ADB

UNDER THE WEATHER AND THE RISING TIDE

ADAPTING TO A CHANGING CLIMATE IN ASIA AND THE PACIFIC

Asian Development Bank

Printed in the Philippines.

Publication Stock No. ARM090274

Cover image: Vietnamese floating coastal village.

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ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
AusAID	Australia's Agency for International Development
CGIAR	Consultative Group on International Agricultural Research
DFID	United Kingdom's Department for International Development
DMC	developing member countries
G8	Group of Eight *(Canada, France, Germany, Italy, Japan, the Russian Federation, the United Kingdom, and the United States)*
GEF	Global Environment Facility
GMS	Greater Mekong Subregion
IPCC	Intergovernmental Panel on Climate Change
LDC	Least Developed Countries
LDCF	Least Developed Countries Fund
MDG	Millennium Development Goal
NAPA	National Adaptation Programme of Action
NGO	nongovernment organization
PRC	People's Republic of China
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change

In this booklet, "$" refers to US dollars.

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ACKNOWLEDGEMENTS

Myanmese family in flooded home in Anthok village as a result of heavy rains triggering floods in Ayeyawaddy River delta. Tens of thousands made homeless, 40,000 acres of rice paddies destroyed

This booklet, and several of the Asian Development Bank's (ADB's) cited adaptation projects and activities, would not have been possible without the Promoting Climate Change Impact and Adaptation in Asia and the Pacific regional technical assistance project. A generous contribution of $2.8 million in partnership funding for this project came from the Government of the United Kingdom (Department for International Development of the United Kingdom). Cofinancing of $800,000 also came from the Japan Special Fund.

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We would also like to thank ADB's Adaptation and Land Use Working Group members and alternates for their invaluable contributions, including Edy Brotoisworo, Robert Everitt, Yue-Lang Feng, Sujata Gupta, Sohail Hasnie, Anthony Jude, Mark Kunzer, Cindy Malvicini, Frank Radstake, Naoki Sakai, Shih-Liang Tu, and Anne Myongsook Witheford.

FOREWORD

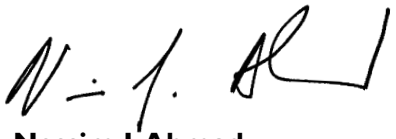
Climate change threatens to reverse decades of progress in poverty reduction in Asia and the Pacific. It is expected to increase the intensity and frequency of natural disasters, such as tropical storms and severe droughts and floods. It will lead to sea level rise and coastal inundation, precipitate more forest fires, and increase environmental stressors on crop production and aquaculture and the incidence of heat-related and infectious diseases. These impacts may undermine the attainment of long-term development goals in many countries, and it is likely that the poorest people in the poorest countries will suffer most.

Climate change mitigation is a global imperative—the global community must take measures to reduce carbon emissions and make the transition to low-carbon development pathways. At the same time, there is a growing recognition that, even under the best-case scenarios, most of the climate change impacts expected over the coming decades cannot be avoided. It is therefore clear that there is a need to manage the impacts of climate change, and increasingly integrate climate risk management and adaptation within the development process.

The Long-Term Strategic Framework of the Asian Development Bank 2008–2020 (Strategy 2020) highlights the importance of environmentally sustainable growth for Asia and the Pacific, and emphasizes the need for concerted action on climate change mitigation and adaptation. In line with this, the Asian Development Bank (ADB) is helping its developing member countries respond to both the causes and consequences of climate change. On the mitigation side of the equation, ADB is seeking to assist its developing member countries to overcome policy, institutional, technology, and financial barriers to low-carbon economic growth. This includes promoting energy efficiency, expanding the use of renewable energy and new technologies, developing carbon markets, planning sustainable transport systems, and arresting deforestation. ADB's evolving adaptation efforts focus on assessing climate vulnerability; analyzing climate change impacts, and identifying and implementing options to integrate adaptation into national development strategies. ADB also seeks to improve the climate resilience of sector development strategies and community programs, and "climate proof" infrastructure in vulnerable areas.

This climate adaptation booklet provides an overview of climate impacts in Asia and the Pacific; a discussion of the challenges facing the region in adapting to climate change; and a review of regional, national, and community adaptation strategies and programs. In addition, the booklet points to key knowledge products, risk management tools and approaches, partnerships, and sources of finance to assist developing member countries in meeting the challenges ahead.

The booklet has benefited greatly from the inputs of ADB's Adaptation and Land Use Working Group in consultation with ADB's Environment Community of Practice. We look forward to working with our partners and stakeholders to foster greater climate change resilience in Asia and the Pacific.



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EXECUTIVE SUMMARY

Climate Impacts and the Development Challenge

The countries of Asia and the Pacific are home to half of the world's population and about two thirds of the world's poor. Most countries here are particularly prone to climate change impacts attributed to human-induced global warming, and are not yet adequately prepared to deal with the grave consequences of climate change. What is essentially at risk is many of Asia's hard-won gains in poverty reduction, and ultimately, attainment of the United Nations' Millennium Development Goals.

This climate adaptation booklet highlights the sector and geo-climatic impacts of climate change, and the development challenges facing the region. It also describes a number of key regional, national, and community adaptation strategies that the international community, the Asian Development Bank (ADB), and its developing member country (DMC) partners are pursuing.

ADB and Adaptation

Recognizing the immense developmental challenges facing Asia and the Pacific from climate change, ADB is promoting the transition to low-carbon economies. We are also helping our DMCs incorporate climate adaptation into their development practices to minimize current and future climate impacts on human settlements, vulnerable infrastructure, and localized ecosystems. Furthermore, we are helping to build coping skills and climate adaptive resilience in communities at risk.

ADB's climate change adaptation program reflects several important considerations for DMCs. **Country ownership** continues to be a key strategic operating principle. We seek to align our programs with the poverty reduction strategies of our DMCs. Fostering **partnerships** helps us increase our development effectiveness, respond to the threats of climate change, and assist our DMCs to achieve their development goals. The integration of **disaster risk reduction** and **climate risk management and adaptation** allows ADB and its partners to manage the current hazardscape through disaster management, while integrating longer-term climate risk management and adaptation approaches into our programming. Finally, ADB's adaptation program reflects the **no-regrets approach**, whereby our climate adaptation decision-making supports the mainstreaming of positive development outcomes, whether or not specific climate change impacts actually materialize.

Key Geo-Climatic Impacts

Certain geo-climatic zones are at greater risk from climate change impacts. **Semi-arid and dry sub-humid areas** are vulnerable to crop yield failure from water scarcity and variable temperature. **River basins and deltas in low-lying areas** are vulnerable to run-off changes, and riverine and coastal delta flash floods. The mega deltas of Asia are especially affected by climate change due to large populations and high exposure to sea level rise and storm surge. Also of great importance are the **small islands** of the Pacific. With more than 50% of the region's population residing within 1.5 kilometers of the shoreline, these human settlements and their coastal infrastructure are especially vulnerable to sea level rise, coastal inundation, and ecosystem instability. Lastly, **fragile mountain ecosystems** are facing unprecedented climate change threats resulting from irreversible glacial melt, downstream flooding, and reduced agricultural outputs.

Key Sector Impacts

Certain sectors in Asia and the Pacific are extremely vulnerable to the effects of climate change. For many climate adaptation and development practitioners, climate change is mostly about water. It is estimated that 120 million to 1.2 billion people will experience increased water stress by the 2020s, and this number will range from 185 million to 981 million people by the 2050s. Hydrogeological cycles are becoming less predictable, and this is causing downstream flash floods, deterioration of watersheds, increased flash fires, biotic changes in ecosystem thresholds, and food security concerns. These impacts may precipitate forced transboundary migration and cross-border water conflicts.

For parts of Asia, projected decreases in agricultural crop yields range from 2.5% to 10% in the 2020s, and from 5% to 30% in the 2050s. As for human health, increases in coastal air and water temperature and more flooding and resulting contaminated water supplies will exacerbate the spread of, and/or development of, more virulent strains of cholera, malaria, and dengue fever in South Asia. For the energy sector, altered water flows from glacial melt are expected to reduce power generation reliability in the long term.[1]

Incremental Adaptation Costs

The Economics of Climate Change (known as the Stern Review) estimates that adapting to the inevitable climate impacts will cost poor countries $10 billion annually. The global cost of climate-proofing new projects, cited by sources such as the World Bank and Oxfam, is in the range of $10 billion to $150 billion per annum depending on scope of impact assessments and development assumptions. The overall costs and risks

Fragile mountain ecosystem vulnerable to climate change impacts, Asia

1 This may induce a return to high carbon-based technology by the power sector as countries consider returning to fossil- fuel-dependent thermal power to compensate for unpredictable hydropower.

Rice field near Anghor in Siem reap Province, Cambodia

of inaction may be equivalent to losing at least 5% of global gross domestic product annually. Unfortunately, the majority of ADB's DMCs are particularly prone to floods, storm surge, and water shortages, and are not yet adequately prepared to deal with the resulting effects, nor do they possess the requisite adaptation resources to respond.

From Global to Local Adaptation Responses

Adaptation needs to be addressed through a multilevel approach. At the global level, international negotiating mechanisms, such as the **United Nations Framework Convention on Climate Change** (UNFCCC) and **Kyoto Protocol**, provide a negotiating framework for greenhouse gas emission reductions, and market-based mechanisms, as well as adaptation considerations. The **Nairobi Work Programme** (2005–2010) offers participating countries a global framework within which to employ climate change adaptation knowledge, methods, and risk management measures. These actions were adopted at the 13th United Nations Climate Change Conference of the Parties, and call for spirited action and adaptation priorities, especially following the post-2012 deal.

At the climate change conference in Poznan in late 2008, several important decisions were adopted, establishing the necessary administrative and legal instruments to operationalize the Adaptation Fund against a backdrop of a worsening global economy and uncertainty about a post-2012 regime agreement. Thus, it is expected that the Adaptation Fund will begin to finance concrete adaptation projects in 2009. Estimates for the size of the fund vary. What is significant is that developing countries will be able to directly access Adaptation Fund resources. The objectives of the Fund mirror ADB's strategic agenda for environmentally sustainable growth.

In addition to the Adaptation Fund, several bilateral and multilateral agencies—such as

ADB, the Australian Agency for International Development (AusAID), the Department for International Development of the United Kingdom (DFID), World Bank, and World Food Program—have pioneered specialized grant and lending programs to address climate change, and have begun to incorporate climate adaptation into their strategic planning. The Global Environment Facility (GEF), as a financial mechanism of the Convention, has also been central to managing multilateral adaptation funds.

Beyond these global efforts, DMCs are gradually formulating national strategies and programs to mainstream adaptation measures. At the local level, projects that involve vulnerable communities in participatory impact assessments and risk management are among the most successful in adaptation capacity-building efforts. These initiatives identify specific "downscaled" climate impacts and associated sector or ecosystem risks, help reduce vulnerability to localized impacts, and increase the adaptive resilience of vulnerable populations exposed to climate hazards.

ADB's Approach

With global climate change dramatically altering the development landscape, ADB seeks to mainstream climate adaptation into its operations in a number of ways. First, ADB's new Long-Term Strategic Framework 2008–2020 (**Strategy 2020**) focuses on responding to climate change as part of our broader agenda of environmentally sustainable economic growth in Asia and the Pacific. Second, ADB is responding to the adaptation challenge by significantly increasing our adaptation activities by formulating climate change implementation plans in each of our five regions. Third, ADB is developing knowledge products to equip Asia and the Pacific with the requisite intellectual ammunition to improve adaptation interventions.

ADB's Adaptation Program

ADB is helping economies in Asia and the Pacific to improve their resilience to adverse climate impacts through four central themes:

- **Adaptation Policy:** ADB is collaborating with governments to formulate adaptation policy and integrate adaptation considerations into their development strategies.
- **Sector Resilience:** Country sector road maps will be adjusted to include an analysis of climate change vulnerabilities.
- **Project Climate-Proofing:** Climate-proofing measures will be introduced to protect development investments (e.g., infrastructure) and livelihood security.
- **Vulnerable Groups:** As climate regimes continue to destabilize, there will be mounting pressure to expand our understanding of how to better manage the socioeconomic risks associated with climate change. Thus, adequate attention to the needs and participation of women, the poor, and minority groups will be important.

Major Adaptation Initiatives

This booklet highlights a number of adaptation initiatives that ADB is supporting in collaboration with our international country partners. Examples include:

- The **Coral Triangle Initiative**, which was launched in 2007 as a joint effort of six DMCs in Southeast Asia and the Pacific, to sustainably manage coastal and marine resources of high economic and environmental value.
- The **Vulnerability to Climate Change: Adaptation Strategies and Layers of Resilience Project**, which is being implemented by the International Crops Research Institute for the Semi-Arid Tropics, is part of ADB's ongoing

support to the International Agricultural Research Centers

- The **Central Asian Countries Initiative for Land Management Project,** which is a collaborative partnership between ADB's Central Asian DMCs and the international donor community, to combat land degradation and improve rural livelihoods in Central Asia.

Mobilizing Adaptation Resources

Because costs for climate adaptation are anticipated to be in the billions between 2008 and 2012, innovative financing approaches must be devised. International development agencies, including ADB, have an important catalytic role to play in providing technical advice and access to financing, while engaging the private sector and civil society. To support the various elements of its climate change program, ADB has established several internal funds, and has also forged partnerships with other development institutions to mobilize specialized adaptation funds.

As such, ADB is well-poised to facilitate the access of our developing member country partners to these adaptation funds. For instance, ADB's **Climate Change Fund** provides grant financing for innovative projects, technical assistance, and research to build climate adaptive resiliency in critical investments with our country partners. With water being the crosscutting sector at greatest risk, we have also established the **Water Financing Partnership Facility**, worth $100 million to 2010, which can include adaptation project elements. Our $1.2 million regional technical assistance project, Small Grants for Activities, enables the rapid mainstreaming of adaptation issues into project and national investment planning.

Small Grants for Activities forms part of ADB's *Promoting Climate Change Impact and Adaptation in Asia and the Pacific* project. This project includes $2.8 million in cofinancing from the Government of the United Kingdom, and $800,000 in financing from the Japan Special Fund. We are using this project's resources to quickly increase internal capacity centrally and regionally, and to facilitate the development of adaptation innovations within our DMCs across Asia and the Pacific.

As an executing agency of the GEF since 1999, ADB has been assisting eligible countries to access and implement adaptation projects through the Least Developed Countries Fund (LDCF), the Special Climate Change Fund, and the Strategic Priority on Adaptation. Further, the Adaptation Fund, established under the Kyoto Protocol to the UNFCCC, will provide a new and innovative source of funding for adaptation projects. In addition, the Climate Investment Fund (CIF), with $6 billion in pledges, was established by the multilateral development banks to increase assistance to developing countries for climate actions until a post-2012 climate change regime and financing mechanism is available. The Pilot Program for Climate Resilience is a subcomponent of the CIF, amounting to possibly $500 million globally. It is designed to assist developing countries formulate adaptation proposals, in concert with multilateral development banks, to integrate climate resilience into their development planning and budgets. Other adaptation funds include Japan's Cool Earth Partnership worth up to $2 billion (¥250 billion) in grant aid.

Initial Adaptation Lessons

ADB's nascent portfolio on climate adaptation is rapidly growing, with more than 30 adaptation-related pilot activities being implemented during 2007–2009, and more projects slated for 2009–2011.

Preliminary lessons will help guide the development of our adaptation portfolio with our country partners, especially in the context of emerging trends and innovations within the international climate change and development community. Adaptation lessons outlined in this booklet cover projects being undertaken in Asia and the Pacific.

New Avenues for Adaptation

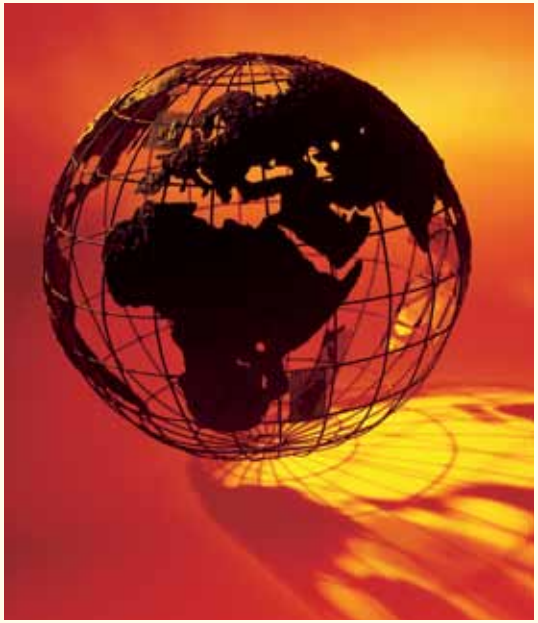
To improve the region's overall adaptive capacity and climate resilience, ADB's adaptation program is developing a number of knowledge products and innovative adaptation methodologies (including our rapid assessment Climate-Framework Integrating Risk Screening Tool), and producing a series of flagship studies. We are also developing a number of adaptation tools for use by our DMC partners.

Thai Tropical rainforest, vulnerable to climate-induced temperature stressors and changes in hydrological cycle.

CHAPTER 1

INTRODUCTION

GLOBAL WARMING: The Science, The Source, The Impacts and Risks in Asia and the Pacific, and The Development Challenges



Human induced global warming makes for a climate changing world

The Science

The Earth works like a greenhouse. Carbon dioxide (CO_2), methane, and other naturally occurring greenhouse gases (GHGs), as well as manmade industrial gases trap heat from escaping into space. This keeps the earth within a life-sustaining range. Without the greenhouse effect, the earth is much colder— an average temperature of -19° Celsius (°C).

There is now broad scientific consensus that our climate is changing as the result of greenhouse gas emissions from human activities. Human reliance on fossil fuels for energy has increased the amount of CO_2 in the atmosphere. Biogenic emissions of GHG from land use have magnified the greenhouse effect. Deforestation and poor land use, which have reduced the absorptive capacity of plants, forests, and soils for CO_2, have made things worse.

