annual variation. The increasing exposure of people and assets has been a major cause of changes in disaster losses. Climate models project more frequent hot days throughout the 21st century, and there is a likely increase in heat waves in the WHO European Region with an increase in warm days and nights in Europe. Fig. 12 shows the projected return periods for maximum daily temperature.

Fig. 12: Projected return periods for the maximum daily temperature that was exceeded on average once during a 20-year period in the late 20th century (1981–2000)



Note: Projected return period (in years) of late 20th-century 20-year return values of the annual maximum of the daily maximum temperature. The bar plots (see legend for more information) show results for regionally averaged projections for two time horizons, 2046 to 2065 and 2081 to 2100, as compared to the late 20th century (1981-2000), and for three different SRES emission scenarios (B1, A1B, A2). Results are based on 12 GCMs contributing to the CMIP3. The 'Globe' analysis (inset box) displays the projected return period (in years) of late 20th-century 20-year return values of the annual maximum of the daily maximum temperature computed using all land grid points.[30]

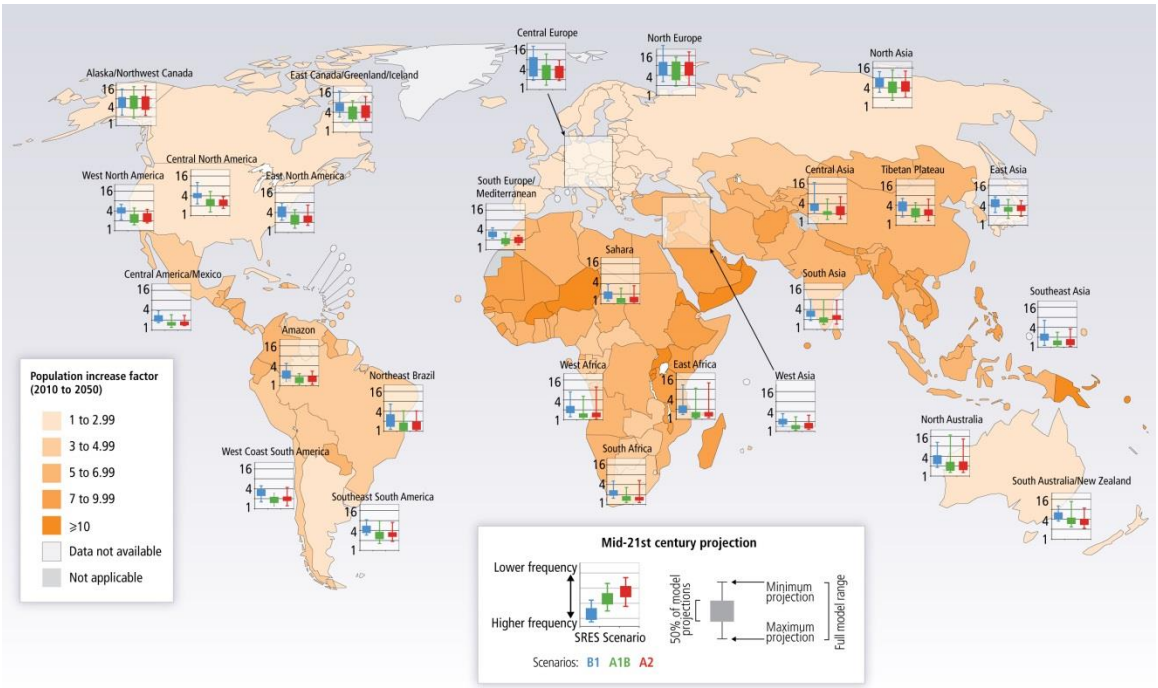
Hans Portner, CLA WGII author of Chapter 6 on **Ocean Systems** delivered background on the impact of climate change on the ocean. Physical evidence was outlined, including the oceans role as an insulator: absorbing 90% of the heat accumulated in the atmosphere. Displacement of marine species was highlighted as a key issue, with reference to the marginalization of certain ecosystems in the face of climate change. Deoxygenation, acidification and algal blooms were referenced in relations to other harmful impacts on climate change on the ocean environment. Further risks with consequences on social

30 *Source:* IPCC, 2012: *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change* Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.). Figure 3-5b. Cambridge University Press, Cambridge, UK, and New York, NY, USA, 582 pp.

economic development included: coastal security, reduced marine resources and impacts on the shipping industry. The impacts on human health have only recently started to be considered.

