

# Climate Change 2007 Synthesis Report

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## Foreword

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The Intergovernmental Panel on Climate Change (IPCC) was jointly established in 1988, by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP), with the mandate to assess scientific information related to climate change, to evaluate the environmental and socio-economic consequences of climate change, and to formulate realistic response strategies. The IPCC multivolume assessments have since then played a major role in assisting governments to adopt and implement policies in response to climate change, and in particular have responded to the need for authoritative advice of the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC), which was established in 1992, and its 1997 Kyoto Protocol.

Since its establishment, the IPCC has produced a series of Assessment Reports (1990, 1995, 2001 and this one in 2007), Special Reports, Technical Papers and Methodology Reports, which have become standard works of reference, widely used by policymakers, scientists, other experts and students. The most recent publications include a Special Report on “Carbon Dioxide Capture and Storage” and one on “Safeguarding the Ozone Layer and the Global Climate System”, published in 2005, and the “Guidelines for National Greenhouse Gas Inventories” re-edited in 2006. A Technical Paper on “Climate Change and Water” is under preparation.

This Synthesis Report (SYR), adopted in Valencia, Spain, on 17 November 2007, completes the four-volume Fourth Assessment Report (AR4), which was released in various steps throughout the year under the title “Climate Change 2007”. It summarises the findings of the three Working Group reports and provides a synthesis that specifically addresses the issues of concern to policymakers in the domain of climate change: it confirms that climate change is occurring now, mostly as a result of human activities; it illustrates the impacts of global warming already under way and to be expected in future, and describes the potential for adaptation of society to reduce its vulnerability; finally it presents an analysis of costs, policies and technologies intended to limit the extent of future changes in the climate system.

The AR4 is a remarkable achievement involving more than 500 Lead Authors and 2000 Expert Reviewers, building on the work of a wide scientific community and submitted to the scrutiny of delegates from more than one hundred participating nations. It is the result of the enthusiasm, dedication, and

cooperation of experts from many different but related disciplines. We would like to express our gratitude to all of them, to the Members of the IPCC Bureau, to the staff of the Technical Support Units, particularly of the Technical Support Unit for the IPCC Synthesis Report in The Energy and Resources Institute (TERI) in Delhi, to Dr Renate Christ, Secretary of the IPCC, and to the Secretariat staff.

We acknowledge with gratitude the governments and organisations that contribute to the IPCC Trust Fund and provide support to experts in different ways. The IPCC has been especially successful in engaging in its work a large number of experts from the developing countries and countries with economies in transition; the Trust Fund enables extending financial assistance for their travel to IPCC meetings. We also acknowledge the cooperative spirit in which all government delegates have worked together in the IPCC Sessions to reach a meaningful and powerful consensus.

Finally, we would like to thank the Chairman of the IPCC, Dr Rajendra K. Pachauri, for leading tirelessly and with dedication the effort of all. This is particularly appropriate at this time as the IPCC as a whole, under his guidance, has been awarded the 2007 Nobel Peace Prize.

We would also like at this occasion to express deep recognition and sorrow in remembrance of Prof. Bert Bolin, who led the way twenty years ago as first Chairman of IPCC, and who sadly passed away on 30 December 2007 after a brilliant career in meteorology and climate science.



Michel Jarraud  
Secretary General  
World Meteorological Organization



Achim Steiner  
Executive Director  
United Nations Environmental Programme



This Synthesis Report with its Summary for Policymakers is the fourth and final part of the Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC) – “Climate Change 2007”. It draws together and integrates for the benefit of policy makers and those from other professions, up to date policy-relevant scientific, technical and socio-economic information on climate change. This report is intended to assist governments and other decision-makers in the public and private sector in formulating and implementing appropriate responses to the threat of human-induced climate change.

The scope of the Synthesis Report includes the information contained in the three Working Group contributions to the IPCC AR4, the Working Group I report on “The Physical Science Basis”, the Working Group II report on “Impacts, Adaptation and Vulnerability” and the Working Group III report on “Mitigation of Climate Change”. It also draws on other IPCC reports, in particular recently published IPCC Special Reports. The Synthesis Report was written by a team dedicated to this task drawn from the authors of each Working Group report of the AR4 led by the Chair of the IPCC. As instructed by the Panel, the authors prepared the draft in a non-technical style while ensuring that scientific and technical facts are recorded correctly.

The Synthesis Report addresses a range of broad policy-relevant questions, structured around 6 topic headings agreed by the Panel, and it gives careful attention to cross-cutting themes. It consists of two parts, a Summary for Policymakers (SPM) and a longer report. The sections of the SPM follow largely the topic structure of the longer report, but for brevity and clarity, certain issues covered in more than one topic are summarised in one section of the SPM.

**Topic 1** brings together information from Working Groups I and II on observed changes in climate and the effects of past climate change on natural systems and human society.

**Topic 2** addresses causes of change, considering both natural and anthropogenic drivers of climate change. It analyses the chain including greenhouse gas emissions and concentrations, to radiative forcing and resultant climate change, and evaluates whether observed changes in climate and in physical and biological systems can be attributed to natural or anthropogenic causes. In providing that information it draws on information contained in all three Working Group contributions to the AR4.

**Topic 3** presents information from the three Working Group reports on projected future climate change and its impacts. It provides updated information on emissions scenarios and pro-

jected future changes in climate in the 21<sup>st</sup> century and beyond, and describes the projected impacts of future climate change on systems, sectors and regions. Special attention is given to issues of human well-being and development.