The fastest heat rise in history. Atmospheric CO_2 concentration was approximately 180 parts per million (ppm) during the last ice age. According to the Intergovernmental Panel on Climate Change (IPCC), the concentration of atmospheric CO_2 (and other greenhouse gases) has increased from a pre-industrial value of 280 parts per million to 387 ppm as of May 2008[2]. Moreover, IPCC projects that GHG levels will rise to 550–700 ppm CO_2 equivalent by 2050, and 650–1200 ppm CO_2 equivalents by 2100. The difference of 100 ppm translated into a 4°C mean temperature rise—the difference between an ice age and a relatively warm period for the planet. However, according to the Economics of ***Climate Change***[3], any increase in mean temperatures of more than 2°C over pre-industrial levels is predicted to have devastating impacts on people's lives, economic infrastructure, and natural environments around the world.

The Source

Asia's Growing Greenhouse Gas Emissions. While emissions from industrialized countries are responsible for most of the historic greenhouse gas buildup in the atmosphere, Asia's developing countries are the fastest growing source of new emissions, and will soon be the largest source globally. For example, the People's Republic of China (PRC) and the United States are the two largest emitters in the world. India and Indonesia are also ranked among the world's top 10 high-emitting countries.

2 Mauna Loa Observatory website updates. www.mlo.noaa.gov
3 Stern, N. 2007. The Economics of Climate Change. The Stern Review. Cambridge: Cambridge University Press.
4 Nobis imi, arumquid explam, omnis rerepti quis rehenem inulluption nosto int

The International Energy Agency's *World Energy Outlook 2007*[4] reports the following:

- Developing Asia accounts for 29% of global energy-related carbon dioxide emissions, which is thrice its share 30 years ago.

- With an estimated $6 trillion needed for energy investments by 2030, it is projected that Asia's share of global energy-related carbon emissions could rise to 42%. Moreover, emissions from deforestation and land degradation will add to this share of emissions. The impacts of these atmospheric emissions on the region will be catastrophic.

The Impacts and Risks in Asia and the Pacific

It is widely known and accepted that changes in atmospheric temperature and precipitation patterns will impede poverty reduction efforts as a result of more intense and frequent floods, droughts, heat waves, severe storms, and other climate-induced impacts.

The countries of Asia and the Pacific are home to over half the world's population, and about two thirds of the world's poor. Climate impacts affecting this region therefore represent a serious threat to global environmental and economic stability, and demand an urgent and collaborative regional response.

Evidence shows that climate change has affected, and will continue to affect many regions and sectors, with more pronounced changes in terrestrial and marine ecosystems. Sectors and areas, such as water, small islands, water-dependent hydroelectricity, and agriculture, will be especially hard hit (see Appendix 1: Estimated Climate Risks by ADB Sector).

Pacific Island vulnerability to sea-level rise. Half above/half below view of Francis Island, beqa lagoon, Fiji.

Trekkers walking in the Lirung Glacier in the Lantang Valley some 60 kilometres (37.5 miles) northwest of Kathmandu, Nepal. The glacier has retreated at least two kilometres in recent decades, an effect of global warming that is worrying local residents.

Other expected impacts include:

- In Central and West Asia: destabilized hydrological cycles with a reduction in the water lens from rapid glacial melt and/or retreat, prolonged droughts, and land degradation.

- In Southeast Asia and Pacific islands: deterioration of marine and coastal ecosystems caused by sea level rise, ocean acidification, temperature increases, and more intense cyclonic activity, with consequent coral bleaching and coastal erosion.

- In Central and South Asia: a decrease in crop yields of perhaps 30%–50% by 2050, with reduced agricultural yields, and increased risk of hunger.

- In megacities and arid or semi-arid lands: a higher incidence of heat-related health problems and infectious diseases from heat waves and unseasonal urban flooding.

- In coastal megacities (i.e., Bangkok, Jakarta, Karachi, Manila, Mumbai, and Shanghai): increasing vulnerability to flooding and storm surge from unpredictable weather patterns.

- In vulnerable populations: Increasing frequency and intensity of extreme events, precipitating forced human (and species) migration, with consequent land use changes and population pressures, followed by destabilization of localized biodiversity. Populations residing in vulnerable areas—such as coastal Bangladesh, Maldives, and Tuvalu—may become "climate change migrants."

The Development Challenges

Water resources and ecosystems are destabilizing, and food security, human health, and livelihoods are being adversely impacted. With the poor being disproportionately affected, climate change poses a direct threat to Asia's hard-won gains in poverty reduction, and to achieving the Millennium Development Goals (MDGs).

In this regard, the Asian Development Bank (ADB) promotes the transition to low-carbon economies across Asia and the Pacific. ADB is also committed to incorporating climate adaptation into development practices to minimize the impacts of extreme and variable weather on human settlements, public infrastructure, and localized ecosystems, and to building coping skills and climate adaptive resilience in vulnerable communities.

WHAT IS CLIMATE ADAPTATION?

The Inter-Governmental Panel on Climate Change defines adaptation as: "Adjustments in ecological, social or economic systems in response to actual or expected climatic stimuli and their effects and impacts... (and) to changes in processes, practices and structures to moderate potential damages or to benefit from opportunities associated with climate change."

KEY ADAPTATION CONSIDERATIONS FOR DEVELOPING MEMBER COUNTRIES

Considering the aforementioned impacts and development challenges across Asia and the Pacific, it is vital that ADB and its regional partners help reduce and/or manage these impacts through climate change risk-resiliency measures. This will allow ADB and our development partners to better meet our development objective of poverty reduction, and resilient economies move toward a more sustainable growth pathway, while safeguarding ADB investments.

ADB's climate adaptation program reflects several important adaptation considerations recognized by many international development agencies. These considerations include: country ownership of adaptation within the development process, partnership synergies, the integration of disaster **risk** reduction, and climate **risk** management and adaptation[5], and a no-regrets approach.

The temperature threshold of ecosystem sensitive flora and fauna, such as this Gecko, to climate change variability and extremes is tenuous (belgianchocolate's photostream: http://www.flickr.com/photos/frank-wouters/305145503/)

- **Country ownership.** ADB supports this approach by: aligning our country strategies and programs with national poverty reduction strategies; delivering assistance programs consistent with DMC priorities, using existing country systems whenever possible; and supporting sustainable national capacity development, including developing human resources and strengthening institutions.

5 Climate risk management and adaptation is a term used for a large and growing body of work, bridging the climate change adaptation, disaster management, and development sectors, among many others. See van Aalst, M., Hellmuth, M. and Ponzi, D. (2007) Come Rain or Shine: Integrating Climate Risk Management into African Development Bank Operations. Working Paper No 89. African Development Bank, Tunis

According to the United Nations International Strategy for Disaster Reduction Secretariat[a], a "risk" is defined as follows:

Risk, Hazard, and Vulnerability

The terms "risk," "hazard," and "vulnerability" have been used in many confusing and contradictory ways. Adaptation practitioners generally use these terms in the same way that disaster risk reduction and hazard management specialists do. The UNISDR presents these terms together in the following equation:

Risk = Hazard x Exposure x Vulnerability

Where:
- Overall **risk** of damage or losses is determined by the nature, intensity, and frequency of the hazard, (e.g., the frequency of flood of a certain level);
- **Exposure** to a hazard (e.g., the number of people living on a floodplain); and
- **Vulnerability** to the hazard (e.g., the conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards).a

For instance, climate change will alter the frequency and intensity of hazards; population increase and settlement patterns will change **exposure**; and social, economic, and environmental factors will change **vulnerability**. Adaptation seeks to reduce **exposure** and **vulnerability** to the hazards associated with climate change impacts.

[a] *United Nations International Strategy for Disaster Reduction Secretariat Basic Terminology: www.unisdr.org/eng/library/lib-terminology-eng-2004.htm*

- **Partnership synergies.** Five partnership approaches are important: ownership, alignment, harmonization, managing for results, and mutual accountability. These approaches provide us with ways to improve our development effectiveness, respond to the threats and risks of climate change, and help our DMCs achieve their MDGs.

- **Integration of disaster risk reduction and climate risk management and adaptation.** ADB will strategically address climate change, both internally and in our DMCs, by responding to current climate variability and extremes through disaster and hazard risk reduction approaches. At the same time, we seek to integrate climate risk management and adaptation approaches into our development programming. Our adaptation program is also enhanced by ADB's Disaster and Emergency Assistance Policy, and 2008 action plan.[6]

- **No-regrets approach.** This approach involves climate-related decisions or actions that make sense in development terms, whether or not a specific future climate change threat actually materializes. While operating under conditions of uncertainty regarding future climate impacts and trends, we maximize near-term development outcomes. Thus, some current and future vulnerability to climate risks can be tackled through no-regret adaptation approaches.

6 ADB. 2008. Action Plan for Implementing ADB's Disaster and Emergency Assistance Policy. Manila.

CHAPTER 2

CLIMATE VULNERABILITY AND EXPECTED IMPACTS IN ASIA AND THE PACIFIC

This chapter highlights some of the key regions and sectors deemed by IPCC, the United Nations Framework Convention on Climate Change (UNFCCC), nongovernment organizations (NGOs), the private sector, and ADB and its DMCs, to be most vulnerable to climate change impacts.

KEY GEOGRAPHIC IMPACTS

Impacts by Geo-Climatic Zone

Certain geo-climatic zones of Asia and the Pacific are at great risk from climate impacts. These zones include arid, semi-arid, and dry sub-humid areas; river basins, deltas, and mega cities in low-lying areas; small islands; and fragile mountain ecosystems (Table 1 on page 19 lists specific impacts by zone).

- **Arid, semi-arid, and dry sub-humid areas.** These areas are vulnerable to yield failure from water scarcity and variable temperature stressors. The Central and West Asian countries of Afghanistan, Kazakhstan, Pakistan, and Uzbekistan fall into this category.

- **River basins, deltas, and megacities in low-lying areas.** River basins and deltas are highly vulnerable to run-off changes, and riverine and coastal delta flash floods. The Southeast Asian countries of Cambodia, the Lao People's Democratic Republic, and Papua New Guinea are prime risk candidates for this category.

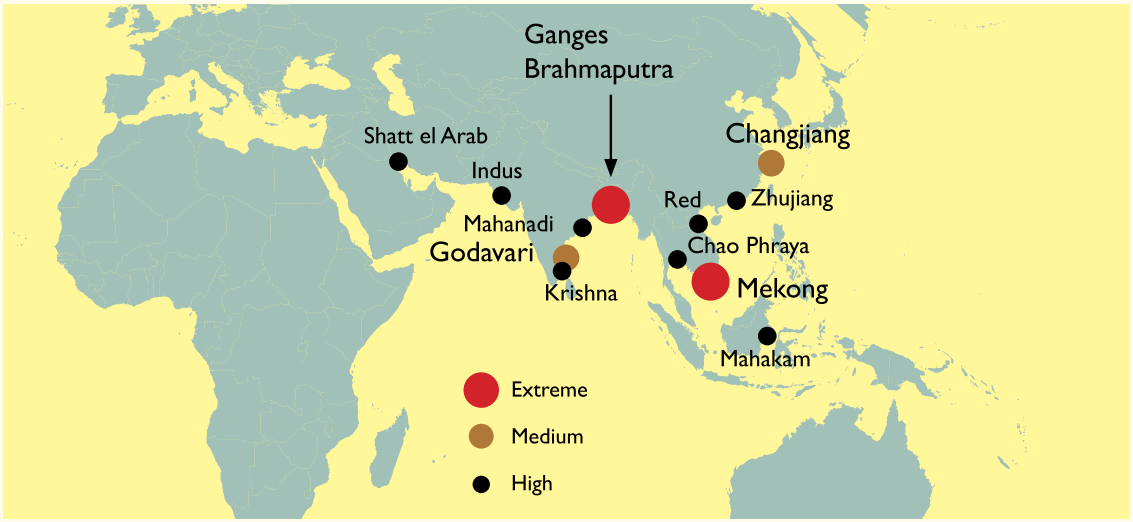


FIGURE 1: Asian megacities at risk.

Mega deltas are especially affected by climate change due to large populations and high exposure to sea level rise and storm surges (Figure 1).[7] The average mega-delta population density is 500 people per square kilometer, with the largest population in the Ganges–Brahmaputra delta of Bangladesh. Much of the population of these deltas is at risk from climate change impacts, over and above existing coastal erosion and land loss (primarily a result of decreased sediment delivery by the rivers). Millions of people will be directly affected by 2050 in the major deltas of Asia, including those of the Chao Phraya in Thailand, the Ganges–Brahmaputra in Bangladesh, the Mekong in Viet Nam, and the Yangtze in the PRC.

7 Source: Image map IPCC 2007.

Pacific Island highly vulnerable to sea-level rise and storm surge

- **Small islands.** Small islands are especially vulnerable to sea level rise, coastal inundation, and coastal infrastructure risk. The majority of the world's population lives within 60 kilometers of a coast, and this is steadily increasing.[8]

  This profound demographic shift has significant implications for coastal megacities and their infrastructure, populations, and ecosystem stability. In the Pacific islands,[9] more than 50% of the population live within 1.5 kilometers of the coast. Almost without exception, airports, roads, and capital cities in the small islands of the Indian and Pacific oceans are in coastal areas.

- **Fragile mountain ecosystems.** Mountain ranges, such as the Pamirs, the Hindu Kush, the Kunlun, the Karakoram, and the Tian Shan, are facing unprecedented climate change threats. These threats include irreversible glacial melt, unpredictable water flow patterns and downstream flooding, dramatic temperature fluctuations, and reduced agricultural outputs.

Protecting Island Biodiversity and Traditional Culture in Pacific Island Communities through Community-Based Climate Risk Assessment and Management

This ADB project will incorporate community-based impact and adaptation strategies within four vulnerable communities on Aitutaki and Rarotonga in the Cook Islands. The project will develop replicable community-based adaptation risk management tools to minimize risks on critical infrastructure and service sectors, and help climate-proof vulnerable community investments.

ADB. 2007. Promoting Climate Change Adaptation in Asia and the Pacific.

Low-Income Countries and Fragile States

Low-income countries and fragile states face additional vulnerability due to their weak capacity to adapt. They have fewer coping strategies and greater socioeconomic challenges. They also have very restricted financial and institutional resources to effectively build resilience against the increasingly unpredictable impacts of climate shocks.

8 Comment and notes from: J. Mara Hendrix. 2008. Coastal Cities Summit: Values & Vulnerabilities. International Ocean Institute. www.intbau.org/conferencesarchive2008.htm#CS1108
9 Cook Islands, Fiji Islands, Kiribati, Federated States of Micronesia, Marshall Islands, Nauru, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, Timor-Leste, and Vanuatu.

TABLE 1 GEO-CLIMATIC ZONE	CLIMATE IMPACTS
Arid, Semi-Arid, and Dry Subhumid	• Resilient ecosystems and complex human pastoral and cropping systems, but medium certainty that 10%–20% of drylands degraded • 10%–30% projected decrease in water availability in next 40 years • Projected increase in droughts and floods • Likely overall decrease in agricultural productivity and compromised food production from variability, with rain-fed agriculture yield reduced by up to 50% by 2020
River Basins, Deltas, and Megacities in Low-Lying Areas	• Highly vulnerable to sea level rise, run-off changes, riverine flash floods, and storm surges • Natural and human-induced subsidence, human water extraction and diversion, and declining sediment input from dam entrapment accelerating sea level rise above global average
Small Islands	• Especially vulnerable to the effects of climate change, sea level rise, and increases in the frequency and/or intensity of extreme events • Limited size, susceptibility to natural hazards, and external shocks increase climate vulnerability • Low adaptive capacity, and high adaptation costs relative to gross domestic product • Sea level rise to exacerbate inundation, storm surge, and coastal erosion, threatening vital infrastructure (especially airports, roads, and capital cities) and human settlements (very high confidence) • Less rainfall coupled with accelerated sea level rise compound the threat to water resources, with an estimated 10% reduction in average rainfall predicted for 2050[a],a which is likely to correspond to a 20% reduction in the size of any island's usable groundwater lens
Fragile Mountain Ecosystems	• Accelerating and unprecedented threats such as irreversible glacial melt, unpredictable water flow patterns, and downstream flooding and glacial overflows Dramatic fluctuations in temperature stressors, and megafauna and flora species impact such as species migration and forest dieback

[a] *Tarawa Atoll, Kiribati. UNEP, GRID Arendal, www.grida.no/publications/climate-in-peril/page/3545.aspx*

Glacier ice melting from global warming

IMPACTS ON KEY SECTORS AND AREAS

This section describes those sectors and areas in Asia and the Pacific that are most vulnerable to the effects of climate change.

Water

Climate change impacts are expected to be felt most strongly in the water sector. For many adaptation practitioners, climate adaptation is mostly about water (impact on the hydrological cycle). Most development sectors and human activities are directly dependent upon the availability of water.

Hydrogeological cycles are becoming destabilized and less predictable because of sea level rise, saltwater intrusion in watersheds, and changing precipitation regimes. Consequently, water availability or water scarcity directly impacts electricity generation in hydropower plants, food production and productivity in agricultural zones, and potable water and irrigation supplies. Moreover, the increasing frequency and intensity of unseasonal floodwaters is placing added stress on already burdened urban wastewater infrastructure.

It is estimated that 120 million to 1.2 billion people will experience increased

Strengthening Resilience of Water Sector in Khulna to Climate Change

This ADB poverty reduction project will enhance the Khulna Water Supply Project through a support project, Strengthening Resilience of Water Sector in Khulna to Climate Change.

The project will provide structural and nonstructural climate-proofing measures to water systems, in the face of sea level rise and saltwater intrusion, more intense cyclonic activity, and flash floods.

ADB. 2008. Strengthening Resilience of Water Sector in Khulna to Climate Change.

Glacial Melt and Downstream Impacts on Indus-Dependent Water Resources and Energy

This ADB project will help the Government of Pakistan develop a Mountain Glacier and Downstream Water Risk Management Framework and Adaptation Guide. This includes operational risk management and climate impact resiliency strategies for the hydro-energy and water sectors (including irrigation). The investment portfolio is valued at $1.5 billion in ongoing projects, and $700 million in planned new projects.

ADB 2008. Promoting Climate Change Adaptation in Asia and the Pacific.

Glacial ice fields in Kyrgistan mountains subject to increasing glacier retreat

Cascading rice field terraces in Asia, dependent upon stable water supply and constant temperatures for high agricultural yields

water stress by the 2020s, and this number will range from 185 million to 981 million people by the 2050s.[10]

Recent measurements in Central and West Asia postulate declines in glacier volumes that are likely to have substantial impacts on water flows to downstream valleys. At lower mountain altitudes, observed climatic changes include deterioration of watersheds and depletion of water recharge capacities, increased likelihood of flash fires, and biotic changes in ecosystem thresholds and composition.

