

Preface

This volume, *Climate Change 2001: Impacts, Adaptation, and Vulnerability*, is the Working Group II (WGII) contribution to the Third Assessment Report (TAR) of the Intergovernmental Panel on Climate Change (IPCC). The companion volumes of the TAR are *Climate Change 2001: the Scientific Basis* (WGI) and *Climate Change 2001: Mitigation* (WGIII). A fourth volume of the TAR is being prepared to provide a synthesis of the findings of the three Working Groups and will focus on questions addressing particular policy issues raised in the context of the Framework Convention on Climate Change.

Since the inception of the IPCC, its Working Group II has focused on the impacts of projected climate change. The current WGII report differs somewhat in scope from earlier WGII assessments. This report examines climate change impacts, adaptation, and vulnerability across a range of systems and sectors, as was done in the Second Assessment Report (SAR, published in 1996), and includes a regional assessment, updated from the *Special Report on Regional Impacts of Climate Change* (1998). Environmental, social, and economic dimensions of these issues are assessed in this report, whereas the previous WGII report focused primarily on environmental dimensions. Efforts are made in the new assessment to address a number of issues that cut across the various sectors and systems covered by the WGII report, as well as across the three Working Groups of IPCC, such as sustainable development, equity, scientific uncertainties, costing methodologies, and decisionmaking frameworks. Mitigation of climate change, treated in previous WGII reports, is now the subject of WGIII's contribution to the TAR.

Research on climate impacts has grown considerably since the SAR, and much has been learned in the past 5 years regarding the potential risk of damage associated with projected climate change. The research has added to what we know about the vulnerabilities to climate change of a wide range of ecological systems (forests, grasslands, wetlands, rivers, lakes, and marine environments) and human systems (agriculture, water resources, coastal resources, human health, financial institutions, and human settlements).

Observational evidence of changes has accumulated in many physical and biological systems (e.g., glacial melting, shifts in geographic ranges of plant and animal species, and changes in plant and animal biology) that are highly consistent with warming observed in recent decades. These observations are adding to our knowledge of the sensitivity of affected systems to changes in climate and can help us to understand the vulnerability of systems to the greater and more rapid climate changes projected for the 21st century. A number of unique systems are increasingly recognized as especially vulnerable to

climate change (e.g., glaciers, coral reefs and atolls, mangroves, boreal and tropical forests, polar and alpine ecosystems, prairie wetlands, and remnant native grasslands). In addition, climate change is expected to threaten some species with greater probability of extinction. Potential changes in the frequency, intensity, and persistence of climate extremes (e.g. heat waves, heavy precipitation, and drought) and in climate variability [e.g., El Niño Southern Oscillation (ENSO)] are emerging as key determinants of future impacts and vulnerability. The many interactions of climate change with other stresses on the environment and human populations, as well as linkages between climate change and sustainable development, are increasingly emphasized in recent research and preliminary insights from these important efforts are reflected in the report.

The value of adaptation measures to diminish the risk of damage from future climate change, and from present climate variability, was recognized in previous assessments and is confirmed and expanded upon in the new assessment. Understanding of the determinants of adaptive capacity has advanced and confirms the conclusion that developing countries, particularly the least developed countries, have lesser capacity to adapt than do developed countries. This condition contributes to relatively high vulnerability to damaging effects of climate change in these countries.

The WGII report was compiled by 183 Lead Authors between July 1998 and February 2001. In addition, 243 Contributing Authors submitted draft text and information to the Lead Author teams. Drafts of the report were circulated twice for review, first to experts and a second time to both experts and governments. Comments received from 440 reviewers were carefully analyzed and assimilated to revise the document with guidance provided by 33 Review Editors. The revised report was presented for consideration at a session of the Working Group II panel held in Geneva from 13 to 16 February 2001, in which delegates from 100 countries participated. There, the Summary for Policymakers was approved in detail and the full report accepted.

This report contains a Summary for Policymakers (SPM) and a Technical Summary (TS) in addition to the 19 chapters comprising the full report. Each paragraph of the SPM has been referenced to the supporting sections of the TS. In turn, each paragraph of the TS has been referenced to the appropriate section of the relevant chapter. The first three chapters set the stage for the report by discussing the context of climate change, methods for research and assessment, and development of scenarios. Chapters 4 through 9 assess the state of knowledge regarding climate change impacts, adaptation, and vulnerability for different natural and human systems or sectors. Chapters 10

through 17 assess vulnerabilities and key concerns of eight regions of the world: Africa, Asia, Australia/New Zealand, Europe, Latin America, North America, polar regions, and small island states. Chapter 18 presents a synthesis of adaptation challenges, options, and capacity. Chapter 19 concludes the report with a synthesis of climate change risks for unique and threatened systems, extreme climate events, uneven distribution of impacts, global aggregate impacts, and large-scale high-impact events. An electronic version of the report that can be searched for key words will be available on the web (<http://www.ipcc.ch>) and CD-ROM.

We wish to express our sincere appreciation to all the Coordinating Lead Authors, Lead Authors, Contributing Authors, Review Editors, and expert and government reviewers, without whose expertise, diligence, and patience and considerable investments of uncompensated time a report of this quality could never have been completed. We would also like to thank members of the Working Group II Bureau for their assistance throughout the preparation of the report.

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