Alistair Woodward, Coordinating lead author of Chapter 11 of the IPCC WGII AR5, University of Auckland, presented the **key findings on human health of chapter 11**. He outlined the difficulty of detecting and attributing health impacts within the current scientific approaches. The Paracelsus notion of 'the dose makes the poison' was challenged by the view that in climate change it is 'the speed of climate change and variability of exposures which present risk factors in their own right nowadays'. The presentation confirmed the AR4 finding, on that the "present burden on health is currently small compared to other stressors" and that "Rising temperatures have increased the risk of heat-related death and illness". However in addition combined risks of population growth, aging and heat exposure were assessed (see Fig. 13)

Fig. 13: Projected changes (°C) in 20-year return values of the annual maximum of the daily maximum temperature



Note: Increasingly frequent heatwaves will combine with growing vulnerable populations. Bar graphs show how frequently a heat event that would have occurred only once in 20 years in the late 20th Century, is expected to occur in the mid-21st Century, under different climate change scenarios. Lower numbers indicate more frequent events. Countries are shaded according to the expected proportional increase in urban populations aged over 65.[31]

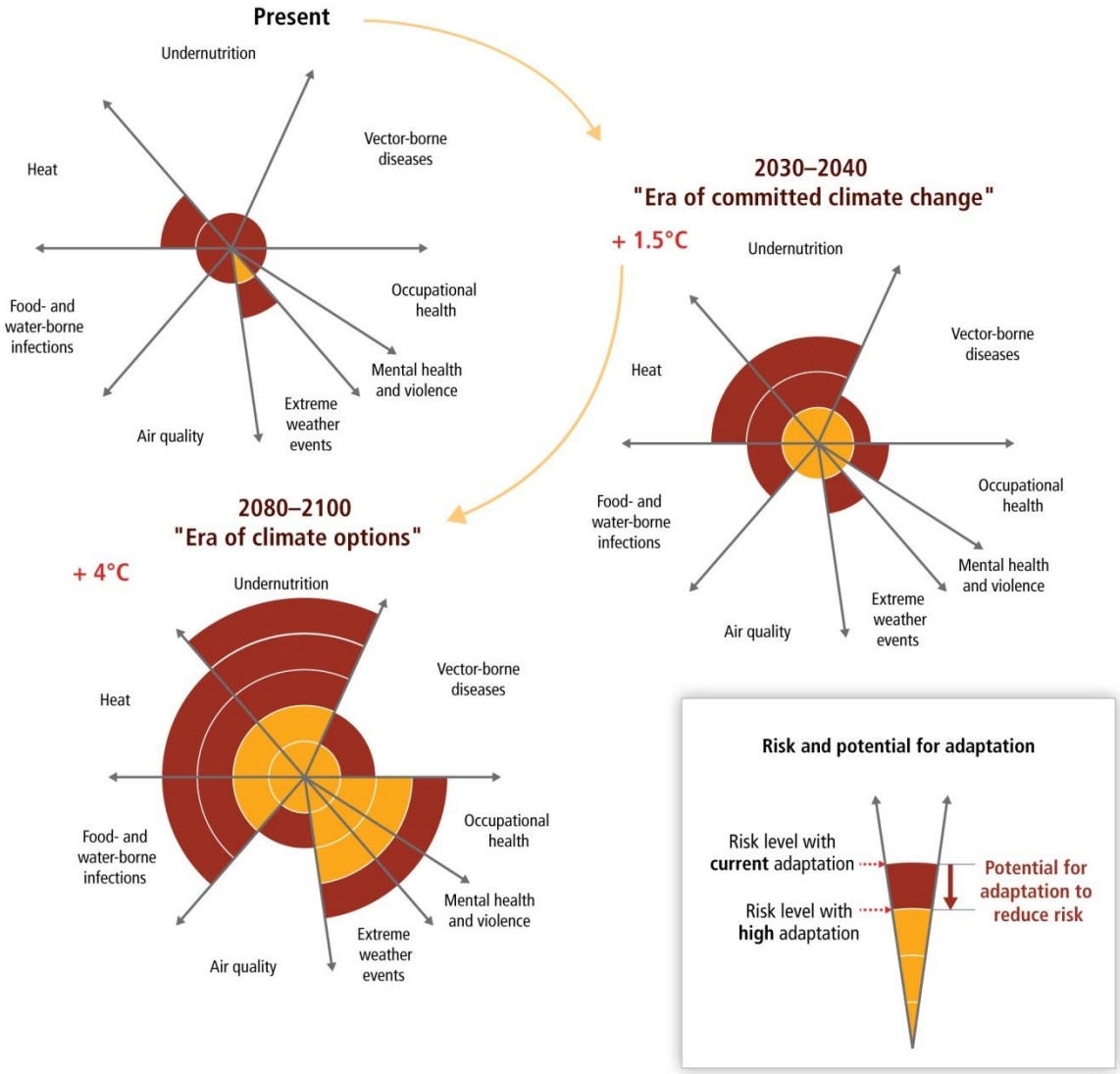
New findings on observed impacts include that "local changes in temperature and rainfall have altered distribution of some water-borne illnesses and reduced food production for some vulnerable populations" and that "Some parts of the world already exceed the international standard for safe work activity during the hottest months of the year" It further projects that "The capacity of the human body to thermoregulate may be exceeded on a regular basis, particularly during manual labour, in parts of the world during this century. In the highest Representative Concentration Pathway, RCP8.5, by 2100 some of