Over the short term, the substantial risk of glacial overflows and highland flash floods places large downstream populations and infrastructure in danger.

Glacier-fed rivers, such as the Indus, are a major source of irrigation and hydropower in western Himalayan countries. In Pakistan alone, it is estimated that 80% of the river run-off flowing into the Indus Basin Irrigation System originates from glacier melt, and supports the irrigation of 75% of the country's cultivated area. Over the medium term, the Indus is listed as one of the world's 10 rivers at greatest risk of dying because of climate change, according to the World Wide Fund for Nature.[11]

As a consequence of impacts on the water cycle and higher soil surface temperatures, and the adaptive limitations of less-developed subregions, agricultural yield decreases in Asian highlands are likely to increase the disparity in food production and food security in rural highlands. These food disparities are expected to precipitate forced migration and cross-border water conflicts.

Agriculture and Food Security

For parts of Asia, projected decreases in crop yields range from 2.5% to 10.0% in the 2020s, and 5% to 30% in the 2050s.[12]

In some Asian countries, yields from rain-fed agriculture could be reduced by up to 50% by 2020. With water availability in drylands expected to decrease by 10%–30% over the next 40 years, these changes will cause severe impacts on the region's food security.

ADB's Water Financing Partnership Facility is cofinancing several water and sanitation projects that are climate-related

The Mekong Water Supply and Sanitation Project will help prepare sanitation strategies for nine towns. The Sri Lanka Dry Zone Water Supply and Sanitation Project advocates improved sanitation and septic management, and promotion of healthy rivers via the development of resilient catchment management plans.

ADB. 2006. Water Financing Partnership Facility. Manila. Contributors are Australia (about $8.7 million equivalent), Austria ($5.0 million), Multi-Donor Trust Fund ($23.3 million), Netherlands Trust Fund ($19.8 million), Norway (about $4.6 million equivalent), and Spain ($5.0 million).

Climate Risk Management and Assessment for Agriculture in Thailand and Viet Nam

This ADB project will improve the understanding of climate variability and its impact on water and cropping patterns, structures of income and/or employment, and adaptation strategies. It will also develop gender-equitable agricultural adaptation strategies in the rain-fed semi-arid tropics.

ADB. 2008. Promoting Climate Change Adaptation in Asia and the Pacific.

10 Under the full range of scenarios in the Intergovernmental Panel on Climate Change Special Report on Emission Scenarios; Ahlenius, H. 2007. Water Towers of Asia—Glaciers, Water and Population in the Greater Himalayas-Hindu Kush-Tien Shan Tibet Region: UNEP/Grid-Arendal website (June).
11 Wong, CM, CE Williams, J. Pittock, U. Collier, and P. Schelle. 2007. World's Top 10 Rivers at Risk. Gland, Switzerland: World Wide Fund for Nature.
12 Intergovernmental Panel on Climate Change. 2007. Climate Change 2007: Synthesis Report, Summary for Policymakers: 10.4.1.1. Bonn.

The Yangtze River water is sluiced through the Three Gorges Dam in Yichang, Hubei Province.

Human Health

Climate change is expected to increase endemic morbidity and mortality from communicable diseases in South and Southeast Asia. Increases in coastal air and water temperature, and increased flooding and resulting contaminated water supplies, will lead to increased occurrence of, and/or more virulent strains of, cholera, malaria, and dengue fever in South Asia. Moreover, natural habitats of vector-borne and waterborne diseases in North Asia are likely to expand over time.

Energy

Altered water flows from glacial melt (short-term acceleration and medium-term reduction) are expected to reduce power generation reliability. This may induce a return to high carbon-based technology by the power sector as countries consider returning to fossil fuel-dependent thermal power plants to compensate for unpredictable hydropower potential.

The resulting increase in greenhouse gas emissions would further contribute to globing warming, and exacerbate glacial melt.

Social Dimensions

While adaptation research and activities are increasingly targeting vulnerable populations (with varying levels of success), limited attention is being given to distinctly at-risk populations, such as women in impoverished communities, indigenous groups, and cultural minorities. This is especially true of decision-making power and addressing livelihood security and family income issues. Without tangible knowledge products to mainstream climate risk management practices, and practical participatory coping skills to empower disadvantaged groups to reduce their vulnerability to impacts, these groups will remain marginal and increasingly

Chong Kneas, Malaysia: Mother and son at prow of boat. Increased prevalence of water-borne diseases from climate-induced flash floods and heat waves will exacerbate child mortality and morbidity (Ian Gill)

11 Wong, CM, CE Williams, J. Pittock, U. Collier, and P. Schelle. 2007. World's Top 10 Rivers at Risk. Gland, Switzerland: World Wide Fund for Nature.

exposed to risk.

THE ECONOMICS OF CLIMATE CHANGE

The *Stern Review*[13] estimates that, even if atmospheric CO_2 concentrations are kept below dangerous levels through concerted international action, adapting to the inevitable climate change impacts will cost poor countries $10 billion annually. This best-case estimate is conservative, as the global cost of climate-proofing new projects, cited by sources such as the World Bank and Oxfam, is in the range of $10 billion to $150 billion per annum (see Appendix 2). This, of course, depends on factors such as level of risk and infrastructure vulnerability. The United Nations Development Programme (UNDP) 2007 *Human Development Report* suggests adaptation investment needs will be $86 billion by 2015.[14]

These investments do not include retrofitting of existing capital stock. They also do not consider socially-oriented and community adaptation expenditure. These adaptation expenditures would help safeguard the lives and livelihoods of the hundreds of millions of impoverished people who are subject to floods, storm surge, water shortages, cyclones, and other increased risks brought on by climate change. One scenario of available incremental adaptation funds would possibly yield total annual adaptation financing of about $200 million[15] per year between now and 2012. It is clear that this amount falls far short of global, and even regional adaptation needs.

Unfortunately, the majority of ADB's DMCs are particularly prone to climate risks, and are not yet adequately prepared to deal with the resulting adverse impacts on agricultural output, labor productivity, health, infrastructure, and internal displacement. Importantly, the vulnerability of Asia and the Pacific to climate change is dictated by its unique physical and socioeconomic attributes. These attributes include high population density, relatively low income levels, long coastlines, and the prominence of climate-sensitive agriculture and fishing in providing livelihoods.

If adaptation measures are not implemented now, the *Stern Review* calculates that the overall costs and risks of inaction would be equivalent to losing at least 5% of global gross domestic product annually. If a wider range of risks and impacts is taken into account, the estimates of damage could rise to 20% of gross domestic product or more. It is estimated that the climate-proofing of projects at risk may result in as much as a 20% increase in costs.[16]

Recognizing the daunting climate change challenge that faces Asia and the Pacific, a concerted effort to mainstream climate risk management and adaptation measures will have to be made internationally, regionally, and at the country level. These longer-term adaptation responses to climate variability will be coupled with shorter-term disaster risk reduction responses to extreme events to ensure an integrated risk management and development approach.

A Regional Review of the Economics of Climate Change in Southeast Asia

ADB is collaborating with the Government of the United Kingdom, through its Foreign and Commonwealth Office, to undertake ***A Regional Review of the Economics of Climate Change in Southeast Asia***. This is a regional version of the UK-***commissioned Stern Review on the Economics of Climate Change***.

Through this effort, ADB aims to assess economic costs and benefits of unilateral and regional actions on mitigation and adaptation. The Review also aims to raise awareness of the urgency of climate change challenges and their socioeconomic impact in Southeast Asia.

ADB. 2007. A Regional Review of the Economics of Climate Change in Southeast Asia.

emissions from coal-fired power plant

13 Stern, N. 2007. The Economics of Climate Change. The Stern Review. Cambridge University Press: Cambridge.
14 UNDP. 2007. Fighting Climate Change—Human Solidarity in a Divided World. Human Development Report 2007/2008. New York, Palgrave Macmillan.
15 vvan Aalst, M., Hellmuth, M. and Ponzi, D. (2007) Come Rain or Shine: Integrating Climate Risk Management into African Development Bank Operations. Working Paper No 89. Annex 2, 24. African Development Bank, Tunis.
16 Notes from the Stern Review on the Economics of Climate Change on the importance of investing in adaptation measures, and the costs of introducing climate-proofing measures.

CHAPTER 3

FROM GLOBAL TO LOCAL ADAPTATION RESPONSES

Responses to climatic change vary, depending on the scope of the impacts, the target sector at risk, the level of vulnerability, and the caliber of social agency. Responses will also vary depending on whether prescriptive government adaptation policy exists, or community and private sector adaptation resources are easily mobilized.

This chapter describes the various levels of agency response to adaptation: international, multilateral and bilateral, national, private sector, inter-agency networks, and vulnerable communities and NGOs.

INTERNATIONAL RESPONSE

United Nations Framework Convention on Climate Change

The UNFCCC, founded at the Rio Earth Summit in 1992, is universally recognized to be the appropriate global forum to tackle the complex problem of climate change. With 192 parties, the convention enjoys near-universal country membership. The ultimate objective of the convention is to stabilize greenhouse gas concentrations in the atmosphere at a level that will prevent dangerous human interference with the climate system.

Residents walking along flooded street in Muara Angke, densely populated area in North Jakarta. Unusually high tide on June 14, 2007.

The Kyoto Protocol

The UNFCCC is complemented by the 1997 Kyoto Protocol, which has 184 parties. The Protocol entered into force in 2005 during the 11th United Nations Climate Change Conference in Montreal, Canada. Under this treaty, 37 industrialized countries and the European Community committed to reduce their emissions by an average of 5% by 2012 against 1990 levels. Industrialized countries must first take domestic action against climate change. The Kyoto Protocol also allows them to meet their emission reduction commitments abroad through so-called market-based mechanisms, such as the Clean Development Mechanism and Joint Implementation.

Nairobi Work Programme on Impacts, Vulnerability, and Adaptation to Climate Change

On the adaptation front, the 5-year Nairobi Work Programme (2005–2010) aims to assist all parties to the Kyoto Protocol (developing countries and especially least-developed countries and small island developing states) to:

- improve their understanding and assessment of impacts, vulnerability, and adaptation to climate change; and
- make informed decisions on practical adaptation actions and measures to respond to climate change on a sound scientific, technical, and socioeconomic basis.[17]

The program has become a global framework on adaptation, involving over 130 intergovernment organizations and NGOs, the private sector, and other adaptation stakeholders.

The framework is structured around nine work areas. They include: methods and tools; data and observations; climate modeling, scenarios, and downscaling; climate-related risks and extreme events; socioeconomic information; adaptation planning and practices; research; technologies for adaptation; and economic diversification.

Bali Action Plan

The Bali Action Plan (adopted in December 2007 at the 13th United Nations Climate Change Conference of Parties) identifies four essential elements or "building blocks" that a future post-2012 climate change agreement must address. These are mitigation, adaptation, financing, and technology transfer.

The Bali Action Plan fully acknowledges the urgent need for resources and expertise to assist countries to adapt to the effects of climate change. The plan calls for enhanced action on adaptation, and identifies priorities to be taken, considering the "urgent and immediate needs of developing countries."

From Bali Through Pozna to Copenhagen Post-2012

In Bali, the atmosphere at the 13th United Nations Climate Change Conference in December 2007 was characterized by the strong international reaction to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, and a sense of urgency about climate change. By contrast, at the 14th United Nations Climate Change Conference in Pozna, Poland, in December 2008, the negotiations took place against the backdrop of a rapidly worsening global economy. Many were concerned about climate change policy falling victim to the economic crisis.

There has been uneven development between the adaptation and mitigation disciplines. Add to this the unevenness of country commitment issues between Annex 1 and non-Annex 1, and the global economic downturn. These factors may hinder the attainment of an international agreement during the 2009 negotiations at the 15th United Nations Climate Change Conference in Copenhagen.

MULTILATERAL AND BILATERAL RESPONSE

There is growing consensus among multilateral development banks, development institutions, and industrialized nations that climate change will impose new and troubling costs on developing countries of Asia and the Pacific, affecting their ability to sustain economic growth.

G8 Declaration

This aforementioned consensus is articulated in the 2008 G8 *Declaration on Environment and Climate Change,*[18] which states:

17 UNFCCC: unfccc.int/adaptation/sbsta_agenda_item_adaptation/items/3633.php
18 G8 Information Centre: www.g8.utoronto.ca/summit/2008hokkaido/2008-climate.html

Chong Kneas, Malaysia: Malay children in dug-out canoe, at increasing risk from coastal storm surge, riverine flooding, and land slides (Ian Gill).

> We reaffirm our commitment to take strong leadership in combating climate change and in this respect, welcome decisions taken in Bali as the foundation for reaching a global agreement in the United Nations Framework Convention on Climate Change (UNFCCC) process by 2009. ... Enhanced commitments or actions by all major economies are essential for tackling climate change.

INTERNATIONAL ADAPTATION FUNDING AND STRATEGIES

Several international agencies have pioneered specialized grant and lending programs and policies to address climate change (Chapter 5). Agencies include ADB, the Australian Agency for International Development (AusAID), the Department for International Development of the United Kingdom (DFID), and the World Bank. The Global Environment Facility (GEF)—a financial mechanism of the UNFCCC managed by the World Bank—also provides adaptation funding. These institutions have begun to incorporate climate adaptation policies and practices into their strategic planning.

There has also been increasing convergence and collaboration among multilateral and bilateral institutions to help developing countries build capacity to assess their vulnerability to climate change. Assistance has also been provided to examine their climate impact and adaptation options.

ASIA AND THE PACIFIC COUNTRY RESPONSE

Developing member countries in Asia and the Pacific are working to understand area-specific threats, and how to cope. They are developing strategies and programs to mainstream adaptation measures, thus improving their resilience to local climate change impacts. This includes the formulation of National Adaptation Programmes of Action (NAPAs) for Least Developed Countries (LDCs). Furthermore, all Parties to the Convention have prepared National Communications, which include vulnerability and adaptation assessments. These National Communications form the basis for follow up action and, in their preparation, also build national capacity and guide policy direction.

National Adaptation Programmes of Action

The purpose of developing a NAPA is to identify the urgent and immediate needs of a country to effectively adapt to present-day threats from climate change. The majority of LDCs have prepared their NAPAs, and are shifting their attention towards the implementation of identified priorities.

Support for the implementation of these priority activities is available through the

ADB Technical Support to Bangladesh

ADB, in partnership with the World Bank and DFID, is providing technical assistance to the Government of Bangladesh to develop its National Climate Change Policy and Adaptation Action Plan.

ADB. 2007. Climate Change Fund.

GEF Least Developed Countries Fund (LDCF) as well as other sources of funding which can be mobilized. Thirteen countries in Asia and the Pacific are eligible.[19]

National Communications and Enabling Activities

All Parties to the Convention are required to prepare National Communications which are fully funded by the GEF, and are supported largely by UNDP and United Nations Environment Programme. These reports include vulnerability and adaptation assessments and can help develop the groundwork necessary to establish national policies and develop follow-up actions. Typically, national climate change committees are established to ensure engagement by all relevant stakeholders. Countries can use these committees to guide policy directions and mobilize resources. The GEF has also funded other enabling activities which were deemed important for building the capacity and knowledge necessary for sound adaptation planning. An example of this is the Assessment of Impacts and Adaptation for Climate Change (AIACC) project, which builds scientific capacity and original research in developing countries.

PRIVATE SECTOR RESPONSE

With climate risk management and adaptation becoming an urgent and essential complement to greenhouse gas mitigation, a new integrated approach is required to optimize the responses of the private sector, governments, and civil society.

Insurance Industry

Multinational corporations and regionally based business coalitions are beginning to address the risks climate change poses to their profitability. Leading re-insurers, such as MunichRe and SwissRe, are pioneering adaptive climate risk (indexed) insurance schemes for climate-vulnerable client groups and regions.

Tourism Industry

The response of the tourism industry to the challenges of climate change has also visibly increased, leading to the signing of the Davos Declaration during the 2nd International Conference on Climate Change and Tourism in Davos, Switzerland, on 1–3 October 2007. Tourism and carbon levy initiatives to finance mitigation and adaptation costs are currently being discussed in South Pacific and Indian Ocean countries.

Pacific Regional Partnerships for Climate Change Adaptation and Disaster Preparedness Project

This ADB project provides $1 million in grant financing through the Regional Cooperation and Integration Financing Partnership. The project will facilitate development of a regional hazard risk and exposure database for risk minimization, toward possible development of a regional pooled catastrophic insurance scheme.

This project is ADB's response to the request by Pacific DMCs for a financial mechanism to deal with the increasing intensity and frequency of natural disasters, and the need for climate-related risk insurance.

ADB. 2008. Pacific Regional Partnerships for Climate Change Adaptation and Disaster Preparedness Project

ADAPTATION NETWORKS

The emerging Global Climate Change Adaptation Network[20] is being supported by several bilateral and multilateral and development agencies, including ADB. Its purpose is to improve the adaptive capacity of developing countries. The network will mobilize knowledge and technology for communities at all levels, and pilot adaptation options, while demonstrating and

19 These least-developed countries are Afghanistan, Bangladesh, Bhutan, Cambodia, Kiribati, the Lao People's Democratic Republic, Maldives, Myanmar, Nepal, Samoa, Solomon Islands, Tuvalu, and Vanuatu.
20 http://wikiadapt.org/index.php?title=Global_Climate_Change_Adaptation_Network

disseminating best practices. The network will also provide packages of adaptation services; help integrate adaptation options into national and regional development planning processes; and promote synergies between various disciplines, practitioners, sectors, and regions.

There are also several private sector and academia-driven networks and investor groups providing innovative climate change adaptation expertise. Examples include the Investor Network on Climate Risk, launched by United States institutional investors to manage over $700 billion in assets. Others include: ClimAdapt, a Canadian public–private sector and NGO network promoting risk management and adaptation internationally; and the Linking Climate Adaptation Network, a community of over 900 adaptation practitioners, stakeholders, researchers, and policy makers.

Malaysia boat village susceptible to sea-level rise and storm surge disasters.

COMMUNITY AND NGO RESPONSE

Communities' and NGOs' participatory projects are among the more successful climate adaptation capacity-building efforts. They involve identifying specific "downscaled" climate impacts and associated sector or ecosystem risks, help reduce vulnerability to localized impacts, and increase adaptive resilience in vulnerable populations. ADB is supporting a number of community-based adaptation projects including the Protecting Island Biodiversity and Traditional Culture in Cook Islands Through Community-Based Climate Risk Management; and Nepal's Community-Based Vulnerability Assessment, Risk Mapping and Adaptation Planning.

