

Ottmar Edenhofer · Johannes Wallacher  
Hermann Lotze-Campen · Michael Reder  
Brigitte Knopf · Johannes Müller *Editors*

# Climate Change, Justice and Sustainability

Linking Climate and  
Development Policy

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# Preface

This book is a result of a large research project on Climate Change and Justice. It was initiated and driven by the need for new alliances spanning the scientific and social domains of climate change, justice and sustainability. This has prompted four very dissimilar partners to join forces. From the scientific domain, these are the Potsdam Institute for Climate Impact Research (PIK) and the Institute for Social and Development Studies in Munich (Institut für Gesellschaftspolitik, IGP). They combine scientific results about the causes, consequences, and economics of climate change with ethical implications for development policy and sustainability. The commissioning parties and project partners are MISEREOR – the German Catholic Bishops’ Organisation for Development Cooperation, and the Munich Re Foundation – a non-profit organization founded by the global risk carrier Munich RE. In this project, the scientific community, development cooperation practitioners and experts from the insurance area have worked together to develop strategies for a global and yet equitable climate and energy policy.

At the same time, all four partners have embarked on a dialogue with those at the heart of this debate – the people directly affected, often the poor, in the countries of the global south. The multifaceted interaction with partners from developing and newly industrialised countries in a total of eight dialogue fora around the world has been challenging and enriching for all participants.

The aim of the project was to open up new pathways in which climate change mitigation, adaptation, development, and poverty reduction can be combined effectively, efficiently, and equitably. Cooperation between such different partners is an affirmation of the need for new alliances to make this happen. Without dialogue and partnerships, the challenges will be met neither now nor in the future.

Potsdam Institute for Climate Impact Research (PIK)  
Institute for Social and Development  
Studies in Munich (IGP)  
MISEREOR – the German Catholic Bishops’  
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More information on the project “Climate Change and Justice – Climate policy as a component of fair globalization and sustainable poverty reduction” can be found at [www.climate-and-justice.de](http://www.climate-and-justice.de).

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# Acronyms

|                      |  |
|----------------------|--|
| AD                   | Avoided deforestation                                      |
| AF                   | Adaptation Fund  |
| AR4                  | The Fourth Assessment Report of the IPCC                   |
| AR5                  | The Fifth Assessment Report of the IPCC                    |
| BAU                  | Business as usual  |
| CARP                 | Comprehensive Agrarian Reform Program                      |
| CBD                  | Convention on Biological Diversity                         |
| CCAP                 | Center for Clean Air Policy                                |
| CCS                  | Carbon capture and storage                                 |
| CDA                  | Cooperative Development Authority                          |
| CDC                  | Common but differentiated convergence                      |
| CDM                  | Clean Development Mechanism                                |
| CIESIN               | Centre for International Earth Science Information Network |
| CFT                  | Crop functional type                                       |
| CH <sub>4</sub>      | Methane  |
| CO <sub>2</sub>      | Carbon dioxide   |
| CO <sub>2</sub> -equ | Carbon dioxide equivalent                                  |
| COP                  | Conferences of the Parties (UNFCCC)                        |
| CSE                  | Centre for Science and Environment                         |
| CSOs                 | Civil society organizations                                |
| CSR                  | Corporate social responsibility                            |
| C&C                  | Contraction and convergence                                |
| DIE                  | German Development Institute                               |
| DIVA                 | Dynamic and Interactive Vulnerability Assessment model     |
| DKKV                 | German Committee for Disaster Reduction                    |
| EITI                 | Extractive Industries Transparency Initiative              |
| EJ                   | Exajoule   |
| ETS                  | Emissions Trading System                                   |
| EU                   | European Union   |
| FACE                 | Free Air Carbon Enrichment                                 |
| FAO                  | Food and Agriculture Organization of the United Nations    |