[31] *Source:* IPCC, 2012: *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change* Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.). Cambridge University Press, Cambridge, UK, and New York, NY, USA, 582 pp.

the world's land area will be experiencing 4°C to 7°C higher temperatures due to anthropogenic climate change. If this occurs, the combination of high temperatures and high humidity will compromise normal human activities, including growing food or working outdoors in some areas for parts of the year"

The projected changes confirm the AR4 findings, however identify new challenges over different timeframes and weight against adaptation (see Fig. 14).

Fig. 14: Conceptual presentation of the health impacts from climate change and the potential for impact reduction through adaptation



Note: Risks are identified in eight health-related categories based on assessment of the literature and expert judgments by authors of Chapter 11. The width of the slices indicates in a qualitative way relative importance in terms of burden of ill health globally at present. Risk levels are assessed for the present and for the near-term era of committed climate change (here, for 2030–2040). For some categories, for example, vector-borne diseases, heat/cold stress, and agricultural production and undernutrition, there may be benefits to health in some areas, but the net impact is expected to be negative. Risk levels are also presented for the longer-term era of climate options (here, for 2080–2100) for global mean temperature increase of 4°C above preindustrial levels. For each timeframe, risk levels are estimated for the current state of adaptation and for a hypothetical highly adapted state, indicated by different colours.[32]

[32] Source: Smith, K.R., A. Woodward, D. Campbell-Lendrum, D.D. Chadee, Y. Honda, Q. Liu, J.M. Olwoch, B. Revich, and R. Sauerborn, 2014: Human health: impacts, adaptation, and co-benefits. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects.

Diarmid Campbell-Lendrum, Climate change and health team leader of the Public Health and Environment Department, World Health Organization **adjourned some of the recent findings and described the relevance of IPCC findings for Adaptation Policy and Practice.**

A recent WHO study showed, that between 2030 and 2050, climate change is expected to cause approximately 250 000 additional deaths per year, from malnutrition, malaria, diarrhoea and heat stress. The direct damage costs to health (i.e. excluding costs in health-determining sectors such as agriculture and water and sanitation), is estimated to be between US$ 2-4 billion/year by 2030.[33] Areas with weak health infrastructure – mostly in developing countries – will be the least able to cope without assistance to prepare and respond. Health specific adaptation experience is accumulating across regions. Governments at various levels are starting to develop adaptation plans and policies and to integrate climate-change considerations into broader development plans. Most current health adaptation focuses on improvements in public health functions to reduce the current adaptation deficit, such as enhancing disease surveillance, monitoring environmental exposures, early warning and improved disaster risk management, risk mapping, provision of vaccination, medical supplies and facilitating coordination between health and other sectors to deal with shifts in the incidence and geographic range of diseases. Key messages of the IPCC report's on adaptation include the necessity for further strengthen basic public health measures, enhance climate specific measures and the human physiological limit to adaptation. There is a strong evidence base for the potentiating of disparities in public health in the face of climate change. The most important impacts of climate change on health act via environmental and social determinants of health. Limits to global adaptation capacity were outlined and the need for a systematic and structured approach to adaptation was clearly emphasized.

