

Climate Change Strategy for the South Asia Region

Table of Contents

Glossary	viii
Abbreviations	xiii
Acknowledgements	xv
Executive Summary	xvi
The Global Challenge	xvi
The Strategy and Its Objectives	xvi
Why Is South Asia So Vulnerable to Climate Change?	xvii
South Asia's Greenhouse Gas Contribution	xix
World Bank's Role	xx
Broad Principles of a Development Strategy for Climate Change	xxi
PART I. General Context and Strategy.....	1
Chapter 1. Introduction.....	2
The Context.....	2
Report Structure	3
Process and Consultation Strategy.....	3
Chapter 2. Climate Change: The Global Scene	5
The Science of Climate Change.....	5
Confronting Climate Risks: The Need for Adaptation	12
The Global Emission Footprint.....	14
Chapter 3. The Regional Scene: South Asia's Climate Vulnerability and Contribution to Greenhouse Gas Emissions	21
Why is South Asia Vulnerable to Climate Change?	21
What Might the Future Hold for South Asia?.....	26
Who Will be Most Affected by Climate Change?	30
South Asia's GHG Footprint	31
Chapter 4. The Way Forward – Strategic Priorities	35
Role of the World Bank and the Pillars of Engagement.....	35

Financing Climate Adaptation and Mitigation	39
Conclusions.....	50
PART II. Sectoral Context and Strategies.....	60
Chapter 5. The Sector Outlook.....	61
Chapter 6. Climate Change and the Water Sector	64
Water Resource Supply, Demand and Management: Why South Asia Is Vulnerable	64
Projected Impacts of Climate Change.....	66
Future Challenges and Opportunities.....	69
Strategy for the Future	70
Chapter 7. Agriculture and Rural Sector	74
Climate Variability and Change.....	75
Costs of Climate Change in the Agricultural Sector.....	76
Adaptation in the Agricultural Sector.....	84
Adaptation and Mitigation Links	85
Chapter 8. Natural Disasters	87
Toll of Natural Disasters.....	87
Fiscal Impact of Disasters.....	91
Response to the Natural Hazards Threat: From Relief to Resilience	92
Role of the World Bank.....	93
Chapter 9. The Health Sector	95
Impacts Directly Related to Weather or Climate.....	95
Impacts Resulting from Climate-Induced Environmental Changes	97
Impacts Resulting from the Consequences of Climate-Induced Economic Dislocation	100
Health Sector Strategies to Address Climate Change.....	101
Chapter 10. The Social Dimensions of Climate Change.....	104
The Human Face of Climate Change.....	104
Vulnerable Groups to Climate Change	106
Social Development Adaptation Strategies	109
Chapter 11. Ecosystems and Biodiversity.....	112
South Asia's Rich Biodiversity Under Stress	112

Threats of Climate Change upon Ecosystems and Biodiversity in South Asia	113
Recommended Next Steps	119
Chapter 12. The Energy Sector	123
South Asia Region: Energy Outlook and Options in Selected Countries	123
Approaches for Reducing Emission Intensity.....	127
Chapter 13. The Transport Sector	133
Overview of Greenhouse Gas Emissions from the Transport Sector	133
Factors Underlying South Asia's Transport Carbon Emissions	135
Future Challenges	139
Opportunities for World Bank Engagement	141
Chapter 14. The Urban Sector.....	146
Urban Sector in South Asia.....	146
Climate Change and the City Governance Challenge.....	150
Elements of an Urban Climate Change Strategy for South Asia	152
Appendix. Country Profiles	155
References.....	173

Figures

Figure 2.1 Projected GHG Emissions and Global Surface Warming.....	8
Figure 2.2 Projected Warming 2020–2099	9
Figure 2.3 Sea Level Rise in 2080–2099 from 1980–1999	11
Figure 2.4 Sources of GHG Emissions	14
Figure 2.5 GHG Emissions of 10 Highest Emitters, 1995 and 2000	16
Figure 2.6 Countries with the Highest Per Capita CO ₂ eq Emissions, 2000	17
Figure 2.7 CO ₂ Intensity: Main Emitters, 2000	18
Figure 3.1 South Asia Population Projections	21
Figure 3.2 Ganges River Basin	23
Figure 3.3 Glacial Lakes from Retreating Glaciers	24
Figure 3.4 South Asia Urban Population Projections	25
Figure 3.5 Relative Change in Runoff in the Twenty-First Century	27
Figure 3.6 Projected Global Average Sea Level Rise at the End of the Twenty-First Century ...	28

Figure 3.7 The Gangotri Glacier, India: Last 200 Years	30
Figure 3.8 Per Capita Greenhouse Gas Emissions by Region, 1995 and 2000	31
Figure 3.8 Greenhouse Gas Contributions by Country in South Asia, 2000	32
Figure 4.1 Clean Development Mechanism Projects by Country, Beneficiary, and Sector	41
Figure 4.2 Structure of the Climate Investment Funds	45
Figure 6.1 Observed and Projected Decline in Annual Average Per Capita Water Availability in India	65
Figure 6.2 Principal Rivers of the Himalayas	66
Figure 6.3 Changes in Glacier Cover in the Western Himalayas	68
Figure 7.1 Breakdown of Poverty (Rural/Urban) by Country	74
Figure 7.2 Distribution of Climate Impacts on Smallholder Agricultural Net Revenues Per Hectare Based on Alternative Climate Scenarios	83
Figure 8.1 Number of Reported Disasters in South Asia by Disaster Type (1970–2008).....	88
Figure 8.2 Distribution of Hazard Risk Hotspots in South Asia	89
Figure 8.3 Reported Costs of Damage in South Asia by Country and Disaster Type (1990–2008)	91
Figure 14.1 Urbanization and Economic Development: South Asian Countries in World Context	147
Figure 14.2 Major Urban Centers in South Asia	148