|                   |  |
|-------------------|--|
| FGD               | Focus group discussions  |
| GCM               | General Circulation Model  |
| GDP               | Gross domestic product   |
| GDR               | Greenhouse Development Rights  |
| GHG               | Greenhouse gas   |
| GJ                | Gigajoule  |
| GNP               | Gross national product   |
| Gt                | Giga tons  |
| GtCO <sub>2</sub> | Giga tons CO <sub>2</sub>  |
| GVA93             | Global Vulnerability Assessment of Coastal Areas   |
| HadCM2            | The second Hadley Centre coupled ocean-atmosphere GCM                                      |
| HDI               | Human Development Index  |
| HIV               | Human Immunodeficiency Virus   |
| HPI               | Human Poverty Index  |
| IATI              | International Aid Transparency Initiative  |
| ICC               | Inuit Circumpolar Council  |
| ICCPR             | International Covenant on Civil and Political Rights                                       |
| ICESCR            | International Covenant on Economic, Social and Cultural Rights                             |
| ICHRP             | International Council on Human Rights Policy   |
| IDNDR             | International Decade for Natural Disaster Reduction  |
| IEA               | International Energy Agency  |
| IEAs              | International Environmental Agreements   |
| IGP               | Institute for Social and Development Studies in Munich (Institut für Gesellschaftspolitik) |
| ILO               | International Labour Organization  |
| IMF               | International Monetary Fund  |
| IPCC              | Intergovernmental Panel on Climate Change  |
| IPR               | Intellectual property right  |
| IRRI              | International Rice Research Institute  |
| ISDR              | International Strategy for Disaster Reduction  |
| JRC               | Joint Research Centre  |
| LCCR              | Low-Carbon and Climate Resilient Development   |
| LDCF              | Least Developed Countries Fund   |
| LDCs              | Least-developed countries  |
| LEDS              | Low Emission Development Strategies  |
| LEIRP             | Low External Input Rice Production   |
| LPJmL             | Lund-Potsdam-Jena Dynamic Global Vegetation Model with managed Land                        |
| MA                | Millennium Ecosystem Assessment  |
| MAE               | Ministry of the Environment  |
| MAGPIE            | Model of Agricultural Production and its Impact on the Environment                         |
| MASIPAG           | Magsasaka at Siyentipiko para sa Pag-unlad ng Agrikultura                                  |
| MDGs              | U.N. Millennium Development Goals  |
| MRV               | Monitoring, Reporting and Verification   |
| NAPA              | National Adaptation Programmes of Action   |

|                  |  |
|------------------|--|
| NGO              | Non-governmental organisation  |
| N <sub>2</sub> O | Nitrous oxide  |
| ODA              | Official Development Assistance  |
| OECD             | Organisation for Economic Co-operation and Development                       |
| OHCHR            | Office of the United Nations High Commissioner for Human Rights              |
| PIK              | Potsdam Institute for Climate Impact Research                                |
| PLACE-I          | Version 1 of the Population, Landscape, and Climate Estimates dataset        |
| PLACE-II         | Version 2 of the Population, Landscape, and Climate Estimates dataset        |
| PLDP             | Peoples Led Disaster Preparedness  |
| PPCR             | World Bank's Pilot Program for Climate Resilience                            |
| PRSP             | Poverty Reduction Strategy Papers  |
| RCI              | Responsibility and Capacity Index  |
| REDD             | Reduction of emissions from deforestation and forest degradation             |
| REMINd           | Refined Model of Investments and Technological Development                   |
| REMINd-R         | Refined Model of Investments and Technological Development<br>- Regionalized |
| R&D              | Research and development   |
| SCCF             | Special Climate Change Fund  |
| SNTCF            | Ecuadorian Outsourced National Forest Control System                         |
| SO <sub>x</sub>  | Sulfur oxide   |
| SRES             | Special Report on Emissions Scenarios  |
| SRREN            | IPCC Special Report on Renewable Energy Sources                              |
| TEEB             | The Economics of Ecosystems and Biodiversity                                 |
| UDHR             | Universal Declaration of Human Rights  |
| UNCESCR          | United Nations Committee on Economic, Social and Cultural Rights             |
| UNDP             | United Nations Development Programme   |
| UNECA            | United Nations Economic Commission for Africa                                |
| UNEP             | United Nations Environment Programme   |
| UNFCCC           | United Nations Framework Convention on Climate Change                        |
| WBGU             | German Advisory Council on Global Change                                     |
| WCDR             | World Conference on Disaster Reduction                                       |
| WCO              | World Customs Organization   |
| WHO              | World Health Organization  |
| WIPO             | World Intellectual Property Organization                                     |
| WMO              | World Meteorological Organization  |
| WTO              | World Trade Organization   |





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# Chapter 1

## Introduction

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### 1.1 Introduction

In the twenty-first century, human society faces three grand challenges: reducing worldwide poverty, enabling development, and avoiding dangerous climate change. Progress on all these challenges is slow, and possible solutions are increasingly interlinked.

While the relative share of extremely poor people in global population has decreased, mainly due to progress in East Asia, the absolute number of people with an income of less than US\$1.25 per day is still increasing in many regions, especially Sub-Saharan Africa. The goal of the Millennium Declaration of the United Nations to reduce the share of people below the poverty line by half until 2015 will certainly be missed in many regions. There is a strong need for strategies to foster pro-poor growth and development over the coming decades.