Regional Impacts. The WHO European Region spans several of the regions covered in the IPCC report, including Europe, Polar Regions and Asia. In this meeting, only Europe and Polar regions were considered, however a careful analysis also of other chapters is required.

Oleg Anisimov, CLA IPCC WGII, author of Chapter 28 "**Polar regions**" of the State Hydrological Institute, St Petersburg, the Russian Federation. Physical features include a reduction in duration of the ice period on rivers, reduction in the extent of sea ice, warming and thawing of permafrost and changes in the distribution and ranges of plant and animal species. Changing availability of critical supplies and services was highlighted as a specific risk in communities. Effect on diet, zoonotic diseases, infrastructure damage (health-related built environment (sanitation structures, water supply, nuclear waste storages, historic cattle burial grounds), release/transport of contaminants (POPs, radioactivity, heavy metals) and biomagnification in traditional foods, intrusion of new insects serving as disease vectors, and compromised traditional food preservation (ice cellars, drying) were outlined as indirect potential effects. There

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Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.). Figure TS.10. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 709-754.

[33] WHO 2014 Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s. Hales S., Kovats S., Lloyd S., Campbell-Lendrum D. (eds.). World Health Organization, Geneva, Switzerland.

will be an observed difference in the impact faced by rural as opposed to urban communities which should be considered in attempts to achieve adequate adaptation. Table 2 describes the key risks and potential adaptation options.[34]

Table 2: Key climate related risks in the Arctic and Antarctic, and potential adaptation practices[35]

Table 28-2 |Key climate-related risks in the Arctic and Antarctic, and potential adaptation practices.

Key risk	Adaptation issues & prospects	Climatic drivers	Timeframe	Risk & potential for adaptation
Risks for freshwater and terrestrial ecosystems (*high confidence*) and marine ecosystems (*medium confidence*), due to changes in ice, snow cover, permafrost, and freshwater/ocean conditions, affecting species' habitat quality, ranges, phenology, and productivity, as well as dependent economies [28.2-4]	• Improved understanding through scientific and indigenous knowledge, producing more effective solutions and/or technological innovations • Enhanced monitoring, regulation, and warning systems that achieve safe and sustainable use of ecosystem resources • Hunting or fishing for different species, if possible, and diversifying income sources	Warming trend; Snow cover; Ocean acidification	Present; Near term (2030–2040); Long term (2080–2100) 2°C 4°C	Very low – Medium – Very high
Risks for the health and well-being of Arctic residents, resulting from injuries and illness from the changing physical environment, food insecurity, lack of reliable and safe drinking water, and damage to infrastructure, including infrastructure in permafrost regions (*high confidence*) [28.2-4]	• Co-production of more robust solutions that combine science and technology with indigenous knowledge • Enhanced observation, monitoring, and warning systems • Improved communications, education, and training • Shifting resource bases, land use, and/or settlement areas	Warming trend; Snow cover	Present; Near term (2030–2040); Long term (2080–2100) 2°C 4°C	Very low – Medium – Very high
Unprecedented challenges for northern communities due to complex inter-linkages between climate-related hazards and societal factors, particularly if rate of change is faster than social systems can adapt (*high confidence*) [28.2-4]	• Co-production of more robust solutions that combine science and technology with indigenous knowledge • Enhanced observation, monitoring, and warning systems • Improved communications, education, and training • Adaptive co-management responses developed through the settlement of land claims	Warming trend; Snow cover	Present; Near term (2030–2040); Long term (2080–2100) 2°C 4°C	Very low – Medium – Very high

Climate-related drivers of impacts: Warming trend; Snow cover; Ocean acidification

Level of risk & potential for adaptation: Potential for additional adaptation to reduce risk; Risk level with **high** adaptation; Risk level with **current** adaptation

Sari Kovats, Coordinating Lead Author of Chapter 23 "**Europe**", WGII IPCC AR5 and LWEC Health Fellow at the department of Social and Environmental Health Research presented the key risks within western Europe of climate change and adaptation options. Specific focus was given on heat waves, flooding, emerging infections, air quality, food safety, social impacts and ecosystem services. Climate change adaptation by sector was outlined, including the necessity for: coastal zone management, integrated water resource management, disaster risk reduction/management, land use planning, and rural development. Table 3 illustrates the key identified risks and adaptation options.[36]