**Topic 4** describes adaptation and mitigation options and responses as assessed in the reports of Working Groups II and III, and the inter-relationship of climate change and response measures with sustainable development. The focus of this topic is on response measures that can be implemented by 2030. Technologies, policies, measures and instruments as well as barriers to implementation are addressed along with synergies and trade-offs.

**Topic 5** covers the long-term perspective and analyses scientific, technical and socio-economic aspects relevant to adaptation and mitigation, consistent with the objectives and provisions of the United Nations Framework Convention on Climate Change (UNFCCC). It places decision-making about climate change in a risk management perspective, paying attention to broader environmental and integration issues. The topic describes emissions trajectories for stabilisation of greenhouse gas concentrations at various levels and associated temperature increases, along with information about the costs of mitigation, required technology development and deployment, and avoided climate impacts. It also explores in detail five main reasons for concern regarding climate change, which it finds have become stronger due to new knowledge since the TAR.

**Topic 6** highlights robust findings and key uncertainties.

While the Synthesis Report is a largely self-contained document, it needs to be viewed in the context of the other volumes of “Climate Change 2007” and it is recommended that for further details the contributions of the three Working Groups be consulted. Each of the Working Group reports consists of a series of chapters which contain a detailed scientific technical assessment, a Technical Summary, and a Summary for Policymakers that has been approved by the IPCC line by line.

The longer Synthesis Report contains extensive references to the relevant chapters in the Working Group contributions to the AR4 and other relevant IPCC reports. For easy reading, references in the Summary for Policymakers only lead to the relevant sections of the longer Synthesis Report. The CD RoM included in this report contains the full text of the three Working Group contributions to the AR4 in English, as well as the Summaries for Policymakers and Technical Summaries and the Synthesis Report in all official UN languages. References in these electronic versions are provided as hyperlinks to en-

able the reader to easily find further scientific, technical and socio-economic information. A user guide, glossary of terms, and lists of acronyms, authors, Review Editors and Expert Reviewers are provided in the Annexes to this report.

The preparation of the Synthesis Report was carried out in accordance with the Procedures for the Preparation, Review, Acceptance, Adoption, Approval and Publication of IPCC Reports, and it was adopted and approved by the IPCC at its Twenty Seventh Session (Valencia, Spain, 12-17 November 2007).

We take this opportunity to thank:

- the Core Writing Team who drafted this report and, with their meticulous and painstaking attention to detail, finalised it
- the Review Editors who made sure that all comments were taken into consideration and that consistency with the underlying reports was maintained
- the members of the Working Groups' teams of Coordinating Lead Authors and Lead Authors who helped with the drafting
- the Head and staff of the SYR Technical Support Unit, particularly Dr Andy Reisinger, and the Technical Support Units of the three Working Groups, for logistical and editorial support
- the staff of the IPCC Secretariat for innumerable tasks performed in support of the preparation, release and publication of the report

- WMO and UNEP for supporting the IPCC Secretariat and for financial contributions to the IPCC Trust Fund
- all member governments and the UNFCCC for their contributions to the IPCC Trust Fund
- and all member governments and participating organisations for invaluable in-kind contributions, including through supporting experts involved in the IPCC process and hosting meetings and sessions of the IPCC.



Dr. R.K Pachauri  
Chairman of the IPCC



Dr. Renate Christ  
Secretary of the IPCC

# Climate Change 2007: Synthesis Report

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## Contents

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<b>Foreword</b>	<b>iii</b>
<b>Preface</b>	<b>v</b>
<b>Summary for Policymakers</b>	<b>1</b>
<b>Synthesis Report</b>	<b>23</b>
Introduction	25
Topic 1	29
Topic 2	35
Topic 3	43
Topic 4	55
Topic 5	63
Topic 6	71
<b>Annexes</b>	
I. User guide and access to more detailed information	75
II. Glossary	76
III. Acronyms, chemical symbols; scientific units; country groupings	90
IV. List of authors	92
V. List of Reviewers and Review Editors	94
VI. Index	100
VII. List of Publications by the Intergovernmental Panel on Climate Change	102



### Sources cited in this Synthesis Report

References for material contained in this report are given in curly brackets { } at the end of each paragraph.

In the [Summary for Policymakers](#), references refer to Sections, Figures, Tables and Boxes in the underlying Introduction and Topics of this Synthesis Report.

In the [Introduction and six Topics](#) of this Synthesis Report, references refer to the contributions of Working Groups I, II and III (WGI, WGII and WGIII) to the Fourth Assessment Report and other IPCC Reports on which this Synthesis Report is based, or to other Sections of the Synthesis Report itself (SYR).

The following abbreviations have been used:

SPM: Summary for Policymakers

TS: Technical Summary

ES: Executive Summary of a Chapter

Numbers denote the specific Chapters and Sections of a report.

For example, {WGI TS.3; WGII 4.ES, Figure 4.3; WGIII Table 11.3} would refer to the Technical Summary Section 3 of WGI, the Executive Summary and Figure 4.3 in Chapter 4 of WGII, and Table 11.3 in Chapter 11 of WGIII.

Other reports cited in this Synthesis Report:

TAR: Third Assessment Report

SROC: Special Report on Safeguarding the Ozone Layer and the Global Climate System