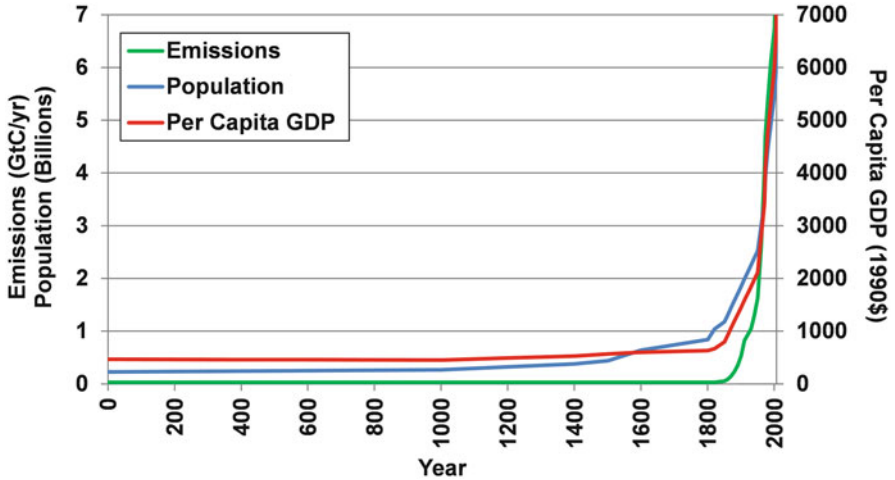
Human innovation and the industrial revolution together with trade and competition in the nineteenth and twentieth century have led to an unprecedented growth of population and wealth in many parts of the world. This growth was facilitated by a “lottery price” (Sombart 1928) – the discovery of abundant fossil fuels, like coal, oil

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**Fig. 1.1** Relationship between population growth, increase in per capita income (*GDP*), and greenhouse gas emissions (own representation, data for population and *GDP* based on Maddison 2008, emission data based on Schultz et al. 2008 and Mieville et al. 2009)

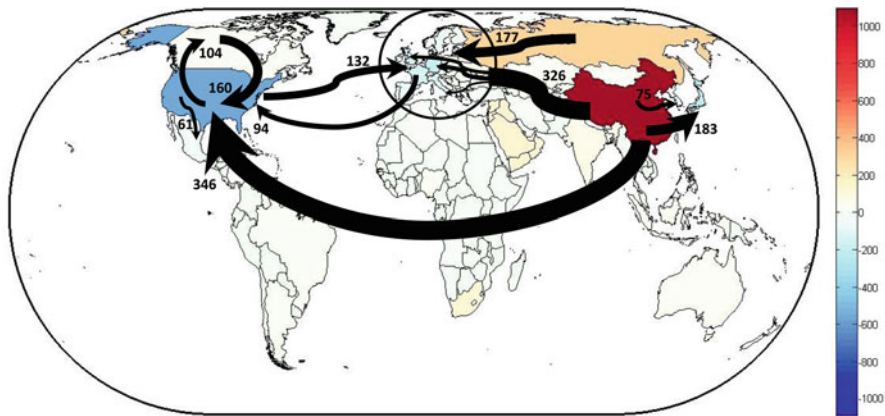
and gas. Since then, the traditional path of economic growth across the world was closely linked to rising emissions of greenhouse gases, mainly carbon dioxide ( $\text{CO}_2$ ) (Fig. 1.1). However, already at the end of the nineteenth century it was shown by Svante Arrhenius that increasing  $\text{CO}_2$  emissions from burning fossil fuels are responsible for global warming and climate change. The creation of wealth in today's rich parts of the world has been primarily based on the availability of cheap fossil fuels and the use of the atmosphere as disposal space for emissions.

Human society faces a dilemma. Energy use is a prerequisite for economic growth and development, but the current energy mix in most countries is associated with high greenhouse gas emissions. Further economic growth along a fossil-fuel-intensive path will almost certainly lead to dangerous climate change, with all the negative consequences, especially for many poor people in the developing world. For example, food security, water supply, and coastal protection will be affected in many regions of the world (Part I). On the other hand, if the use of fossil fuels is restricted and emissions are strongly reduced, many poor countries will lose the opportunity of relatively cheap economic growth and poverty reduction. Hence, the choice is between dangerous climate impacts and dangerous climate mitigation strategies.

Moreover, the link between climate change mitigation and poverty reduction raises fundamental issues of global justice (Part II). Poor people in least developed countries have not participated in the traditional growth path and have hardly contributed to global emissions. However, they will be most heavily affected by the negative impacts of climate change. They are also highly vulnerable and lack the means for appropriate adaptation measures.