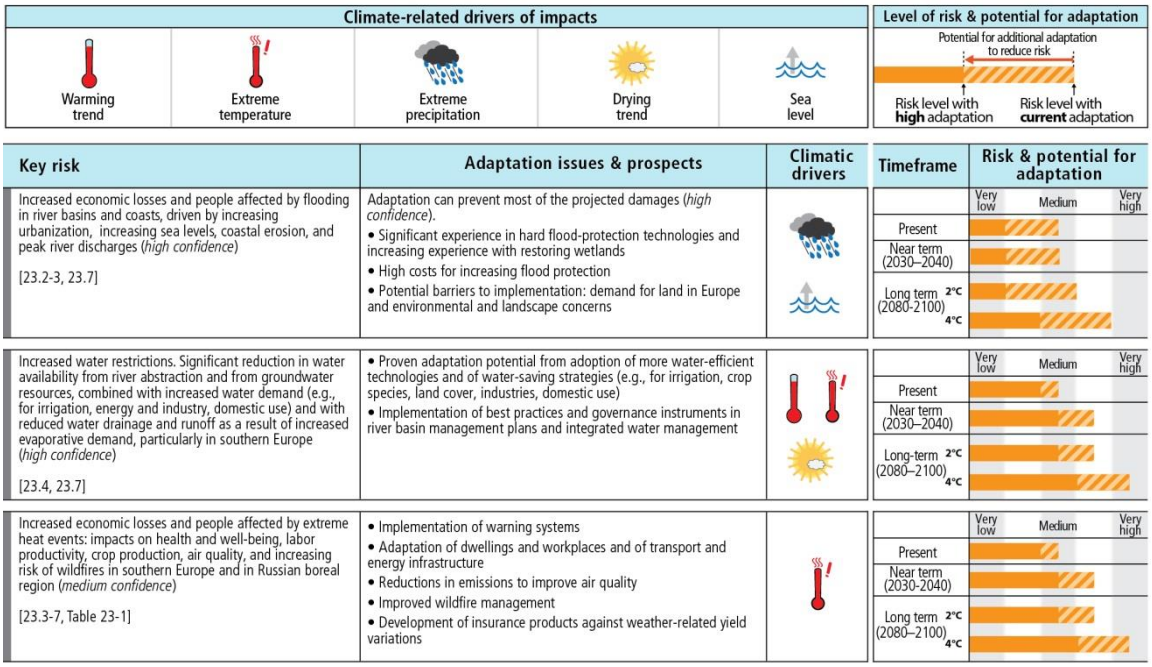
[34] IPCC, 2014: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Chapter 28: Polar Regions. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 688 pp.

[35] *Source:* IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 688 pp.

[36] IPCC, 2014: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Chapter 23: Europe. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 688 pp.

Table 3: Key risks from climate change in Europe and the potential for reducing risk through mitigation and adaptation[37]

Table 23-5 | Key risks from climate change in Europe and the potential for reducing risk through mitigation and adaptation. Risk levels are presented in three timeframes: the present, near-term (2030–2040), and longer term (2080–2100). For each timeframe, risk levels are estimated for a continuation of current adaptation and for a hypothetical highly adapted state. For a given key risk, change in risk level through time and across magnitudes of climate change is illustrated, but because the assessment considers potential impacts on different physical, biological, and human systems, risk levels should not necessarily be used to evaluate relative risk across key risks, sectors, or regions. Key risks were identified based on assessment of the literature and expert judgment.



She further described emerging health risks, for Europe. These include multiple systemic impacts of extreme weather events, cascade effects of systems and sectors affected on human health, such as through reduction of arable crop yields, change of distribution of terrestrial and freshwater species, changes to plant and animal health. She also mentioned a perceived positive emerging effect of awareness from European governments which may reduce vulnerability in western Europe.

Possible implications for the UNFCCC process

Dr Florin Vladu, Manager of the Adaptation Technology and Science Programme and Program Officer at UNFCCC Secretariat, provided updates to the IPCC AR5, including a near-term global and regional climate change projection supplement, a regional atlas, and mitigation scenarios. He delivered some key messages, based on the evidence presented, namely:

- The World is warming
  - The rise in global temperatures has not "paused" in recent years
  - Observed impacts of climate change are widespread and substantial
  - Adaptation to climate change is already occurring
  - CO_2 remains the main driver of climate change
  - The greenhouse gases reached levels that are unprecedented in at least 800,000 years

37 *Source:* IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 688 pp.