Tables

Table E.1 Summary of Climate Risks by Country	xxiii
Table E.2 Summary of Regional and Sector Impacts in the Context of Climate Change and Priority Responses	xxiv
Table 3.1 Contributions to Greenhouse Gas Emissions by Sector and Country in South Asia....	33
Table 4.1 Available Carbon Financing for South Asia.....	42
Table 4.2 Sources of Funds for Adaptation	46
Table 4.3 GEF Projects under the New Climate Change Funds.....	47
Table 4.4 GFDRR Projects in South Asia under Track II	48
Table 4.5 Summary of Sector Impacts in the Context of Climate Change and Priority Responses	52
Table 4.6 Priority Response and Potential World Bank Country Engagement	56
Table 6.1 Major River Systems in the South Asia Region	66
Table 6.2 Water Resources in South Asia: Climate Change Issues and Priority Areas	72

Table 7.1 Estimates of Climate Change-related Impacts on Agricultural Production by 2080 for Selected Countries in the South Asia Region	79
Table 7.2 Results of Ricardian Assessments for Selected Crops in India	80
Table 7.3 Results of Agronomic Assessments for Crops in India	81
Table 7.4 Contributors to Indian CO ₂ -equivalent Greenhouse Gas Emissions in 2000	86
Table 8.1 Reported Natural Disaster Impacts in South Asia (1990–2008).....	87
Table 8.2 Countries at Relatively High Mortality Risk from Multiple Hazards ^a	90
Table 9.1 Action Matrix for Climate Change in South Asia	103
Table 10.1 Human Development and Vulnerability in South Asian Countries.....	104
Table 10.2 Probability of Dying Under Age 5 (per 1000).....	106
Table 10.3 Prevalence of Anemia in Women Aged 13-49 Years, 1992.....	107
Table 10.4 Climate Change Risks and World Bank's Potential Role.....	111
Table 11.1 Biodiversity Profile of SAR Countries	113
Table 11.2 Climate Change Impacts and Vulnerability Index.....	121
Table 11.3 Climate Change Strategy for Ecosystems and Biodiversity in the South Asia Region: The PURSE Approach	122
Table 12.1 Energy Efficiency Opportunities and Measures in Key Consuming Sectors	129
Table 13.1 Per Capita and Per Unit of GDP Transport CO ₂ Emissions by Region and by South Asian Country, 2005	133
Table 13.2 Growth Rate of Transport CO ₂ Emissions by Region and by South Asian Country (1990–2005); (2000–2005)	134
Table 13.3 CO ₂ Emissions Intensity (Grams per Vehicle-Kilometer) in Four Cities.....	137
Table 13.4 Estimates of Life-Cycle Carbon Emissions from Select Conventional Fuels and Biofuels.....	139
Table 13.5 Viable Short- and Medium-Term Policies to Reduce CO ₂ eq Emissions from Transport in South Asia	144
Table 14.1 Percentage of Total Population in Urban Areas	148
Table 14.2 Total Urban Population and Urban Population in the Low Elevation Coastal Zone in 2000	150

Boxes

Box 1.1 The Strategic Framework on Development and Climate Change.....	3
Box 2.1 What Is the Greenhouse Effect?.....	6
Box 2.2 Role of Anthropogenic GHGs in Global Warming.....	7
Box 2.3 A Word of Caution about Climate Models	11

Box 4.1 Can Regional Cooperation Reduce Climate Vulnerabilities of South Asia?	39
Box 4.2 Lagging Regions and Climate Change.....	40
Box 4.3. Carbon Partnership Facility.....	44
Box 4.4. IFC's support to Climate Mitigation and Adaptation in South	49
Box 6.1 Changes in Runoff Due to Climate Change	67
Box 7.1 Carbon Fertilization Effects	76
Box 7.2 Food Price Crisis	77
Box 7.3 Approaches to Measuring Climate Impacts on Yields.....	78
Box 8.1 India and Bangladesh: National Disaster Management Frameworks	92
Box 9.1 Storm Surges	97
Box 9.2 Cholera and El Niño	99
Box 9.3 Climate Change, Migratory Birds, and Infectious Diseases	99
Box 10.1 Potential Impacts of Climate Change on MDGs.....	105
Box 10.2 Good Practice Example: Community-Level Involvement in Jharkhand, India	110
Box 11.1 Sea Level Rise and the Biodiversity of the Bangladesh Coastal Area.....	118
Box 11.2 Ocean Acidification and the Protective Services of Coral Reefs.....	119
Box 12.1 India Supply Options for Lowering Emissions: Planning Commission Estimates.....	125
Box 12.2 Emissions from Coal and Natural Gas	126
Box 13.1 Scenario Assessment of Future Growth for the Transport Sector in India and the Impact of Nano Distribution on GHG Emissions	140
Box 14.1 Potential Strategies for Adaptation to Climate Change	151
Box 14.2 Potential Mitigation Projects	153