The transformation of the energy system and widespread access to clean energy technologies for all are prerequisites for sustainable socio-economic development across the world. As emphasized in the Special Report on Renewable Energy Sources





**Fig. 1.2** Colours indicate the CO<sub>2</sub> trade balances of the different world regions in 2004 (in Mt CO<sub>2</sub>). Blue tones indicate an export deficit of CO<sub>2</sub>, and red tones an export excess of CO<sub>2</sub>. Arrows indicate the largest trade flows between the world regions (Based on Peters et al. 2011)

and Climate Change Mitigation (IPCC 2011, Chapter 9), a low-carbon energy system can deliver multiple co-benefits related to human health, environmental impacts, and energy security. However, strong incentives, like a cap-and-trade system for emission allowances and policy support for research and development, are required to initiate the energy transformation. If technological progress and technology transfer in the energy sector are slow, this may lead to higher energy prices with negative effects on poverty and income inequality, especially in developing countries.

The UN Climate Change Summits in Copenhagen (2009), Cancun (2010) and Durban (2011) have shown the chances and barriers to overcoming the dilemma on climate change mitigation and poverty reduction. In Copenhagen and Cancun, no global agreement on worldwide reductions of greenhouse gas emissions was achieved, and in Durban the possible starting year was postponed until 2020. Moreover, these conferences did not come up with sufficient financial support for developing countries in their efforts to adapt to already unavoidable climate impacts. But it has now become clear that a solution to both challenges on poverty reduction and emission reduction has to be based on a new path for economic growth. *Low-Carbon and Climate Resilient Development* (LCCR) and *Low Emission Development Strategies* (LEDS) are new catchwords for a strategy to combine climate change mitigation (Part III) and climate change adaptation (Part IV) in a broader context of sustainable development (Chap. 31).

As a global agreement on emission reductions is hard to achieve, it could be argued that it is now time to undertake unilateral action and exclusively focus on “green growth” at the national level. But this neglects the influence of international trade and the embedded emissions in traded goods. By balancing CO<sub>2</sub> emissions for each country and taking into account these embedded emissions, it can be shown that industrialised countries are often net importers of CO<sub>2</sub> and that this “trade deficit” has grown over the last years (Fig. 1.2). CO<sub>2</sub>-intensive industrial production is increasingly relocated to emerging and developing countries, and especially

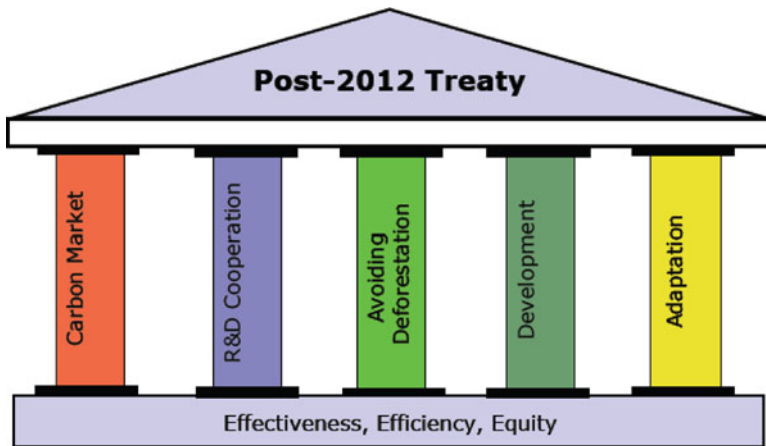
China has become the “work bench” of the world. Hence, if only unilateral action is taken to reduce emissions, emissions are likely to increase in other world regions due to international division of labour and outsourcing of emission-intensive industries. It is clear that a fragmented global climate policy regime will neither be effective nor efficient. Instead, a global approach towards climate protection is required. This can be supported by national frontrunners which show the feasibility of low-carbon energy strategies.

An exclusive focus on national solutions also neglects the fact that climate mitigation and other key aspects of sustainable development are strongly linked to the management of so-called “Global Commons”. The atmosphere as a disposal space for greenhouse gases has to be managed as a global common resource. Likewise, tropical forests can be interpreted as a global common resource, as they store carbon and maintain biodiversity. Tropical deforestation is, apart from the energy system, another major source of greenhouse gas emissions (Chap. 14). Avoiding further deforestation will also require global cooperation, as developing and emerging countries with large forest areas are reluctant to give up opportunities for agricultural expansion and economic growth without compensation (Chap. 27).