  - The emissions of GHGs increased at a growing pace despite reduction efforts, due to economic growth and, to a lesser extent, population growth
  - Cumulative CO_2 emissions have more than doubled since 1970 and regional patterns of emissions are shifting along with changes in the world economy

- The World is changing:
  - Global mean surface temperature might increase by 4°C over the 21st century.
  - World's coastlines will bear the brunt (just to give an example)
  - More deadly weather to come

- Our climate resilient future depends fundamentally on what we accomplish on mitigation:
  - Limiting warming below 2°C implies atmospheric concentrations in 2100 of about 450 ppm CO_2eq
  - Limiting warming below 2°C is still possible, but:
    - Requires major technological and institutional changes including the upscaling of low- and zero carbon energy. Delaying mitigation will increase the difficulty of limiting warming to 2°C
    - Entails a reduction in consumption growth over the 21st century by about 0.06 percentage points per year and requires large changes in investment patterns
    - Effective mitigation will not be achieved if individual agents advance their own interests independently (cooperation). Least-cost mitigation scenarios rely on strong institutions

- Our climate resilient future will also depend on how well we will be able to manage and reduce the risks
  - Otherwise: food production will be threatened; terrestrial and freshwater species will face increased extinction risks; urban areas will be at risk; impacts on water, food and agriculture incomes will affect rural areas; human health will be impacted; and the risks of violent conflicts will increase. Summarizing sectoral, regional and global risks helps us judge when they become dangerous and make decisions
  - Many risks are manageable through adaptation and clever development, should we get our act together!
  - Effective and inclusive climate-change adaptation can help build a richer, more resilient world in the near-term and beyond

He suggested that possible implications of the AR5 report on the international climate negotiations could be to:

- Make a case for ambition, equity and differentiation through nationally determined contributions and a mechanism to maintain ambition;
- Provide a long and near-term perspective on adaptation and mitigation;
- Inform on potential and limits of adaptation and mitigation;
- Inform on the social dimension of vulnerability, development processes and inequalities in societies;
- Provide arguments for mitigation action required to stay below 2°C and consequences of delayed mitigation.

Discussion

Participants agreed that the time for action is now as the window of opportunity to mitigate these scenarios is narrowing by the day. Delayed action in reducing greenhouse gas emissions will increase costs and its impact. Crucially, many of the causes of climate change such as fossil fuel combustion, poorly-designed cities, and overdependence on motorised transport, are also major drivers of the world's fastest-growing public health problem – noncommunicable diseases. By designing smart climate mitigation policy, efforts to reduce carbon emissions offer profound co-benefits for health, which in turn result in cost-savings for the health care system and for governments in general. Measures discussed included, (1) sectoral measures; (2) measures in settings and (3) behavioural change.

It was added, that putting the health sector on a low-carbon trajectory can benefit health systems through greater energy efficiencies, greener forms of on-site power generation, through renewables and co-generation of heat and power, as well as shifting to greener procedures at every link in the health service procurement and delivery chain. Low-carbon energy solutions may also help improve access to energy for vital services. This can be essential to address the energy gap in rural areas, a key constraint to the achievement of universal health coverage. It was however concluded, that low-cost opportunities to avoid ill health are being not systematically addressed.

Discussion on climate change and its impacts, vulnerability and adaptation, mainly agreed that climate change differs from many traditional environment and health issues, in that it acts over long periods, is subject to multiple uncertainties, is strongly mediated by social, economic and environment determinants, and causes diverse and interacting health impacts.

The strongest evidence available is for the following health impacts anticipated 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 undernutrition resulting from diminished food production in poor regions;
- consequences for health of lost work capacity and reduced labour productivity in vulnerable populations.

There is emerging concern about some of the cascade effects which climate change can have on major health determinants. 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.

Key single overarching communication outcome (SOCO)

The scientific findings of the three IPCC working groups formed the basis for a communications discussion. Cristiana Salvi, Communications Officer at the WHO Regional Office for Europe, presented a concept note on the **development of single overarching communication outcomes** (SOCOs). Operational guidelines included the identification of (i) an effective and appropriate SOCO, and (ii) reachable target audiences. Questions to deal with and potential responses, included:

Step 1: **what** is our issue?
- Health effects? Health adaptation? Health co-benefits of mitigation? Sustainable development?