Palau Adaptation Cluster

ADB is collaborating with the Government of Palau to develop a multilevel cluster of adaptation pilots.

At the Country Level. The project will contribute to Palau's country partnership strategy 2009–2013. The Climate Change Road Map will also be aligned with Palau's Facility for Economic and Infrastructure Management Project. It will support the subsequent 5-year Midterm Development Strategy, Palau's Second National Communication, and supporting National Adaptation Strategy.

At the Industry Level. The project will identify high-risk economic sectors and vulnerable structures, such as water resources, marine ecosystems, tourism infrastructure, and agriculture (taro). A geographic information system-based multisector climate vulnerability and risk atlas will be developed, via mobile global positioning system.

At the Community Level. A community-based participatory adaptation framework will blend traditional environmental and adaptive knowledge with contemporary adaptive science and tools. This blending will enable the creation of state- and village-led policy formulation and livelihood security pilots.

Localized disaster risk management planning will also be introduced, along with a climate-oriented environmental assessment, and a climate impact and adaptation cost–benefit analysis.

CHAPTER 4

ADB'S ADAPTATION RESPONSE IN DEVELOPING MEMBER COUNTRIES

BUILDING ADAPTIVE RESILIENCE

There will be increasing demand for adaptation policy reform, capacity building, and incremental adaptation investments in both urban and rural settings. These adaptation measures will help avoid the negative consequences of climate change, and support the millions of people in Asia and the Pacific who are expected to become "climate change migrants."

A combination of adaptation-oriented development assistance and risk insurance or other market schemes will be necessary to cope with climate-triggered disaster events. Coastal cities, flood-prone areas, and low-lying infrastructure will especially need to be protected.

The design of water supply systems, port developments, or hydropower projects may need significant adjustments to deal with greater precipitation and water flow variability. There will also be increased demand for drought- and flood-resistant crops, irrigation innovations, and other adaptive technology and risk management measures.

As climate change is predicted to disproportionately impact poor people, ADB's strategic adaptation efforts will assist DMCs to reduce risk and increase resiliency to expected impacts, and ensure DMCs move toward more sustainable growth.

ASSESSING CLIMATE RISKS

An early step in addressing adaptation to climate change is to identify the level of vulnerability of the target area, system, or project, and the climate risks that threaten it. Vulnerability assessments should consider baseline changes in socioeconomic and environmental conditions, biophysical and socioeconomic impacts, and the capacity for systems to react to climate change through autonomous adaptation.[21]

ADB STRATEGIC ADAPTATION APPROACHES

Global climate change is dramatically altering the development landscape. Taking into consideration those adaptation considerations for DMCs mentioned in Chapter 1, the following points describe how ADB seeks to mainstream climate risk management and resiliency measures in its work with our DMC partners.

Philippines: Strengthening Climate Change Resilience of the Integrated Natural Resources and Environmental Management Sector Development Program

This ADB program will develop adaptation tools for upland mountain communities in watershed-dependent river basin areas. Outputs include a replicable geographic information system-based climate impacts risk atlas, an integrated environmental risk management plan (including disaster risk reduction component), and a public education and outreach adaptive watershed management campaign.

ADB. 2007. Promoting Climate Change Adaptation in Asia and the Pacific

ADB will make strategic and targeted adaptation investments to reduce poverty and ensure socioeconomic and environmental climate resiliency.

ADB's Long-Term Strategic Framework and Climate Change

ADB's Long-Term Strategic Framework 2008–2020 (Strategy 2020)[22] focuses on responding to climate change as part of

21 Smith. et al. 2000. An Anatomy of Adaptation to Climate Change and Variability. Volume 45, Number 1.
22 ADB. 2008. Strategy 2020: The Long-Term Strategic Framework of the Asian Development Bank 2008–2020. Manila.

our broader agenda of environmentally sustainable economic growth in Asia and the Pacific.

Strategy 2020 states that "ADB will play a substantive role in promoting the mitigation of, and adaptation to climate change, resource management and environmental protection, and natural disaster risk reduction in its DMCs [developing member countries]."

ADB Climate Change Implementation Plans

ADB is responding to the adaptation challenge by significantly increasing its climate adaptation activities and resources. We have formulated climate change implementation plans in each of our five regions (Central and West Asia, East Asia, Pacific, South Asia, and Southeast Asia).

Each implementation plan will help guide the establishment of country-specific plans to enable ADB to support climate change actions through to 2015. These actions will be in the form of investments and capacity building. They can be integrated into each country partnership strategy and regional cooperation strategy to help our DMCs mainstream climate vulnerability and risk management.

INDIA, Madhepura: Aerial view from a relief helicopter of the Indian Air Force shows the flood-affected Madhepura district in India's northeastern state of Bihar on September 7, 2008. India was grappling with the task of feeding and housing close to a million villagers displaced by huge floods in the eastern state of Bihar, as the rescue effort wound down. Some 900,000 people fled from their homes or were evacuated by boat since the Kosi river breached its defences on the Nepal border and changed course.

Given varying country needs, the climate change implementation plans will be designed to meet nationally defined objectives, and will incorporate private sector opportunities.

ADB Portfolio at Risk

ADB has conducted an assessment of the potential risks facing its active sovereign loan portfolio posed by anticipated climate change impacts. Using data available in ADB's project performance reports, this *Portfolio at Risk to Climate Change: Preliminary Assessment* analyzed the level of risk facing loans based on a set of predetermined risk criteria associated with climate impacts and variability.

Broadly characterized conclusions gleaned from this rapid risk assessment include:

- a better understanding of the vulnerability of ADB's loans to climate impacts, by region and sector;
- preliminary justification for regional departments and their DMC partners to conduct a more rigorous climate impact vulnerability and impact risk screening exercise on current and future projects deemed to be at high risk;
- insight into the need for screening tools applied at the project preparation stage; and
- motivation for the introduction of climate adaptation and risk management policies, and adaptation resources and actions in ADB operations.

ADB Risk Screening

ADB is piloting its Climate-Framework Integrating Risk Screening Tool (Climate-FIRST), a rapid risk assessment tool for ADB project officers (see Chapter 6). Risk screening is a context-specific approach to systematically support decision making that integrates climate adaptation and disaster risk reduction measures within developmental and poverty reduction plans, programs, and projects.

This risk screening would be followed by field impact assessments and the introduction of pragmatic climate-proofing measures to: reduce climate impacts on projects; strengthen the climate resiliency of infrastructure at risk, and vulnerable communities in Asia's megacities; and improve the overall adaptability of those small island states in the Pacific region that are highly vulnerable to climate shocks.

ADB ADAPTATION PROGRAM

ADB is helping the region's economies mainstream adaptation and enhance their resilience to adverse climate change impacts through four central themes:

- Incorporating vulnerability risk management policies into DMC national development strategies and actions,
- Increasing the climate resilience of vulnerable sectors,
- Climate-proofing projects in DMCs, and
- Addressing the social dimensions of climate change for vulnerable groups.

Incorporating Vulnerability Risk Management into National Development Strategies and Actions

There is a growing demand for national and sector assessments of climate change vulnerabilities and adaptation responses. In this regard, ADB is collaborating with host governments to help formulate adaptation policy and integrate adaptation considerations into their national development strategies.

As future country partnership strategies are developed, climate change impact and adaptation needs will be considered and incorporated into ADB's policy dialogue, capacity-development activities, and investment pipeline.

Increasing Climate Resilience of Vulnerable Sectors

Country sector plans, including current practices for country environmental analysis and disaster risk assessment, will be adjusted

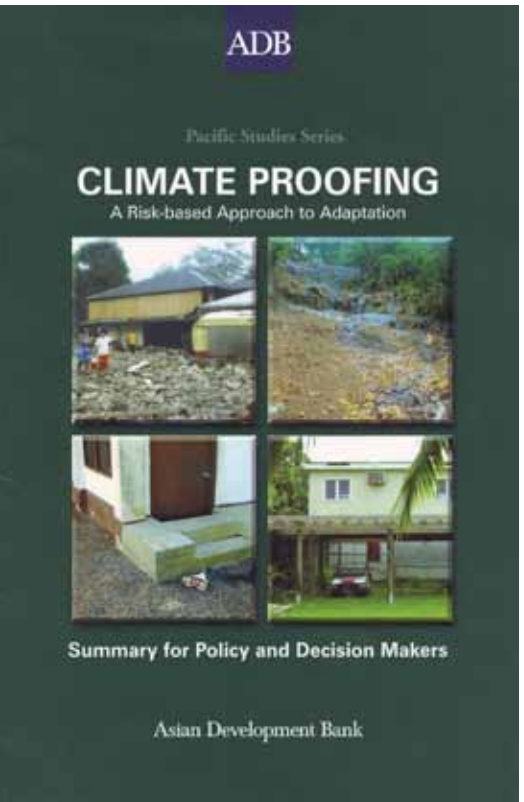
Two Vietnamese farmers walk behind their water buffalos plowing a rice paddy in preparation for planting the winter and spring rice crop in the district of Kim Thi, Hai Hung province. Over 80 per cent of Vietnam's population still makes its living from agriculture, with most tasks performed manually or with the help of livestock.

to include an analysis of climate change vulnerabilities. Sectors and areas of greatest vulnerability are: agriculture and natural resources; urban development; health; water supply and sanitation; transport, including coastal roads and ports; and energy, especially hydropower. DMCs will need help to develop the necessary policy, institutional, and investment responses for each of these sectors to ensure that adaptive measures are implemented, and resiliency to climate impacts is improved.

Climate-Proofing Projects

ADB aims to ensure that projects and programs take account of predicted changes in precipitation patterns, the severity and frequency of storms, accelerated glacial melting, sea level rise, and other climate-related impacts, and associated risks.

Climate-proofing activities at ADB date back to 2002–2003 when ADB provided regional technical assistance to several Pacific countries. This assistance entailed an assessment of climate-proofing opportunities for small-scale island infrastructure through its Climate Change Adaptation Program for the Pacific. This program, funded by the Canadian International Development Agency, included adaptation planning and policy development to support climate-proofing approaches for a breakwater and a harbor in the Cook Islands. It is also included adaptation analysis for a road development project in the Federated States of Micronesia.



ADB's Climate-proofing Program in the Pacific

Addressing Social Dimensions

Climate adaptation is fundamentally about helping people cope with increased threats to their livelihoods and well-being. As climate regimes continue to destabilize, there will be mounting pressure to expand our understanding of how to manage the socioeconomic risks associated with climate

Climate Proofing in the Water Sector

ADB is assessing climate change considerations in the design and implementation of water projects across Asia and the Pacific. For example, in the Citarum River Basin of Indonesia, more than $3 billion will be invested in upgrading water resources management infrastructure and institutions over the next 15 years under an ADB-led program. In parallel, we will examine areas of potential climate-proofing, or consider specific investments required to introduce risk-resiliency measures.

ADB. 2008. Integrated Citarum Water Resources Management Investment Program. Manila. Financed by ADB through a multitranche financing facility.

Climate Proofing in Viet Nam

The Government of the Socialist Republic of Vietnam, ADB, and UNDP are supporting activities to climate proof coastal infrastructure in central Viet Nam. These GEF-financed activities will increase the resilience of Viet Nam's coastal areas against the adverse impacts of climate change. They will also create a policy and infrastructure development framework to promote resilient coastal zone development

ADB Regional Study for Climate Change Migration

This study includes a broad description of migration in Asia and the Pacific, analysis of migration policy options, and to convey policy, institutional, infrastructure, and financing aspects of migration.

ADB. 2008. Addressing Climate Change in the Asia and Pacific Region.

change. Adequate attention to the needs and participation of vulnerable groups—especially women, the poor, and minority groups—will be especially important.

The creation of a trust to soften the social and financial impacts caused by migration, conflict, and shifting regional health patterns is being explored. Community-driven development approaches and partnerships between like-minded agencies could help in implementing these social actions. Examples of partnering agencies include the Association of South East Asian Nations and ADB, and leading environmental and development NGOs—such as the World Wide Fund for Nature, the International Union for Conservation of Nature, and CARE International.

ADB AND REGIONAL KNOWLEDGE HUBS

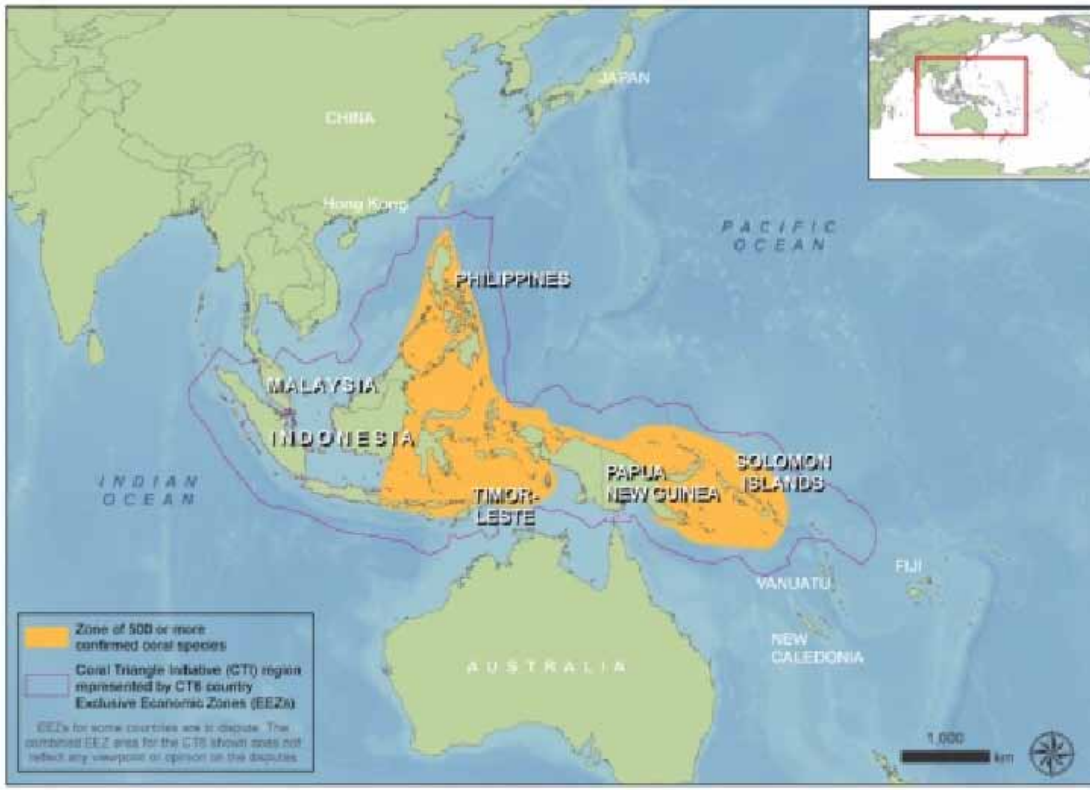
ADB has helped establish climate-related knowledge hubs on various topics at several leading academic institutions in the region: Climate Change at Tsinghua University, Beijing, People's Republic of China; Water and Climate Change Adaptation in Southeast Asia at the National Hydraulic Research Institute of Malaysia; Urban Water Management at the PUB Waterhub, Singapore; Clean Energy at the Energy and Resources Institute, New Delhi, India; and Reduce, Reuse, Recycle (3Rs) at the Asian Institute of Technology, Bangkok, Thailand.

ADB AND INTERNATIONAL COOPERATION

Climate change is a global challenge and therefore requires a coordinated and collective response from governments, international organizations, civil society, and the private sector. ADB is collaborating closely with various development partners to advance the climate change agenda.

For example, since the G8 Gleneagles Summit in 2005, multilateral development banks, including ADB, have worked together on the development and implementation of the Clean Energy Investment Framework. The joint *Clean Energy Investment Framework Progress Report* was prepared for the 2008 G8 Summit. Based on lessons learned, ADB is broadening its collaboration to mobilize further resources to tackle climate change adaptation through climate investment funds (see Chapter 5 for details on funding opportunities).

Coral Triangle Region



Coral Triangle Initiative: The "Amazon of the Seas"

Camels at rest in Jaisalmer, Rajasthan, India. Climate change is exacerbating ecological stressors on these already vulnerable regions

ADB AND DEVELOPING MEMBER COUNTRY RESPONSES TO CLIMATE CHANGE IMPACTS

Coral Triangle Initiative

The Coral Triangle Initiative was launched in 2007 as a joint effort of six Southeast Asian and Pacific countries (Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands, and Timor-Leste) to sustainably manage coastal and marine resources of high economic and environmental value.

Commonly known as the "Amazon of the Seas," the region boasts some of the highest marine biodiversity anywhere in the world. However, the impacts of global warming, especially sea level rise and increases in ocean temperatures and acidity levels, threaten its integrity.

ADB has helped to mobilize up to $63 million in grant funding from GEF for this effort. It is working closely with the Coral Triangle Initiative Secretariat, currently based in Jakarta, to design three regional technical assistance projects. These projects will address coral reef conservation, reduced land-based pollution threatening coastal ecosystems, and adaptation to climate change in low-lying islands.

The GEF contribution is expected to catalyze at least $425 million in cofinancing for the Coral Triangle Initiative. These resources will help introduce sustainable fisheries management, and conserve coral ecosystems while reducing poverty. [23]

Other Coral Triangle Initiative partners that ADB works with include Australia, Finland, the US, and three major NGOs—Conservation International, The Nature Conservancy, and the World Wide Fund for Nature. The Coral Triangle Initiative was supported in the last Association of South East Asian Nations and Asia–Pacific Economic Cooperation leaders meetings.

Vulnerability to Climate Change: Adaptation Strategies and Layers of Resilience Project

Since the adoption of the Agriculture and Natural Resources Research Policy in 1995, ADB has supported the Consultative Group on International Agricultural Research (CGIAR) centers, and other non-CGIAR international agricultural research centers, through an annual regional technical assistance grant.