The UN Climate Change Summit in Durban in December 2011 took up the idea of a global agreement again. While in the Kyoto protocol the world was divided into actors and non-actors, negotiators in Durban committed to reaching a global climate policy agreement by the year 2020. This outcome is probably too late to limit global warming to two degrees above the pre-industrial level. Moreover, it does not contain a binding roadmap for global emission reductions. However, the Durban Summit has shown an awareness that climate change and the overuse of global commons, like the atmosphere or tropical forests, require global solutions by the international community (Part VI).

In the preparation of the UN Conference on Sustainable Development in June 2012 in Rio de Janeiro it has also been acknowledged that energy use, climate change mitigation, and adaptation cannot be separated from poverty reduction and other dimensions of sustainable development, like agricultural production and food security, water availability, human health, and conservation of biodiversity and other ecosystem services. A sustainable development pathway along “green growth” will only be achieved, if resource use stays within acceptable environmental boundaries along all relevant dimensions. Sustainable development without climate protection will not be possible – climate protection not embedded in a broader social and environmental development context will most likely fail.

Moreover, the causes and consequences of climate change are not only a subject for the natural sciences or economics. Debates about the impacts of climate change necessarily exist within ethical frameworks. Often justice is the key concept, which plays an important role in the discussion about climate change and development policy. Issues of justice that arise in the context of climate change and poverty reduction need to be systematically considered. One important task of ethics is to reveal and reflect hidden implications. Therefore, a comprehensive concept of justice needs to be unfolded as a basis for further analysis. In our view, human rights provide a meaningful starting point for such a comprehensive concept of justice.



**Fig. 1.3** The design of a post-2012 treaty for linking climate and development policy

In this book we give an overview of key climate impacts and vulnerabilities (Part I) and important aspects of global justice and human rights in the context of climate change and development (Part II). We then analyze challenges and costs of major options for climate change mitigation (Part III) as well as adaptation (Part IV). Finally, we describe how a global deal for linking climate and developing policy after 2012 could be designed to support sustainable development (Part VI).

Figure 1.3 provides an overview of five pillars that are part of such a post-2012 treaty. The establishment of a global carbon market, i.e. a global cap-and-trade scheme for emission allowances, would provide strong incentives for emission reductions and private investment in new technologies. This would have to be accompanied by public support for research and development (R&D) and technology transfer in energy production and other types of emission reduction. Measures and payments to support the reduction of emissions from deforestation and forest degradation (REDD) would provide incentives to reduce emissions from land use change, especially in tropical regions. Financial support from industrialized countries would be required to implement adaptation strategies in least developed countries. Finally, existing strategies for economic development and technical cooperation between rich and poor countries have to be adjusted towards the new challenges related to climate change adaptation and mitigation. With an appropriate design and implementation of these five pillars, the outcome in terms of climate change mitigation and adaptation will be effective, efficient, and equitable. It will also contribute as much as possible to sustainable development (Chap. 31).

The implementation of such a global agreement will require new institutional arrangements at the regional, national, and international level. These institutional changes will have to be actively supported by the private sector, science, civil society, religions, and each individual citizen in different world regions. Therefore, the five pillars of a post-2012 treaty have been discussed in various regional dialogues with

stakeholders in Latin America, Sub-Saharan Africa, and Asia (Chap. 32). Moreover, a collection of case studies is provided to put the global challenges into specific regional contexts (Part V). Without a combination of multi-regional and multi-level approaches, no global agreement will ever be put into place. But it also holds that without a global agreement all regional and bottom-up approaches are doomed to fail in the long-term. The battle against climate change and the battle against global poverty will be won or lost together.

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**Part I**  
**Climate Impacts and Vulnerability**

# Chapter 2

## Vulnerability to Climate Change and Poverty

Hans-Martin Füßel

### 2.1 Why Do We Talk About Vulnerability?

Which country, region, economic sector, or population group is most vulnerable to climate change? This question is frequently asked in political and scientific debates about global climate change – but what exactly is meant by the “vulnerability” of regions or population groups? This question is not just academic, but can have substantial policy implications for prioritising international adaptation funding (see Chap. 29). This chapter presents the main interpretations of vulnerability in the climate change context. It discusses the relationship between vulnerability and poverty and it uses an integrated vulnerability concept to analyse the inequities created by global climate change. In this context, inequity refers to a situation where some nations and/or population groups suffer substantially more from the adverse impacts of climate change than represented by their respective share in the greenhouse emissions that have caused the problem.

The ordinary use of the word “vulnerability” refers to the capacity to be wounded, or the degree to which a system is likely to experience harm due to exposure to a hazard (Turner et al. 2003). The scientific use of “vulnerability” has its roots in geography and natural hazards research but this term is now a central concept in a variety of research contexts such as natural hazards and disaster management, ecology, public health, poverty and development, secure livelihoods and famine,

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