Step 2: why do we want to focus on this issue and why do we want to focus on it **now**?
- New IPCC report with new and stronger evidence? Health co-benefits of mitigation for NCD reduction? Dramatic scenarios and irreversible changes?

Step 3: what do we want to see **changed** as a result of our communication (our SOCO)?
- Keeping warming under 2°C? Increased resilience to climate change? Health sector's stewardship and leading by example? Health sector's action and/or whole government's action? Urgency of action?

Step 4: which groups of persons are best to **target** to achieve our SOCO?
- Ministry of Health, or other sectors (i.e. economics), or whole of government, cities or others?

Step 5: what is the compelling **new piece of information** that is relevant to our audience now?
- Evidence on health impacts of climate change have been known since at least IPCC AR4!

Experts looked into practical approaches to communicate the findings based on evidence, focussing on the expected magnitude of health risks, the solution for improving people's health now and in the future, and taking into account available resources and stakeholder engagement.

Cristiana Salvi commented on the five key points to remember when targeting an audience for maximum effect and comprehension:
- Point – People are overloaded with information.

- Relevance – People remember things that have meaning to them.
- Number – People won't remember more than 5 things, 3 is optimal.
- Breaks – People retain information when there are regular breaks.
- Action – When people have something to do they remember the message more.

The 7Cs of communication were recalled: in particular issues like communicate a benefit, cater to the heart and the head, as well as create trust and call to action, were considered most important.

Experts in different working groups crafted four SOCOs targeted to four audiences, as well as one key message (KM) per SOCO and several messages:

- For local governments: Make cities sustainable and climate resilient.
  a. KM: **A healthy city is climate resilient and low-carbon.**
  b. Climate change is affecting your city, but it is a manageable risk.
  c. Sustainable cities are healthier and more liveable.
  d. Low-carbon resilient cities provide multiple benefits for residents.
  e. Climate change threatens health in cities.
  f. Cities are at the frontline of climate policy.

- For European policy-makers:
  a. KM: **Mitigate greenhouse emissions to obtain immediate health gains**
  b. Mitigation can lead to substantial cost savings in health care.
  c. The health sector can lead by example.
  d. By cutting carbon we can fight noncommunicable diseases.

- For negotiators of the climate convention: Integrate health into negotiations of the United Nations Framework Convention on Climate Change.
  a. KM: **Human health and well-being is one of the most important outcome and driver of climate change policy.**
  b. There is a need for urgent action now.
  c. Human health is the most important outcome and driver of climate policy.
  d. Collaborate with other sectors for combined action.
  e. State Parties to explore the health co-benefits and health costs of intended national determined contributions (INDCs) for submission to the Conference of the Parties (COP).
  f. Integrate health into National Communications and request parties to evaluate national co-benefits of climate change mitigation.

- For health policy-makers: Integrate climate change aspects into health strategies and policies.
  a. KM: **Addressing climate change is an opportunity for public health development, health security, research, innovation and care.**
  b. Climate change poses risks to human health now.
  c. If we continue business as usual, the risks will become unmanageable.
  d. Main health determinants are affected
  e. End-scenarios present only a narrow window of opportunity.
  f. The evidence is stronger and it is your choice to act!
  g. Addressing climate change is an opportunity for public health development.
  h. We need to protect future generations.
  i. Accountability for pollution.
  j. Mitigating climate change has positive benefits for health.

k. Win-win situation by reducing vulnerability and providing basic services.

A few common themes were identified throughout the discussions that were relevant across the four SOCO areas identified. Notably, emphasis was placed on the importance and need to foster partnerships across the sectors to promote coordinated and coherent multisectoral action, such as with the agriculture, energy and transport sectors, amongst others. Moreover, in some areas there are other potential partners already tackling the issues of climate change and its intersection with health, such as the work of ICLEI on sustainable cities. Strengthening such partnerships would greatly enhance the ability and efficacy of health sector action.

Furthermore, it was pointed out that the IPCC findings are not easy for the health community to understand, and that this meeting demonstrated the need for the results to be 'translated' into appropriate language and format for specific audiences. Further efforts are required to provide an understanding to the health community, by focusing on the main current public health challenges and their linkages to climate change.