The International Crops Research Institute for the Semi-Arid Tropics will be implementing the project component on Vulnerability to Climate Change: Adaptation Strategies and Layers of Resilience. This component will provide science-based solutions and pro-poor approaches to adapt agricultural systems to climate change. Benefitting the most will be the rural poor and vulnerable farmers in semi-arid regions of Asia, particularly Bangladesh, PRC, India, Pakistan, and Sri Lanka. This initiative will

23 The Southeast Asia ADB–GEF Coral Triangle Initiative subproject under the Regional Environment Program (BIMP REP) covers Indonesia, Malaysia, and Philippines, and will focus on sustainable resources management, climate change adaptation, sustainable financing, and project management. The Pacific ADB–GEF Coral Triangle Initiative subproject will involve the Fiji Islands, Papua New Guinea, Solomon Islands, Timor-Leste, and Vanuatu. This subproject will focus on marine protected and/or managed areas, ridge-to-reef management to protect coastal and marine ecosystems, climate change adaptation, and project management.

identify and prioritize the sectors most at risk, and develop gender-equitable agricultural adaptation and mitigation strategies as an integral part of agricultural development in these disadvantaged areas.

The project will also help target countries adapt to future climatic conditions (warmer temperatures, increased winter precipitation, increased summer drought, and eventual loss of glacial melt) through the development of climate-adaptive practices. Adaptive practices envisioned include drought-resistant crops, improvements in irrigation efficiency, water resource management, rehabilitation of degraded forests and pasturelands, and watershed protection.

- ***Central Asian Countries Initiative for Land Management Project***

The Central Asian Countries Initiative for Land Management Project represents a collaborative partnership between Central Asian countries and the international donor community to combat land degradation and improve rural livelihoods.

The project's goal is to restore, maintain, and enhance land productivity in Central Asia. It is expected that this initiative will lead to improved economic and social well-being for populations dependent on these resources, while preserving the ecological functions of the land.

- ***People's Republic of China–Global Environment Facility Partnership to Combat Land Degradation in Dryland Areas***

ADB, with support from GEF, has actively contributed to the development and implementation of the PRC/GEF Partnership on Land Degradation in Dryland Ecosystems.

Since 2002, the project has facilitated cooperation between national and international organizations to introduce and support integrated ecosystem management approaches to combat land degradation, reduce poverty, and restore dryland ecosystems in the six provinces in western PRC. The project supports a long-term approach to address land degradation and associated global environmental concerns, such as loss of biodiversity, desertification, and climate adaptation. The PRC–GEF Partnership Program 2008–2010 represents $600 million (indicative) in loans and grant, involving collaboration between ADB, the Government of the PRC, GEF, the International Fund for Agricultural Development, and the World Bank.

- ***Urban Areas***

ADB is also studying strategies to adapt to the impacts of climate variability and extreme events, and vulnerable sectors and people in urban areas-especially Asian megacities.

Climate Impact and Adaptation in Asian Coastal Cities

ADB is working with the World Bank and the Government of Japan on the Climate Impact and Adaptation in Asian Coastal Cities initiative. This initiative will support an analysis of climate change risks and their costs in four coastal megacities of Asia—Bangkok, Ho Chi Minh City, Kolkota, and Manila. Together, these urban areas are home to more than 50 million people, and all face increasing risks from flooding, heat waves, water shortages, and other adverse impacts of climate change. The study will include economic analysis to determine the likely costs associated with these climate-induced phenomena as a means to prioritize adaptation measures.

ADB. 2007. Promoting Climate Change Adaptation in Asia and the Pacific

CHAPTER 5

MOBILIZING ADAPTATION RESOURCES

FUNDS TO SUPPORT ADB'S CLIMATE CHANGE ADAPTATION PROGRAM

Costs for climate adaptation are anticipated to be in the billions between 2008 and 2012 (see Economics of Climate Change in Chapter 2). Therefore, additional financing is urgently needed, and innovative financing approaches must be devised together with links to newly created specialized global funds. Moreover, development agencies need to move further away from post-natural disaster assistance to a more preventative funding approach that creatively combines disaster risk reduction, climate risk management, and adaptation program financing.

International development agencies, including ADB, have an important catalytic role to play in providing technical advice and access to financing. At the same time, agencies need to engage private sector and civil society stakeholders in innovative investment instruments. To support the various elements of its climate change program, ADB has established several internal funds, and has also forged partnerships with other development institutions to mobilize specialized adaptation funds. For a detailed overview of ADB's adaptation funds and multilateral funds accessible through ADB, see Appendix 3. As such, ADB is well-placed to facilitate access of our DMC partners to these adaptation funds.

INTERNAL ADB FUNDS

ADB has several dedicated and non-dedicated funds to finance climate adaptation projects in Asia and the Pacific.

Climate Change Fund

The Climate Change Fund was established by ADB in May 2008. It is designed to provide grant financing for projects, technical assistance, and research (as it relates to policy work and investments). It also supports other activities to address the causes and consequences of climate change in ADB's DMCs.

ADB has provided an initial $40 million to the fund, which is open for further contributions from countries, other development organizations, foundations, the private sector, and other sources. Of

Another climate adaptive irrigation technique: Field and siphon tube irrigation conserves water, especially during prolonged/unseasonal droughts

this, $10 million has been allocated for adaptation initiatives. An additional $25 million has been allocated to mitigation efforts, and $5 million has been reserved for land use interventions, including forestry. Several adaptation projects financed through the Climate Change Fund are currently being developed across Asia and the Pacific.

Water Financing Partnership Facility

To many in the climate change community, water is the crosscutting sector at greatest risk from climate change impacts. The Water Financing Partnership Facility provides additional financial resources and technical support for investment projects, technical assistance operations, knowledge management, and regional cooperation. Key areas include rural water services, urban water services, river basin water management, and adaptation to climate change. The facility is mobilizing cofinancing and investments from development partners, with initial contributions targeted at $100 million for 2008–1010.

Poverty and Environment Fund

The Poverty and Environment Fund is a $3.6 million multidonor trust fund administered by ADB. It promotes the mainstreaming of environmental considerations, including climate change, into development strategies, plans, programs, and projects.

Small Grants for Activities

ADB's regional technical assistance project, Promoting Climate Change Adaptation in Asia and the Pacific,[24] provided $1.2 million in small grants. Its purpose is to rapidly mainstream adaptation issues into project investment planning, develop national capacity for adaptation, and coordinate and strengthen regional and international community adaptation and disaster risk reduction.

EXTERNAL FUNDS

Where incremental funding is needed, ADB is assisting its DMCs to successfully identify and secure external financing sources to mainstream climate change risk considerations into project preparation and implementation procedures.

FUNDING ESTABLISHED UNDER THE UNFCCC AND KYOTO PROTOCOL

A number of funding windows have been established under the Convention and Kyoto Protocol. ADB has been working closely with GEF since 1999. As an executing

24 ADB. 2007. Promoting Climate Change Adaptation in Asia and the Pacific. Manila.

agency of the GEF,[25] ADB can assist eligible countries to access and implement projects through the LDCF, the Special Climate Change Fund, and the Strategic Priority on Adaptation. As new and pilot funds, resource levels and sources vary and project approvals are subject to resource availability.

Least Developed Countries Fund. The LDCF primarily supports LDC Parties to develop and implement NAPAs. NAPAs are a means towards addressing urgent and immediate adaptation needs of least-developed countries as identified in each country's NAPA. The LDCF resources are contributed on a rolling and voluntary basis. At the time of writing, published figures put the LDCF at $172 million and it is expected to expand. The majority of countries have prepared their NAPAs and are now directing their efforts towards the implementation of priority activities as identified in their NAPA.

Special Climate Change Fund. The Special Climate Change Fund includes four avenues for financing: adaptation; technology transfer; energy, transport, industry, agriculture, forestry, and waste management; and economic diversification. Adaptation has received disproportionate funding. Priority areas include most development sectors as well as capacity building and preventative planning activities. Projects do not need to generate global environmental benefits, but should address local adaptation and development needs. Also, adaptation projects should be justified on sound science and vulnerability assessments such as those undertaken through NAPAs and National Communications. Like the LDCF, this fund is replenished on a rolling and voluntary basis. Much of the existing pledges have been allocated, and funding is dependent of the availability of resources. At the time of writing, the GEF had identified $90 million in pledged contributions.

Strategic Priority on Adaptation. The Strategic Priority on Adaptation was established as a pilot funding window within the GEF Trust Fund. It's objective is to reduce vulnerability to climate change, while generating global environmental benefits. In 2008, the initial $50 million fund was fully committed, with consideration being given to a possible replenishment following fund evaluation.

Adaptation Fund. The Adaptation Fund was established under the Kyoto Protocol to finance adaptation projects and programs in developing countries that are Parties to the Kyoto Protocol. The fund is financed through the sale of 2% of the certified emission reduction carbon credits issued for projects under the Clean Development Mechanism, as well as voluntary contributions. Estimates for the potential size of the fund vary widely but should be important.

The fund is operated by the Adaptation Fund Board. Secretariat services are provided by the Global Environmental Facility, and the World Bank acts as the trustee. Eligible Parties to the Protocol may apply for funds directly or with the assistance of pre-approved implementing entities. It is expected that the fund will be open for business in 2009. The goal of the fund to support concrete adaptation projects in support of development objectives is very much in line with ADB's core business strategy.

Climate Investment Fund

In addition, ADB is poised to help its DMCs access new global funds, such as the proposed Climate Investment Fund (CIF). The fund is a portfolio of funds established by the multilateral development banks—including ADB, the African Development Bank, the Inter-American Development Bank, and the World Bank. The fund objective is to increase assistance to developing countries for climate actions until a post-2012 climate change regime, and corresponding financing mechanism are available.

25 In 1999, the GEF Council expanded opportunities for seven organizations to contribute to the implementation of GEF projects. These organizations are known as executing agencies.

Woman collecting water in rainforest in Kimbe, Papua New Guinea (Eric Sales, ADB)

Within the CIF is the Strategic Climate Fund. This fund will provide financing to test innovative approaches or increase activities for targeted actions. The initial program will be the Pilot Program for Climate Resilience, which will increase climate resilience via national adaptation actions. The objective of the program is to provide incentives for scaled-up action and transformational change through pilot projects. These pilots need to demonstrate how to integrate climate risk and resilience into core development planning to build on developing-country NAPAs. Funding resources for this program are expected to exceed $500 million.

The Pilot Program for Climate Resilience will be followed by the Forest Investment Program, and by the Program for Scaling Up Renewable Energy in Low Income Countries.

- ***Overseas Development Assistance Adaptation Funds***

These include the Global Climate Change Alliance of the European Union, the Japanese Cool Earth Partnership (see Appendix 3), and the UNDP–Spain MDG Achievement Fund.

CHAPTER 6

LESSONS LEARNED AND NEW AVENUES FOR ADB ADAPTATION

INITIAL ADAPTATION LESSONS

ADB's nascent portfolio on climate adaptation is rapidly growing, with over 30 explicitly adaptation-related projects approved and being implemented across Asia and the Pacific during 2007–2009. Projects currently under implementation provide us with some initial lessons to help guide the development of our adaptation portfolio, especially in the context of emerging trends and innovations. A sample of initial lessons learned include the following:

- ***Ho Chi Minh City Study, and Knowledge Products***

This joint ADB–Government of Viet Nam project relied on downscaled climate and hydrological modeling platforms under two IPCC scenarios, along with demographic data to extrapolate the socioeconomic dimensions of climate change impacts.

Lesson: Results of this study have strengthened our understanding of the economic, social, and environmental impacts of climate variability in urban areas. It has also strengthened our knowledge of adaptation options and their economic viability.

- ***Central and/or South Asia Regional Electricity Market Project, and Blending Mitigation and Adaptation***

Global warming is causing concern about the possible return to high carbon-based technology by the energy sector, as substantial upstream glacial melt is expected to cause significant changes in the downstream hydrological cycle. This would result in seasonal flash floods and longer-term dwindling water resources, and a loss of hydropower generation.

Considering the $1 billion scope of this multiparty investment project, and the expected climate impacts and risks

Rice fields in Bali, Indonesia. Climate-induced extreme events, such as flash floods and temperature stressors place these food producing regions at higher risk

to glacier-dependent hydropower, it is reasonable to assume that hydrological records on their own would be insufficient to adequately determine the future availability of water resources for surplus hydropower. Nor would this historical hydrological data adequately inform the development of downscaled climate modeling scenarios, critical in assessing future climate risks to this infrastructure.

Lesson: There is a need to marry research and development efforts in greenhouse gas mitigation and climate adaptation disciplines to better understand our energy future and carbon footprint.

- ***Enhancing Human Security and Environment and Disaster Management, and Blending Community Agency, Partnerships, and Risk Management***

This project in Viet Nam (funded under ADB's Poverty and Environment Fund) involves mapping the area's vulnerability to natural hazards and climate change in terms of income loss and interruption to communications and transport.

Lesson: We have learned that participatory community-based coping mechanisms, developed in partnership with government, communities, and international partners, will ensure greater buy-in and knowledge development. Through these partnerships, village-based "change agents" were trained for awareness building. Moreover, safer-community plans were successfully developed to support proper land-use practices, and environmental protection, disaster preparedness, and climate resilient infrastructure.

- ***Climate Change Adaptation Program for the Pacific, and Downscaled Modeling***

ADB's Climate Change Adaptation Program for the Pacific represented a significant research effort relating to small island vulnerability to climate impacts.

Lesson: Small-island case studies were an effective tool for helping to formulate subnational and national climate adaptation policy and planning mechanisms. We also learned that downscaled climatic data (particularly rainfall, temperature, wind, and sea level) is key to characterizing future climate impacts. However, this downscaled data needs to be collected by qualified personnel with standardization in mind. The need for donor coordination to maximize country and regional resources and knowledge was also a significant lesson.

NEW AVENUES FOR ADAPTATION

In spite of the groundswell of innovative climate change research and projects worldwide, the need for pragmatic adaptation knowledge products, tools, and approaches continues to grow rapidly.

To enhance the region's overall adaptive capacity and climate resilience, and with the above lessons in mind, ADB's adaptation program will endeavor to

- develop knowledge products and innovative adaptation methodologies, and
- support emerging adaptation trends and innovations within the international climate adaptation community.

- ***ADB Knowledge Products and Adaptation Methodologies***

Project Risk Screening. As new projects come on line, there is an increasing need for appropriate risk screening tools at the operational level.

Generally, screening tools seek to address
- whether climate risks have been taken into consideration,
- whether the project is vulnerable to climate change,

ADB, through the Multilateral Finance Institutions' Working Group on Environment, is helping to harmonize tools, methods, and applications after for the adaptation community (see Appendix 4).

- whether plans or approaches may lead to increased vulnerability, and
- what steps need to be taken in the project concept and design stages to reduce risks and associated cost.

Many existing screening tools and a proliferation of new ones have been designed with varying development scenarios and adaptation objectives (institutional, programmatic, geographic, sector, and policy) in mind. Risk management practitioners are therefore uncertain about which tools they would most benefit from for their climate adaptation work. As the demand for project vulnerability and risk screening increases, development agencies are increasingly recognizing the value in establishing a common set of tools. Thus, a harmonization process will allow users to find the right tool for the right job.

ADB's Climate-Framework to Integrate Risk Screening Tool (Climate-FIRST). Considering the timeline and resources required for greater harmonization, and in view of ADB's operational urgency to assess project risk, ADB has formulated a preliminary risk screening tool—Climate-FIRST. This desk-top rapid assessment tool will be both web- and paper-based, and is designed as a pre-screening resource. It is meant to alert project officers to potential climate impacts and risks through a user-friendly checklist. The checklist is designed to pre-screen probable project risk against a number of risk factors and operational assumptions.[26]

Adaptation Studies. ADB is conducting several sector-specific climate adaptation studies to enrich knowledge in the region. One multitheme flagship study focuses on the following two areas:

- **Building climate resilience in the agriculture sector.** Climate change is affecting agriculture, with declines in crop yields, moisture loss, change in duration of seasons, extreme weather (e.g., drought and floods), and loss of water due to glacier melting. Thus, there is a need to better understand climate risks and vulnerabilities as they apply to agriculture, and how they will impact economic growth, poverty reduction, and food security. This study will address these concerns.
- **Climate change and migration.** Climate change has triggered a migration of people across regions and countries through extreme events and changes in environmental patterns and sea levels. Estimates of current global refugees associated with climate change range from 25 million to 50 million people. We need to improve our knowledge and understanding of the risks and vulnerabilities of population displacement and climate-induced migration in different parts of the region under various scenarios. It is also important to know how population displacement will impact the socioeconomic structure of the region, and how the region could cope with these under differing conditions.

Adaptation Tools. There are many climate adaptation tools already developed or in the development stage that can help vulnerable communities, donors, and sector stakeholders identify their levels of vulnerability to anticipated climate impacts. These tools can facilitate the introduction of adaptive measures to minimize risk, and build adaptive resilience to climate impacts.

With the widespread and uneven development of these adaptation tools, a coordinated international effort is needed

26 Assumptions such as location of project in climate-sensitive geo-climatic zones, sector risks, capacity development, and known disaster hotspots.

Flooded rice fields in Asia

to broadly disseminate the best of these tools to field practitioners and policy-makers for their climate risk-reduction activities.

The following is a sampling of adaptation tools that ADB and other agencies are developing or adopting:

- **Vulnerability and Risk Screening Tool.** Facilitates the identification and/or integration of risk reduction and climate adaptation considerations in field projects and institutional operations.

- **Spatial Geographic Information System-Based Risk and Vulnerability Atlas/Map for Communities and Projects.** Provides geographical or sector mapping of existing and expected climate impact on target assets (hard and soft). Can inform the formulation of redesign protocols and planning procedures to reduce vulnerability and risk.

- **Climate-Oriented Environmental Impact Assessment.** Looks at environmental (i.e., climate change) impacts on the project, and consequent impacts of these on the environment. It also helps inform project environmental mitigation practices and contingency

Bangladesh, Sirajgonj: Flood victim clutches bag of relief supplies wading through floodwaters in Sirajgong District, some 105 kms north-west of Dhaka. Two weeks of flooding killed hundreds, and destroyed crops and infrastructure worth hundreds of millions of dollars.

planning, including human security, public health, disaster planning, and management protocols. It allows for review of the design criteria and methodology, but does not necessarily attempt to reengineer the project.

- **Hazard Risk Management and Vulnerability Assessment.** A local or regional risk and vulnerability modeling and mapping exercise generally used for early warning systems and disaster management; usually relying on field data (and climate model projections) that encompass a range of (climate-induced) extreme weather events and natural hazard risks.