The final take home message was the **need for urgency**; the risks that climate change is posing to public health are currently manageable, but eventually they will become too great to manage. We need to act now. Repetition of the issue is important and dialogues need to be maintained.

Next steps

WHO will further work with partners on crafting messages for communication to several audiences. The summary document on key scientific findings will be revised and the outputs will be fed into the key political European processes (e.g. Mid-Term Review of the Parma "Commitment to act" and the HIC Working Group of the EHTF) and technical work of the climate change programme, towards COP21 in Paris.

Annex 1: Final programme

Tuesday, 27 May

08:30 – 09:00 Registration

09:00 – 09:30 Welcoming, scope of the meeting and expected results *(Bettina Menne and Jutta Litvinovitch)*

09:30 – 09:45 Protecting future generations: a springboard for behaviour change *(Hilary Graham)*

09:45 – 10:00 Key single overarching communication outcome (SOCO) *(Cristiana Salvi)*

10:00 – 10:15 Coffee break

10:15 – 10:25 Introductory video: The physical science (IPCC WG1 video)

10:25 – 10:40 The Intergovernmental Panel of Climate change. A historical overview. *(Renate Christ)*

10:40 – 12.15 Key findings of the IPCC, WGIII: Mitigation of climate change *(Jan Minx)*

Additional presentations/comments:

- Co-benefits for health, economic and environment development of mitigation measures *(Keywan Riahi)*
- Urban areas as hotspots of co-benefits *(Felix Creutzig)*
- The example of transport and other sectors *(OliverLah)*

Q&A
Discussion introduced by *Gerard Wynn*

12:15 – 13:00 Key findings of IPCC, WGI: The physical science *(Gian-Kasper Plattner)*

Additional comments:

- Hotspots of climate change in the WHO European Region *(Antonio Navarra)*

Q&A
Discussion introduced by *Franklin Apfel*

13:00 – 14:00 Lunch break

14:00 – 16.00 Key findings of the IPCC, WGII: vulnerability, impact and adaptation *(Jose Manuel Moreno Rodriguez)*

Additional presentations/comments:
Emerging risks *(George Luber)*
Disasters and extreme events *(Maarten van Aalst)*

Oceans *(Hans-Otto Pörtner)*
The Arctic *(Oleg Anisimov)*
western Europe *(Sari Kovats)*

Q&A
Discussion introduced by *Kieran Cooke*

16:00 – 16:15 Coffee break

16:15 – 16:30 Importance of IPCC findings for the United Nations Framework Convention on Climate Change (UNFCCC) *(Florin Vladu)*

16:15 – 17: 30 Three cross cutting working groups: single overarching communication outcome (SOCO)

19:00 Social dinner

Wednesday, 28 May

09:00 – 10:00 Key findings on human health in IPCC*:*

Human health *(Alistair Woodward)*
Emerging health findings *(Sari Kovats)*
Adaptation *(Diarmid Campbell-Lendrum)*
Health and mitigation *(Nick Watts)*

10:00 – 10:15 Feedback from "SOCO" working groups

10:15 – 11:00 Three cross cutting working groups: audience

11:00 – 11:15 Coffee break

11:15 – 11:30 Feedback from "audience" working groups
11:30 – 13:00 Three cross cutting working groups: key messages

13:00 – 14:00 Lunch break

14:00 – 16:00 Presentation of group results and discussion

16:00 – 16:15 Coffee break

16:15 – 17:00 Summarizing the findings of this meeting and next steps

17:00 – 17:15 Closure of the meeting

Annex 2: Final list of participants

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The WHO Regional Office for Europe

The World Health Organization (WHO) is a specialized agency of the United Nations created in 1948 with the primary responsibility for international health matters and public health. The WHO Regional Office for Europe is one of six regional offices throughout the world, each with its own programme geared to the particular health conditions of the countries it serves.

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In May 2014, the WHO Regional Office for Europe organized a technical meeting to discuss Fifth Assessment Report of the Intergovernmental Panel on Climate Change, and its implications for population health in the WHO European Region. Participants agreed that the time for action is now and that delayed action in reducing greenhouse gas emissions will increase costs and its impact, including on human health. Four single overarching communication outcomes (SOCO) were identified to be developed into a communication strategy to feed back to the European Environment and Health Process.

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