- **Adaptation Risk Management Planning and Operational Guide.** Provides operational risk management framework to improve understanding of, and plan for, climate variability and extreme impact on sectors and areas. These include forestry, watersheds, agriculture, social infrastructure, and livelihood security. May include disaster risk reduction component.

- **Impact and Adaptation Public Education and Outreach Tool.** Promotes climate risk management and adaptive practices within a vulnerable target community, helps mobilize community resources, and suggests outreach activities in response to identified vulnerabilities. Can also target different audiences, including NGOs, local government, community leaders, and climate change practitioners.

- **Asset Risk Management Audit Tool.** Auditing framework to assess expected risk and impacts to hard infrastructure (especially ecosystem-dependent investments, such as hydropower, tourism, irrigation, and public service infrastructure) and environmental resources. Also identifies possible incremental adaptation costs and measures, such as design retrofitting and structural rehabilitation.

ADB Support of Emerging Adaptation Trends and Innovations

In collaboration with our DMC partners, ADB seeks to promote emerging climate change adaptation trends and innovations. Examples include greater convergence between mitigation and adaptation activities, synergies between disaster risk reduction and climate risk management and adaptation disciplines, community adaptation approaches, and applied downscaled modeling initiatives.

The introduction of these trends and innovations will be accomplished, in part, through the development of adaptation knowledge products. As well, internal ADB adaptation resources need to be mobilized. ADB is also actively engaged in leveraging a variety of external bilateral and multilateral funding mechanisms benefitting our DMCs.

Blending Mitigation and Adaptation Across Asia and the Pacific

ADB is preparing climate change implementation plans with its DMCs across Asia and the Pacific to strategically introduce both mitigation and adaptation initiatives to counter global warming, and reduce the impacts of climate change.

Blending Mitigation and Adaptation. As the global climate change agenda has evolved over the years (since the UNFCCC was created at the Earth Summit in Rio de Janeiro in June 1992), mitigation (emissions reduction) priorities have become considerably more specialized.

In 1995, during the 1st United Nations Climate Change Conference in Berlin, the climate adaptation discipline formally took root.[27] Since then, the mitigation and adaptation disciplines have had different trajectories, and have been treated as somewhat separate issues. It is only recently that an attempt has been made to identify common issues between these global concerns, and the future offers the potential to creatively blend both climate change issues.

The hydropower sector is an example of potential synergies. Anticipated fluctuations in water flows from glacial melt and water coursing may pose medium- to long-term threats to the productivity of hydropower plants. An expected reduction in power generation may induce the power sector's return to fossil fuel-dependent thermal power to make up for reduced hydropower potential. This potential backtracking on the use of clean energy, and subsequent reversion to fossil fuels, necessitates an analysis on the close connection between greenhouse gas emissions reduction (mitigation) practices, and the adaptive capacity of the power sector to anticipated climate impacts.

One research effort that considers both adaptation and mitigation is integrated assessment modeling or IAM. This approach typically combines energy models and sector impact models with climate, land use, and socioeconomic scenarios to analyze and compare the costs and benefits to society of climate change and climate change policy.

The international community is recognizing that mitigation and adaptation efforts need to be pursued jointly. For instance, the Fourth Assessment Report of the United Nations IPCC notes the importance of assessing the integration of adaptation and mitigation in the field of climate change, as well as on the crosscutting theme of sustainable development.

Disaster Risk Reduction and Climate Change Adaptation. As with the mitigation and adaptation disciplines, until recently there has been a similar disconnect between the largely science-based adaptation community and the disaster risk management[28] community. The latter has traditionally relied on civil defense structures and shorter-term response and rehabilitation practices.

Many countries and economic sectors are already highly vulnerable to disastrous weather and climate extremes, as illustrated by the 2008 tropical cyclones in Myanmar, and recurring catastrophic flooding in the PRC, India, and Viet Nam. Because of the overall reduction in coping skills and resilience of these vulnerable communities, ecosystems, and localized economies, this global crisis has precipitated the convergence of both risk management disciplines.

Today's disaster risk reduction and climate change adaptation practices are both grounded in the principles of risk management and sustainable development. Disaster risk reduction can be the first

27 UNFCCC. 1995. Decision 11/CP.1
28 See the United Nations International Strategy for Disaster Reduction definition of disaster risk reduction and disaster risk

line of defense against current climate variability and extremes, therefore being an essential component of adaptation. Climate adaptation can deal with medium- to long-term climate impacts. With increasing convergence between the approaches, climate adaptation and disaster risk reduction policy makers and practitioners must communicate and collaborate to formulate local, community, national, and international creative risk management

ADB Support to the Hyogo Framework for Action 2005–2015

The priority actions of the Hyogo Framework for Action are supported by 168 participating countries and international agencies. Agencies include ADB, the African Development Bank, the Inter-American Development Bank, UNDP, the World Health Organization, and the World Bank.

The Global Facility for Disaster Reduction and Recovery—a partnership of the International Strategy for Disaster Reduction system—supports the implementation of the Hyogo Framework for Action. The facility provides technical and financial assistance to high-risk low- and middle-income countries to mainstream disaster reduction in national development strategies and plans to achieve the MDGs.

Developed nations are far from immune to climate impacts: road in Australian outback closed from unseasonal flooding

policies and practices.
This collaboration will help reduce short- and long-term vulnerability and extremes, and increase resilience to both natural disasters and human-induced climate change impacts.

At the 2005 World Conference on Disaster Reduction in Kobe, Japan, governments agreed that climate-related risk reduction strategies need to be blended with disaster risk reduction strategies. The Hyogo Framework for Action 2005–2015, an international commitment to reduce disaster risk, also needs to be a focus of attention for the adaptation community.

At the 13th United Nations Climate Change Conference of the Parties in Bali, 2007, governments formally recognized the importance of disaster risk reduction for adaptation in the Bali Action Plan, agreeing that "enhanced action on adaptation" should include consideration of "disaster reduction strategies."

This blending of risks management approaches needs to occur to reduce vulnerability to natural and climate-related hazards, promote the shared agenda of poverty reduction, and achieve a more sustainable approach to development in support of the MDGs.

Synergies Between Disaster Risk Reduction and Climate Change Adaptation

ADB is in the process of strategically identifying significant entry points for convergence between disaster risk reduction and climate change adaptation practices in its developing member countries and risk management programming.

In this regard, ADB's 2004 Disaster and Emergency Assistance Policy or DEAP (and the 2008 action plan for implementing this policy) provides an integrated and flexible framework to embrace all hazard types, including climate risk management and adaptation.

ADB. 2008. Action Plan for Implementing ADB's Disaster and Emergency Assistance Policy.

Community Adaptation. By and large, community-based adaptation (or what is commonly referred to in the climate change community as "micro-adaptation") is only modestly represented in Asia and the Pacific climate change programs. With climate impacts having the greatest effect in disadvantaged vulnerable communities, community-based adaptation represents a unique opportunity to apply risk management and adaptation practices at the city, district, and household levels.

ADB and Community Adaptation

Through its Climate Change Fund and regional technical assistance project—Promoting Climate Change Adaptation in Asia and the Pacific, ADB is currently supporting several community-based adaptation initiatives in Afghanistan, Bangladesh, Cook Islands, Lao People's Democratic Republic, Nepal, Pakistan, Palau, and Philippines.

ADB. 2007. Promoting Climate Change Adaptation in Asia and the Pacific.

Participatory community-based adaptation is essential to reduce vulnerability and risk, and increase adaptive coping mechanisms. Of particular benefit is the blending of traditional environmental knowledge and community-based adaptive practices (both reactive and anticipatory) with contemporary adaptive expertise (science, downscaled modeling, and tools).

Applied Downscaled Modeling. Scientific climate model projections help inform the introduction of vulnerability and risk reduction adaptation measures. **Global circulation models** are a first step in determining potential impacts.

A number of increasingly reliable global circulation models have emerged. These help simulate global climate change and begin to determine anticipated climate impact trends

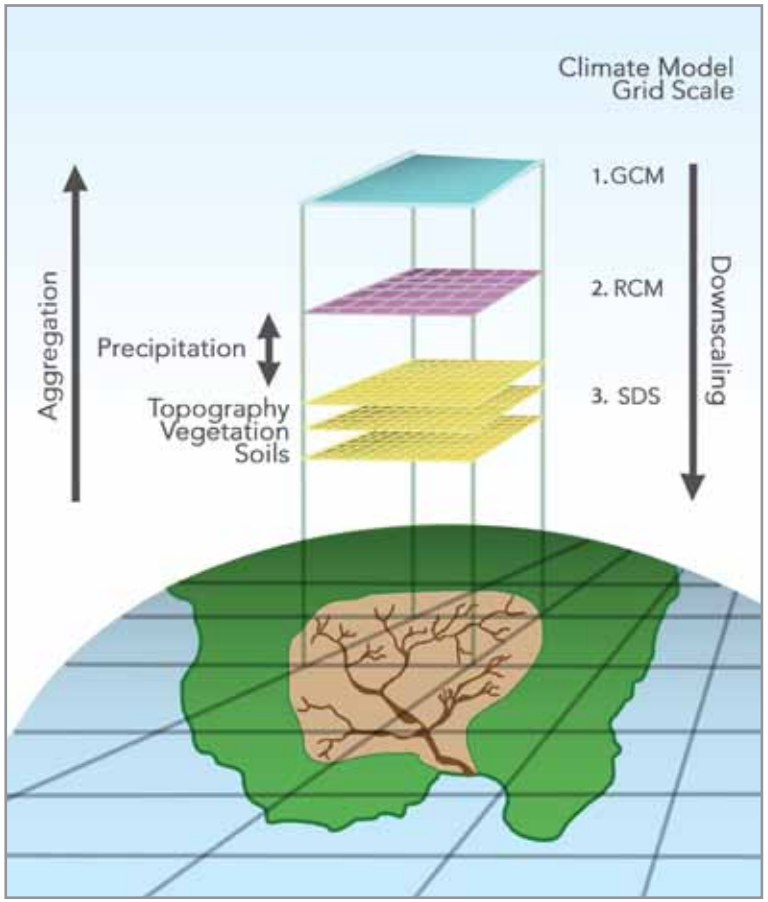


FIGURE 2: Climate change modeling

Ho Chi Minh City Adaptation to Climate Change

Conscious of the need for downscaled model projections to assess localized environmental and economic hotspots in coastal megacities, ADB is supporting the project Ho Chi Minh City Adaptation to Climate Change.

The project has developed modeling scenarios to quantitatively integrate rainfall, land-use, and sea level into water regime scenarios. The project relies on regional (22 by 22 kilometer resolution) climate projections for SRES A2 and B2 modeling with a 1980–1999 baseline.

The project also assesses the current knowledge and coping strategies for floods, storm surge, cyclones, and tides; identifies potential scenarios that could affect coastal watersheds; identifies vulnerable infrastructure and communities; quantifies the magnitude of climate impacts on social, environmental, and economic resources; prioritizes adaptive scenarios within current institutional frameworks; and looks at government capacity to manage natural disasters and climate shocks.

ADB. 2007. Promoting Climate Change Adaptation in Asia and the Pacific.

and scenarios. However, these sophisticated models tend to be of limited value at the project level. They are inaccessible to climate adaptation practitioners because of their complexity, high-grid resolution, and subsequent lack of applied relevance at the project, city, or community level. With reliance on macro-scale climate modeling, which is inappropriate at the local scale, the planning and implementation of localized adaptive measures is hindered as it is difficult to reliably predict climate impacts.

Because the reliability of 1) **Global Circulation Model (GCM)** projections decrease when they are applied at smaller scales, 2) **Regional Climate Models (RCM)** or downscaling methods are necessary to simulate climate features. Moreover, 3) **Statistical Downscaling (SDS)** provides short-range numerical weather prediction data on a target water basin or land base. This adds additional layers of climate-relevant variables such as topography, vegetation, and soil. This layer of data further enhances the climate impact scenarios picture (Figure 2).[29]

The combination of historical (past weather data, etc.), meteorological data (current), modeling data (simulations), and field data (socioeconomic and environmental risk assessment data) will help climate adaptation practitioners and stakeholders formulate more reliable impact scenarios. In this way, they can better project future climatic conditions, anticipate climate hazards, and introduce appropriate risk management and coping measures.

29 Wilby, R.L., and T.M.L. Wigley. 1997. Downscaling General Circulation Model output: a review of methods and limitations. Progress in Physical Geography (pp. 21, 530–548).

IN SUMMARY

We recognize that the magnitude of expected climate change impacts facing vulnerable DMCs threatens many of the hard-won gains in poverty reduction. It also directly threatens the attainment of the MDGs in Asia and the Pacific. Certain geo-climatic zones are at great risk from climate impacts, and certain sectors are deemed to be more vulnerable to the effects of climate change. Considering the magnitude of potential impacts, limited attention is still being given to building climate resilience in sectors, and climate-proofing infrastructure and human settlements at risk.

ADB and its development and country partners are advocating new and additional streams of adaptation funding to address the risk management needs in the regions. Because costs for climate adaptation are anticipated to be in the billions, innovative financing approaches and cost-effective technologies must be devised. International development agencies, including ADB, have an important catalytic role to play in providing technical advice and access to financing, while engaging private sector and civil society stakeholders in innovative investment instruments. To support the various elements of its climate change program, ADB has established several internal funds and forged partnerships with other development institutions.

Mongolian woman and camel resting. These already stressed arid ecological regions are highly susceptible to climate-induced temperature and hydrological stressors, contributing to further land degradation.

ADB is also collaboratively engaging our partners across Asia and the Pacific to promote cutting-edge adaptation approaches, such as the blending of mitigation and adaptation activities, synergies between disaster risk management and climate change adaptation disciplines, risk-resiliency measures in geo-climatic zones at risk, community adaptation tool kits, and risk screening tools such as Climate-FIRST.

It is anticipated that the introduction of these innovative adaptation strategies and risk resiliency-building measures, and innovative knowledge products, in collaboration with our regional DMC partners in government, industry, and civil society, will help those vulnerable communities and economies recover from being "under the weather and the rising tide" of climate change.

Appendix 1

ESTIMATED CLIMATE RISKS BY ADB SECTOR

PROJECT SECTOR	CLIMATE CHANGE IMPACTS
1. **Agriculture and Natural Resources**	Impacts on crop production, yield, and diversity due to increased extreme events (drought, hail, floods, and storms), and changing precipitation and temperature regimes Impacts on the natural disturbance regime, pest cycle, and rate of infestation Impacts on water availability for agricultural sector from extreme events (e.g., El Niño and large-scale weather systems with high winds and precipitation) Impacts from glacial-melt flooding or delta-based flooding Impacts from salinization (drought and saltwater intrusion) of irrigation water, estuaries, and freshwater systems Impacts of changes to ocean currents, and on physical and chemical regime of oceans Impacts on land–sea interactions, including changes in location and viability of sensitive habitats of marine species from changes in marine ecosystems associated with changing water temperatures, increased incidents of marine pollution associated with higher run-off, greater incidents of coastal erosion, and higher incidence of algal blooms from warming of ocean areas Impacts on social and economic enterprises in the marine and fisheries sector largely as a result of changes in migration patterns, fish size, and availability that will be affected by changing water temperatures
2. **Water Supply, Sanitation, and Waste Management**	Decrease in freshwater availability due to drought and salinity intrusion in watersheds Increased water demand and water quality problems (e.g., algal blooms) Adverse effects on quality of surface and groundwater; contamination of water supply Increased demand from water users, natural stresses, and changes in temperature and precipitation altering recharge to water catchment areas and affecting water levels in groundwater aquifers Accelerated glacier melt likely to cause increase in the number and severity of glacial melt-related floods, slope destabilization, and a decrease in river flows as glaciers recede
3. **Transport and Communications**	Increased damage to transport infrastructure due to cumulative effect of sea level rise, storm surge, coastal inundation, and increased incidents of extreme events Port operations will be affected by impacts from sea level rise, extreme events (storms, marine currents, wave action, and storm surge), and changes in shipping patterns associated with changes in ice patterns and more intense and frequent tropical depressions
4. **Energy**	Glacial melt impacting surface water and downstream water recharge feeding hydropower plants. Underestimated risk to oil and gas sector; . Rrefinery and storage infrastructure in coastal locations and marine distribution points at risk from sea level risesea level rise, and increase in cyclonic intensity and frequency.

	PROJECT SECTOR	CLIMATE CHANGE IMPACTS
5.	**Health, Nutrition, and Social Protection**	Increased morbidity and mortality (i.e., malnutrition and diarrheal, cardio-respiratory, and infectious diseases) from heat waves, floods, storms, fires, and droughts Changes in the distribution, frequency, and burden of some vector-borne and waterborne diseases Cumulative impacts from air pollution, with higher temperatures Substantial burden on health services
6.	**Multisector**	Subject to risks at multiple levels due to combined sector portfolio and increased risk exposure.
7.	**Housing Finance and Microfinance**	Indirectly exposed to climate risks as financial investment, although housing infrastructure and small business are more directly vulnerable due to lower resilience to climate shocks Property values will be affected by extreme events, sea level rise, and storm surges
8.	**Industry and Trade**	Diverse sector investment subject to moderate risk from extreme impacts and market interruptions (procurement delays and merchandise transfer disruption).
9.	**Education**	In general, school infrastructure is generally resilient to climate impacts Education reform investments are not directly exposed to environmental conditions, and therefore subject to minimal impacts and consequent risk
10.	**Telecommunications**	Telecommunications (information technology, media) ability to monitor hazards; perceived limited exposure to risk rather than having a high level of preparedness. Communications lines at risk from extreme events, though minimal outlay generally required for rehabilitation (except in coastal and island zones).
11.	**Technical, Vocational Training, and Skills Development**	Nonexistent or very limited direct or indirect exposure to, and/or interdependence with, environmental factors; hence deemed "at no significant risk" from climate change impacts.
12.	**Banking Systems**	Nonexistent or very limited direct or indirect exposure to, and/or interdependence with, environmental factors; hence deemed "at minimal risk" from climate change impacts.
13.	**Capital Markets and Funds**	Nonexistent or very limited direct or indirect exposure to, and/or interdependence with, environmental factors; hence deemed "at minimal risk" from climate change impacts.
14.	**Pensions, Insurance, Social Security, and Contractual Savings**	Nonexistent or very limited direct or indirect exposure to, and/or interdependence with, environmental factors; hence deemed "at minimal risk" from climate change impacts.
15.	**Finance Sector Development**	Nonexistent or very limited direct or indirect exposure to, and/or interdependence with, environmental factors; hence deemed "at minimal risk" from climate change impacts.
16.	**Law, EconomicManagement, and Public Policy**	Nonexistent or very limited direct or indirect exposure to, and/or interdependence with, environmental factors; hence deemed "at minimal risk" from climate change impacts.

APPENDIX 2

GLOBAL STUDIES OF ADAPTATION COSTS

Study	Cost of Adaptation	Regional coverage	Time frame	Sectors	Comments
World Bank (2006)	$9 billion to $41 billion per year	Developing countries	Present	Unspecified	Based on OECD and World Bank analysis of aid flow exposed to climate change. Costs of reducing climate risks (climate proofing).
Stern Review (2006)	$4 billion to $37 billion per year	Developing countries	Present	Unspecified	Update with modification of World Bank study.
Oxfam (2007)	At least $50 billion per year	Developing countries	Present	Unspecified	World Bank study plus extrapolation from NAPAs and NGO estimates.
UNDP (2007)	$86 billion to $109 billion per year	Developing countries	2015	Unspecified	World Bank study, plus costing of targets for adapting poverty reduction programs and strengthening of disaster response.
UNFCCC (2007)	$28 billion to $67 billion per year	Developing countries	2030	Agriculture, forestry, fisheries, water supply, health, coastal zones, infrastructure	Analysis of specific adaptations.
UNFCCC (2007)	$44 billion to $166 billion per year	Global	2030	Agriculture, forestry, fisheries, water supply, health, coastal zones, infrastructure	

NAPA = national adaptation programme of action, NGO = nongovernment organization, OECD = Organisation for Economic Co-operation and Development, UNDP = United Nations Development Programme, UNFCCC = United Nations Framework Convention on Climate Change.

Sources: Agrawala, et al.. 2008. Presented at the OECD workshop on Economic Aspects of Adaptation, taken from Policy & Institutional Reforms to Support Climate Change Adaptation and Mitigation in Development Programs: A Practical Guide; Muthukumara Mani, Anil Markandya, and Viju Ipe, 2008. Environment Department Sustainable Development Network. Washington D.C.: World Bank.

APPENDIX 3

OVERVIEW OF ADB AND EXTERNAL ADAPTATION FUNDS

Fund	Amount ($)	Purpose and/or Criteria
ADB Funds		
CCF	$40.0 million (initial funding contribution)	The CCF was established in May 2008 to provide grant financing for projects, research and analysis, and other activities to address the causes and consequences of climate change in ADB's developing member countriesDMCs. The fund provides support for both mitigation and adaptation initiatives. With respect to adaptation, the scope of activities includes: • improve climate resilience of vulnerable developing countries; • climate-proof vulnerable investments; • enhance the climate resilience of economic development plans, disaster preparedness and response plans and programs, and/or key sector plans and programs (e.g., agriculture, transport, natural resources management, water resources management); • respond to special threats facing Asia and the Pacific, especially in arid, rain-fed agricultural areas, densely populated coastal lowlands and deltas, and low-lying islands; and • provide significant opportunity for leveraging and growth. **Eligibility** ADB's developing member countries DMCs can apply for support from the CCF through the appropriate ADB regional department. Projects must be consistent with the country partnership strategy and results framework, be consistent with the objectives of ADB's Climate Change Program, introduce innovative solutions, adopt a participatory approach, be catalytic, have high demonstration value in the sector, and have good potential for replication and scalability in the country and/or region. Priority CCF interventions enhance the climate resilience of infrastructure and other investments, community livelihoods, and key sectors, especially in the following geo-climatic areas: arid and rain-fed agricultural areas, densely populated coastal lowlands and deltas, and low-lying islands. Priority sectors and areas include water, agriculture, environment and disaster risks, socioeconomic development planning, industry, transport, and urban development.

Fund	Amount ($)	Purpose and/or Criteria
CIF The CIF is a portfolio of funds established by a group of multi-lateral development banks including ADB, African Development Bank, European Bank for Reconstruction and Development, Inter-American Development Bank, and World Bank. The CIF builds on new initiatives by the governments of the United Kingdom (Environmental Transformation Fund), United States, Japan (Cool Earth Fund), and the experience of multilateral development banks with the Clean Energy Investment Framework. ADB can work with developing member countries DMCs to help them access CIF's two funds: the Clean Technology Fund for mitigation purposes, and the Strategic Climate Fund for both mitigation and adaptation efforts. The Strategic Climate Fund includes the Pilot Program on Climate Resilience to support adaptation.		
Climate Investment Fund www.worldbank.org/cif	Over $6.2 billion in pledges (as of March 2009) Pilot Program for Climate Resilience, possibly $500 million globally	**Context** The World Bank board of executive directors gave formal approval to the creation of the CIF—a pair of international investment instruments designed to provide interim, scaled-up funding to help developing countries in their efforts to mitigate rises in greenhouse gas emissions and adapt to climate change. The fund seeks to use the potential of the public and private sectors to address climate change. The CIF will support both mitigation and adaptation actions through the multilateral development banks, including ADB. The World Bank is expected to serve as trustee. Recipient countries can work with multilateral development banks to develop proposals to cover the costs of specific, large-scale, adaptation initiatives under the Pilot Program for Climate Resilience. See: siteresources.worldbank.org/INTCC/Resources/Proposal_for_a_Clean_Technology_Fund.pdf siteresources.worldbank.org/INTCC/Strategy/21770036/ProposalforaStrategicClimateFundMay15736pm.pdf **Expected Scope of Pilot Program for Climate Resilience** Within the Strategic Climate Fund, the first phase of the Pilot Program for Climate Resilience will provide approximately 8 eight countries and 2 two regions with increased support to integrate climate resilience into their development planning and budgets. Where relevant, cooperation will be established with other ongoing national adaptation programs. Two types of activities will be supported during 2008–2012 in recipient countries: 1) Technical assistance will enable developing countries to build upon existing national work, including the National Communications and NAPAs, to integrate climate resilience into core development plans and budgets. This phase will provide support for technical assistance and capacity-building needs as identified by the pilot country, to enable the government to plan for climate-resilient development, with input from civil society and the private sector. 2) The second type of activity will include: budget support, sector-wide approaches, and coordinated investment programs across key sectors, and blending with national financing and/or existing international support mechanisms.

Fund	Amount ($)	Purpose and/or Criteria
		Country Eligibility Fund eligibility will be based on Overseas development assistance eligibility (according to the Organisation for Economic Co-operation and Development - –Development Assistance Committee guidelines), and the recipient must be a multilateral development bank member country. Country eligibility will be based on priority being given to highly vulnerable, least developed countries; transparent vulnerability criteria; country preparedness; an ability to move towards climate-resilient development plans; and country distribution across regions and types of hazards. Final selection of pilot countries will be the decision of the Pilot Program for Climate Resilience Steering Committee. Priority will be given to countries eligible for multilateral development bank concessional funds and/or to small island developing states.
Funding Windows established under the UNFCCC and Kyoto Protocol		
LDCF	$172 million (www.gefweb.org, as of March 2009)	This Fund has focused primarily on supporting the preparation and implementation of NAPAs which are a simplified a direct channel to communicate urgent and immediate adaptation needs. With the majority of countries having prepared their NAPAs, attention is now on the implementation of priority and urgent adaptation needs. These are predominantly in the agriculture, water resources and coastal zone areas and address impacts caused by both gradual changes in climate as well as increased natural disasters. **Eligibility** All LDC countries that are signatories to the UNFCCC are eligible to access this fund. In Asia, these are Kiribati, Maldives, Samoa, Solomon Islands, Timor-Leste, Tuvalu, and Vanuatu in the Pacific as well as Afghanistan, Bangladesh, Bhutan, Cambodia, Nepal, Bhutan Bangladesh, Cambodia, Myanmar, Nepal, Afghanistan and Tajikistan. Projects for the implementation of NAPAs must directly seek to implement NAPA prioritized and must be endorsed by the GEF Focal Points. A country must submit its NAPA to the UNFCCC before it can request for LDCF resources to implement it. Project size is also dependent on resource availability and is subject to the application of equitable access by countries to resources. Several countries in Asia have already accessed their resources but a number remain. Projects must demonstrate clear adaptation benefits.

Fund	Amount ($)	Purpose and/or Criteria
SCCF	$90 million (www.gefweb.org as of March 2009)	As with the LDCF, the SCCF is replenished on a rolling and voluntary basis and project approvals are dependent on resource availability. The scope of the SCCF related to adaptation include adaptation projects in water resources management, land management, agriculture, health, infrastructure development, fragile ecosystems (including mountain ecosystems), integrated coastal zone management, capacity building to foster preventative measures, disaster (including drought) preparedness, and planning, monitoring of disease vectors, early warning systems and strengthening regional networks for rapid response to natural disasters. **Eligibility** Developing Countries countries and countries with economies in transition that are signatory to the UNFCCC; . Pprojects must also be endorsed by GEF Focal Points. Adaptation activities funded under the SCCF will be based on National Communications, NAPAs (in the cased of LDCs only), national and regional relevant studies, and available information. Adaptation measures will be implemented where sufficient information is available to warrant such activities.
SPA	$50 million (fully committed, with possible replenishment in the future)	SPA resources are drawn from the GEF Trust Fund to support pilot and demonstration projects that address local adaptation needs while generating global environmental benefits. **Eligibility** Countries that are signatory to the UNFCCC. Pilot and demonstration projects that address local adaptation needs and also generate global environmental benefits in any one or combination of the six GEF focal areas (biodiversity conservation, climate change mitigation, international waters, and land degradation, persistent organic pollutants and ozone depletion). Projects should build on a rigorous methodology, on national priorities, and relevant adaptation assessments. Example: The ADB Coral Triangle Initiative subproject of GEF PAS received $1 million in SPA funding.
Adaptation Fund	Projected estimates vary	Core funding comes from a 2% set-aside of certified emission reductions credits issued for Clean Development Mechanism projects, plus funds from other sources. Expected to become operational by early to mid-2009. The fund was established to support concrete adaptation projects and programs. The operating entity of the Adaptation Fund is the Adaptation Fund Board, with the GEF providing secretariat services, and the World Bank providing trustee services on an interim basis. The Adaptation Fund board comprises 16 members and will meet at least twice a year to approve projects and set strategic and operational directions.

Fund	Amount ($)	Purpose and/or Criteria
		Eligibility Developing Country Parties to the Kyoto Protocol that are particularly vulnerable to the impacts of climate change Countries will be able to access resources either directly, subject to meeting established criteria or through pre-approved implementing entities
Cool Earth Partner-ship	US$ 10 billion (JP¥ 1,250 billion)	This multilateral fund with the US and the UK, will provide up to US$ 2 billion (JP¥ 250 billion) in grant aid to assist with climate adaptation, and improved access to clean energy. Funding support will be provided through Japan's Environment Program Grant Aid for technical assistance and funding. Funds will support program and project assistance (policy formulation, institution building, human resource development, and project implementation) to promote efforts to address climate change in developing countries. The Fund will also support electrification of rural communities by introduction of solar power generation and small-scale hydro energy. **Eligibility** Based on policy consultations with developing countries Adaptation measures to assist developing countries (e.g., Pacific island countries) vulnerable to the adverse effects of climate change. Adaptation measures may include forest conservation, measures against disasters related to climate change such as drought and flood risk management, adaptation planning.

ADB = Asian Development Bank, CCF = Climate Change Fund, CIF = Climate Investment Fund, COP = Conference of the Parties, GEF PAS = Global Environment Facility - Pacific Alliance for Sustainability, LDCF = Least Developed Country Fund, NAPA = National Adaptation Program of Action, SCCF = Special Climate Change Fund, SPA = Strategic Priority on Adaptation, UNFCCC = United Nations Framework Convention on Climate Change.

APPENDIX 4

SUMMARY MATRIX COMPARING SOME ADAPTATION SCREENING TOOLS

Tool	Description	Screening Level	Tool Functionality	Perceived Relevance / Usefulness
Information Generation, Modeling Databases, and Platforms for Risk Assessment				
1. **PRECIS (Providing Regional Climates for Impacts Studies) Website: precis.metoffice.com UK Met Office, Hadley, UK.**	PRECIS is a regional climate modeling system that can be run over any area of the globe on a relatively inexpensive, fast personal computer to provide regional climate information for impact assessment studies. The tool uses global climate modeling to provide grid-scale averages of hydro-climatic variables as well as soil hydrology and thermodynamics, and some vegetation dynamic variables. The tool is applicable to multiple scales, sectors, and levels of screening but is limited to fine and point scale information. PRECIS is a widely used model to generate high-resolution regional climate information. It is designed specifically to enable non-Annex I countries undertake climate change, climate vulnerability, and adaptation research to meet the UNFCCC reporting requirements on the preparation of national communications and related commitments under Articles 4.1 and 12.1 of the UNFCCC. PRECIS focuses on application of the results to impacts, vulnerability, and adaptation research and how these would eventually feed into decision support systems for sustainable development in non-Annex I countries.	Input Tool	PRECIS is not a decision-making tool, but provides inputs that could be used for risk management and adaptation management processes. Regional model domains typically cover several countries. 8.5 gigabyte dual-layer DVD. Boundary data shipped on hard disk.	Flexible, easy to use, and computationally inexpensive regional climate model designed to provide detailed climate scenarios. Does not integrate impacts. Requires 1-week workshop training. Must purchase workshop module and training services. Additional boundary data required through ECHAM4 or NOAA. Larger regional, much less-precise grid resolution (not downscaled).

Tool	Description	Screening Level	Tool Functionality	Perceived Relevance / Usefulness
2. Statistical DownScaling Model (SDSM) 4.2 Website: www.sdsm.org.uk Environment Agency, UK	SDSM is a Microsoft Windows–based decision support tool for the rapid development of single-site, ensemble scenarios of daily weather variables under present and future regional climate forcing. This computer-based information tool is open source and is aimed at donors, governments, and impact assessors. The tool provides daily transient climate risk information for impact assessment for 1961–2100, and is primarily used for water resource management, though is applicable to multiple sectors.	Project	Free decision-support tool for assessing local UK climate change impacts using a robust statistical downscaling technique (daily surface weather variables under current and future regional climate forcing.	The tool provides rapid assessments to assist impacts and adaptation analysis. Apparent impact limitations on sea level and storm surge. Can methodology somehow be applied to other locations?
3. SERVIR Climate Change Mapping Tool Website: www.servir.net USAID, NASA, CATHALAC, IAGT	This web-based tool is intended to assist users of the USAID Climate Adaptation Guidance Manual to instantly access climate information needed to adaptation projects. The trial or beta version of the Climate Mapper tool for SERVIR—the Regional Visualization and Monitoring System—was released in May 2008. The Climate Mapper makes the results of climate change models accessible to a broad user community. With the Climate Mapper, users can assess climate change projections for the 2030s and 2050s against three-dimensional visualizations of landscape. This should enhance vulnerability assessments as development planners consider adaptation strategies for projects. 50 by 50 kilometer grid.		The tool is an open platform that is applicable to multiple sectors and is available to various users. Web available.	Climate Mapper data currently available only for MesoAmerica/Africa. It will expand to cover the entire globe. Currently for USAID, need to determine whether web-based methodology might be useful even though GCM data not yet formulated. Information on past weather and projected climate should inform project officers as they design projects to be more resilient to climate variability and change.

Tool		Description	Screening Level	Tool Functionality	Perceived Relevance / Usefulness
		The Climate Mapper initially serves Africa (as part of SERVIR's expansion beyond Mesoamerica where SERVIR first started).			
4.	**Climate Analysis Indicators Tool (CAIT) Website: cait.wri.org WRI**	The Climate Analysis Indicators Tool is an information and analysis tool on global climate change developed by the World Resources Institute.	Program	The database contains country data on climate change, particularly on greenhouse gas emissions. It also includes information on historic impacts, particularly from disaster events, as well as a range of human development indexes.	CAIT can be used to analyze a wide range of climate-related data questions and help support future policy decisions made under the UNFCCC. CAIT permits manipulation of data by country.

Tool	Description	Screening Level	Tool Functionality	Perceived Relevance / Usefulness
5. Climate envelopes/ adaptation risk screening platform (CIEAR) Website: www.sei.se/oxford Stockholm Environment Institute (SEI)	This open platform is a work in progress, with the intention to include a collection of software tools (e.g., risk mapping), databases (e.g., criteria, adaptation actions), guidance, examples/prototypes, and communications. It is intended to support analysts who advise a range of final users in multiple sectors at multiple scales. The risk modules tend to focus on fairly immediate links between climate episodes and trends and impacts affecting environmental services, economic activities, and livelihoods. A collaborative platform for climate adaptation called weADAPT (www.weadapt.org) is currently being developed. The weADAPT platform will provide analysts and decision makers with up-to-date information on vulnerability to climate change and tools for screening adaptation options to manage present and future climatic risks. The program assembles spatial data on current vulnerability; analyzes climate trends; calculates thresholds of exposure to climatic risks in a variety of sectors; charts envelopes of climate scenarios for critical thresholds; estimates sensitivity of adaptation options to future conditions; and screens options using simple methods, or complex models if required.	Various	The tool platform will be designed to clarify choices in decision making and not prescribe perfect solutions to specific risks. It has adopted a social learning and process approach to adaptation planning and decision making which incorporates project details, vulnerability data, and stakeholder engagement.	Data is non-climatic and static (only lists), non-modeled, and dated (2001).

Tool		Description	Screening Level	Tool Functionality	Perceived Relevance / Usefulness
		assembles spatial data on current vulnerability; analyzes climate trends; calculates thresholds of exposure to climatic risks in a variety of sectors; charts envelopes of climate scenarios for critical thresholds; estimates sensitivity of adaptation options to future conditions; and screens options using simple methods, or complex models if required.			
6.	**Vulnerability mapping and impact assessment Website: www.dfid.gov.uk/research/mapping-climate.pdf ILRI, TERI, ACTS, CIAT**	This tool utilizes GCM outputs, agriculture systems and land use data, and GIS and vulnerability data and aims to provide donors (and, in the future, governments and NGOs) with information on key characteristics in the agriculture sector at the national level.	Policy	The tool identifies vulnerable populations ("hotspots") and assesses climate change impacts and costs and benefits of potential adaptation options.	At present, the tool is limited to sub-Saharan Africa and omits other key non-agricultural impacts.

	Tool	Description	Screening Level	Tool Functionality	Perceived Relevance / Usefulness
7.	**CRiSTAL (Community-based Risk Screening Tool - Adaptation and Livelihoods) Website: www.iisd.org/security/es/resilience/climate_phase2.asp International Institute for Sustainable Development (IISD), International Union for Conservation of Nature (IUCN), SEI Intercooperation**	CRiSTAL is a decision-support tool which enables project planners and managers to understand the links between local livelihoods and climate, assess a project's impact on livelihood resources important for climate adaptation, and devise adjustments to improve a project's impact on these key livelihood resources. This project-based tool is aimed at numerous community users and is piloted in Mali, Nicaragua, Sri Lanka, and Tanzania, in sectors such as agriculture, water resource management, infrastructure, and natural resource management.	project	This project-based tool has been field-tested and draws on environmental impact assessment models. This is a practical tool used to facilitate the integration of risk reduction and climate adaptation into field projects. A CRiSTAL User's Manual is also available (in PDF format). Since the tool is aimed at numerous users, it is offered in multiple formats (e.g., web-based, spreadsheet, hard copy) and in several languages.	The tool delivers vulnerability and livelihood profiles as well as details for project modification, but requires considerable project field detail; the focus is on community. However, requires detailed project inputs and vulnerability data.

Tool	Description	Screening Level	Tool Functionality	Perceived Relevance / Usefulness
8. ADAPT Assessment and Design for Adaptation to Climate Change: A Prototype Tool Website: go.worldbank.org/AWJKT60300 World Bank	Meant for use by development practitioners, including ADB staff, bilateral agencies, the NGO community, and client governments. This computer-based tool is multisector and currently being tested in South Asia, soon expanding to sub-Saharan Africa. The tool undertakes a sensitivity analysis for specific projects and flags activities that are sensitive to climate change as well as gives advice on adaptation activities.	Project	This multisector computer-based tool undertakes a sensitivity analysis for specific projects and flags activities that are sensitive to climate change as well as gives advice on adaptation activities. The tool utilizes project location and activity information that is screened through a project activity sensitivity matrix based on GCM data.	The tool, which runs on Microsoft Excel, is still in the development stage. It does not utilize specific vulnerability data or adaptation at the sector level. ADAPT is not explicitly a decision-making tool and does not address sensitivities at the program level. Not operational as yet.
9. Adaptation Wizard Website: www.ukcip.org.uk/index.php UK Climate Impacts Programme (UKCIP)	The Adaptation Wizard is a web-based tool that is designed to help users gain a basic understanding of climate change as well as integrate climate risks into their decision making. It is a high-level, generic tool that is valuable to newcomers to the climate change issue, as well as those who are preparing to adapt.	Various	The tool takes users through a five-step process to help assess their vulnerability to current and future climate change, identify options to address key climate risks, and help develop a climate change adaptation strategy. It is more a decision support tool than a decision-making tool, and plays a valuable awareness-raising and educational role.	Though the tool walks users through an economic analysis of adaptation options and scenarios, it is specifically aimed at the UK context

Tool	Description	Screening Level	Tool Functionality	Perceived Relevance / Usefulness
10. Country Database UNDP GEF	The country database aims to help UNDP offices develop adaptation proposals and improve staff awareness on climate risks for other project design. It compiles a common set of information for each UNDP partner country, drawn from National Communications, National Adaptation Programme of Action (NAPAs), and other scientific studies, together with UNDP country program information, on an easy to operate web-page format.	Project		Database restricted to users of UNDP intranet.
Adaptation and Risk Management Screening Processes				
11. Climate-FIRST: Climate Framework Integrating Risk Screening Tool ADB pilot	Climate-FIRST is a user-friendly, desk-top (web- and paper-based) risk screening tool pilot. The check-list alerts project officers and mission leaders to potential climate-induced impacts and risks, and allows for possible incorporation of risk reduction measures at the project preparation stage. .	Project/ policy	Climate-FIRST relies on existing project data/ knowledge. It pre-screens and assesses probable risk against a number of preconceived impact and risk tables, and risk-related assumptions (location of project in climate-sensitive geo-climatic zones, sector risks, capacity development, and known disaster hotspots).	In pilot stage. Rapid desk-top assessments of potential impacts and adaptation analysis. Helps mainstream risk reduction and adaptation during project preparation. Does not rely upon impact modeling data. Designed for Asia and the Pacific (methodology applicable in other geographical areas). Tool generates corresponding risk value to help determine range of risks (high, medium, low), with supporting recommendations.

Tool	Description	Screening Level	Tool Functionality	Perceived Relevance / Usefulness
12. **ORCHID (Opportunities and Risks of Climate Change and Disasters) Website: www.ids.ac.uk/climatechange Institute of Development Studies (IDS) in partnership with the Department for International Development of the United Kingdom (DFID)**	ORCHID is a systematic climate risk management methodology that assesses the relevance of climate change and disaster risks to an organization's portfolio of development projects. ORCHID aims to raise awareness of climate risk management and future climate change among staff, stimulate dialogue with donor partners, and integrate disaster risk reduction and climate change adaptation policies and activities.	Project	Process-based tool designed to be a light-touch screening process for donor programs. Utilizes quantitative inputs and climate science applied to the risk assessment of programs (usually at wide scales), using directional trends rather than discrete figures. The tool utilizes project documents and interviews with project staff as well as past trends in vulnerability and disaster risks.	In pilot stage. Highly involved project-specific iterative process in field. Comprehensive review of project documents. The process makes recommendations for how programs might enhance risk management through adaptive practices and cost–benefit analysis. Also, sector economic assessments are undertaken for areas where clear adaptation options can be discerned and where sufficient data is available.

Tool	Description	Screening Level	Tool Functionality	Perceived Relevance / Usefulness
13. **NAPA Platform Website: www.napa-pana.org UNITAR**	The purpose of developing a NAPA is to identify the urgent and immediate needs of a country to adapt to the present threats from climate change. Addressing these needs will expand the current coping range and enhance resilience in a way that will promote the capacity to adapt to current climate variability and extremes, and consequently to future climate change. The process is uniquely for least-developed countries as they have the least capacity to deal with climate impacts.	Project, program	The NAPA platform is aimed at providing informational support to NAPA country teams, implementing agencies vulnerability and adaptation experts, and other partners providing NAPA technical assistance. It aims to facilitate the delivery of technical assistance to NAPA teams formulating their NAPA documents, particularly with regards to the synthesis of existing vulnerability and adaptation information, and the formulation of adaptation projects profiles.	It provides multisector information aimed at the program and project level for least- developed countries within the NAPA process.

Tool	Description	Screening Level	Tool Functionality	Perceived Relevance / Usefulness
14. Climate Change Adaptation (USAID) Guidance Manual	The Guidance Manual is aimed at USAID country missions to assist in the mainstreaming of climate change adaptation in all projects. At present the manual is being tested in Honduras, Mali, South Africa, and Thailand in sectors such as agriculture, coastal development and flooding, water infrastructure, and fisheries and livelihoods. Future projects may cover protected lands management, integrated river basin management, and health.	Policy, project	The manual leads project designers through a series of steps to help them understand whether their project may be vulnerable to climate variability or change. The manual encourages stakeholder engagement and provides guidance on where to find more information and assistance in gathering data (i.e., USAID Climate Change Team).	The USAID Global Climate Change Team developed this Adaptation Guidance Manual to assist missions and other partners to understand how climate change may affect their project outcomes and identify adaptation options to integrate into the design for more resilient projects.
15. Climate Quick Scans Website: www.nlcap.net DGIS, The Netherland	This paper- and process-based tool is aimed at donors (particularly DGIS) and is applicable to multiple sectors. This quick process draws on expert advice to screen programs and /or projects to establish adaptation priorities and raise awareness about climate risks with partner countries. Currently only Bangladesh, Bhutan, Mongolia, Viet Nam experts and ministry experts.	Project, program	The project draws on various inputs including project and/or program details, stakeholder engagement, and varying levels of vulnerability data.	Only presentations and reports. Aimed at specific donors/DGIS and select countries, and relies upon expert advice; very project-specific.

Tool	Description	Screening Level	Tool Functionality	Perceived Relevance / Usefulness
16. Preparedness for Climate Change Website: www.climatecentre.org Red Cross/Red Crescent	The Red Cross/Red Crescent Climate Centre, through its Preparedness for Climate Change Program, offers national Red Cross and Red Crescent societies in developing countries the opportunity to improve their understanding of the negative impacts of climate change for their country and programs. "Preparedness for climate change - understanding and addressing the risks of climate change 2006-2008" is a flexible program, aimed at meeting the specific situations of national societies which are interested in participating. A web-based guide with an application form, reporting formats and other documents is available.	Program, policy	The tools draws on Red Cross/Red Crescent project details, national staff, and the use of Red Cross/Red Crescent vulnerability data in order to set priorities for follow-up, including modifications to existing programs, and to strengthen local capacity in addressing climate-related risks. The tool is primarily aimed at disaster management, health, and the water and sanitation sectors.	This paper- and process-based tool is aimed primarily at local Red Cross and Red Crescent societies to assess key climate change–related risks facing vulnerable people in the country and programs of the national society.
17. Integration of Climate Risks Into Country Programming UNDP	This short briefing note provides guidance to improve the capacity of UNDP country offices to incorporate climate risks into UNDP country programming. It takes staff through a set of questions to assess whether climate risk is adequately reflected during the formulation of common country assessments and UN development assistance frameworks.	Program		UNDP intranet only.

ACTS = African Centre for Technology Studies, ADB = Asian Development Bank, CAIT = Climate Analysis Indicators Tool, CAIT V&A = Climate Analysis Indicators Tool Vulnerability and Adaptive Capacity, CATHALAC = Centro del Agua del Trópico Humedo para America Latina y el Caribe *(Water Center for the Humid Tropics of Latin America and the Caribbean; Panama)*, CIAT = International Centre for Tropical Agriculture, CIEAR = Climate envelopes/adaptation risk screening, CRISTAL = Community-based Risk Screening Tool Adaptation and Livelihoods, DDC = Data Distribution Centre, DFID = Department for International Development of the United Kingdom, DGIS = Directorate General for International Cooperation, GCM = global climate modeling, GEF = Global Environment Facility, GIS = geographic information system, IAGT = Institute for the Application of Geospatial Technology, IDS = Institute of Development Studies, IISD = International Institute for Sustainable Development, ILRI = International Livestock Research Institute, IPCC = Intergovernmental Panel on Climate Change, IUCN = International Union for Conservation of Nature, LDC = least-developed country, LDCF = Least Developed Country Fund, NAPA = National Adaptation Program of Action, NASA = National Aeronautics and Space Administration, NGO = nongovernment organization, NOAA = National Oceanographic and Atmospheric Administration, ORCHID = Opportunities and Risks of Climate Change and Disasters, SDSM = Statistical DownScaling Model, SEI = Stockholm Environment Institute, TERI = Energy and Resources Institute, UK = United Kingdom, UKCIP = UK Climate Impacts Programme, UN = United Nations, UNDP = United Nations Development Programme, UNEP = United Nations Environment Programme, UNFCCC = United Nations Framework Convention on Climate Change, UNITAR = United Nations Institute for Training and Research, USAID = United States Agency for International Development, WRI = World Resources Institute.

Appendix 2

ASIAN DEVELOPMENT BANK ADB GLOSSARY OF CLIMATE ADAPTATION AND DISASTER RISK MANAGEMENT TERMS

These definitions are sourced from the United Nations Framework Convention on Climate Change (UNFCCC) Glossary, and IPCC's Third and Fourth Assessment Reports, and UNISDR, unless specified with source. Weblinks to these sites can be found in Appendix 6.

Adaptation. Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.

Autonomous adaptation. – Adaptation that does not constitute a conscious response to climatic stimuli but is triggered by ecological changes in natural systems and by market or welfare changes in human systems. Also referred to as spontaneous adaptation.

Adaptive capacity. The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, take advantage of opportunities, or cope with the consequences.

Atmosphere. The gaseous envelope surrounding the Earth. The dry atmosphere consists almost entirely of nitrogen and oxygen with trace gases including carbon dioxide and ozone.

Capacity building. In the context of climate change, the process of developing the technical skills and institutional capability in developing countries and economies in transition to enable them to address effectively the causes and results of climate change.

Carbon market. A popular but misleading term for a trading system through which countries may buy or sell units of greenhouse- gas emissions in an effort to meet their national limits on emissions, either under the Kyoto Protocol or under other agreements, such as that among member states of the European Union. The term comes from the fact that carbon dioxide is the predominant greenhouse gas and other gases are measured in units called "carbon-dioxide equivalents."

Climate. Climate in a narrow sense is usually defined as the "'average weather," ', or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. These quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state, including a statistical description, of the climate system. The classical period of time is 30 years, as defined by the World Meteorological Organization (WMO).

Climate change. Climate change refers to any change in climate over time, whether due to natural variability or as a result of human activity. This usage differs from that in the United Nations Framework Convention on Climate Change (UNFCCC), which defines "'climate change' change" as: "'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.'". See also climate variability.

Climate models. A numerical representation of the climate system based on the physical, chemical, and biological properties of its components, their interactions and feedback processes, and accounting for all or some of its known properties. The climate system can be represented by models of varying complexity (i.e., for any one component or combination of components a hierarchy of models can be identified, differing in such aspects as the number of spatial dimensions, the extent to which physical, chemical, or biological processes are explicitly represented, or empirical parameterisations parameterizations are involved.

Climate variability refers to variations in the mean state and other statistics (such as standard deviations, statistics of extremes, etc.) of the climate on all temporal and spatial scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability). See also climate change.

Climate risk management. An approach to systematically manage climate-related risks affecting activities, strategies, or investments, by taking account of the risk of current variability and extremes in weather as well as long-term climate change.

Climate scenario. A plausible and often simplified representation of the future climate, based on an internally consistent set of climatological relationships and assumptions of radiative forcing, typically constructed for explicit use as input to climate change impact models. A '"climate change scenario' scenario" is the difference between a climate scenario and the current climate.

Conference of the Parties (COP). The supreme body of the Convention. It currently meets once a year to review the Convention's progress. The word "conference" is not used here in the sense of "meeting" but rather of "association," which explains the seemingly redundant expression "fourth session of the Conference of the Parties."
Coping capacity. The means by which people or organisations organizations use available resources and abilities to face adverse consequences that could lead to a disaster.

Disaster. A serious disruption of the functioning of a community or a society causing widespread human, material, economic, or environmental losses which exceed the ability of the affected community or society to cope using its own resources.

Disaster risk management. The systematic process of using administrative decisions, organizations, operational skills, and capacities to implement policies, strategies, and coping capacities of a society to reduce the impacts of disasters.

Disaster risk reduction. The conceptual framework of elements considered with the possibilities to minimise minimize vulnerabilities and disaster risks throughout a society, to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development.

Downscaling a method that derives local- to regional-scale (10 to 100 kmkilometers) information from larger-scale models or data analyses. Two main methods are distinguished: dynamical downscaling and empirical/statistical downscaling. The dynamical method uses the output of regional climate models, global models with variable spatial resolution or high-resolution global models. The empirical/statistical methods

develop statistical relationships that link the large-scale atmospheric variables with local/regional climate variables. In all cases, the quality of the downscaled product depends on the quality of the driving model.

Early warning. The provision of timely and effective information, through identified institutions, that allows individuals exposed to a hazard to take action to avoid or reduce their risk and prepare for effective response.

Emissions. In the climate change context, emissions refer to the release of greenhouse gases and/or their precursors and aerosols into the atmosphere over a specified area and period of time.

Fossil fuels. Carbon-based fuels from fossil hydrocarbon deposits, includes coal, peat, oil, and natural gas.

Global warming is the gradual increase, observed or projected, in global surface temperature as one of the consequences of radiative forcing caused by anthropogenic emissions.

Greenhouse gases (GHGs). Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds. This property causes the greenhouse effect. Water vapour (H2O), carbon dioxide (CO22), nitrous oxide (N22O), methane (CH4) and ozone (O3) are the primary greenhouse gases in the Earth's atmosphere. As well as CO22, N22O, and CH4, the Kyoto Protocol deals with the greenhouse gases sulphur hexafluoride (SF6), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs).

Global Environment Facility (GEF). The GEF acts as an operating entity of the financial mechanism of the UN Framework Convention on Climate Change.

Hazard. A potentially damaging physical event that may cause loss of life or injury, property damage, social and economic disruption, or environmental degradation.

(climate change) Impacts The effects of climate change on natural and human systems. Depending on the consideration of adaptation, one can distinguish between potential impacts and residual impacts:

Potential impacts: all impacts that may occur given a projected change in climate, without considering adaptation.

Residual impacts: the impacts of climate change that would occur after adaptation. See also aggregate impacts, market impacts, and non-market impacts.

Intergovernmental Panel on Climate Change (IPCC). Established in 1988 by the World Meteorological Organization and the UN Environment Programme, the IPCC surveys world-wide scientific and technical literature and publishes assessment reports that are widely

recognized as the most credible existing sources of information on climate change. The IPCC also works on methodologies and responds to specific requests from the Convention's subsidiary bodies. The IPCC is independent of the Convention.

Kyoto Protocol. The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate ChangeUNFCCC. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas emissions .These amount to an average of 5% against 1990 levels over 2008–2012.

Least Developed Countries (LDCs). The World's world's poorest countries. The criteria currently used by the Economic and Social Council (ECOSOC) for designation as an LDC include low income, human resource weakness, and economic vulnerability. Currently 50 countries have been designated by the UN General Assembly as LDCs.

Least Developed Country Fund (LDCF). The LDCF is a fund established to support a work programme to assist Least Developed Country Parties to carry out, inter alia, the preparation and implementation of national adaptation programmes of action (NAPAs). The Global Environment FacilityGEF, as the entity that operates the financial mechanism of the Convention, has been entrusted to operate this fund.

Likelihood. The likelihood of an occurrence, an outcome or a result, where this can be estimated probabilistically, is expressed in this Report publication using a standard terminology.

Mitigation. In the context of climate change, a human intervention to reduce the sources or enhance the sinks of greenhouse gases. Examples include using fossil fuels more efficiently for industrial processes or electricity generation, switching to solar energy or wind power, improving the insulation of buildings, and expanding forests and other "sinks" to remove greater amounts of carbon dioxide from the atmosphere.

National adaptation programmes of action (NAPAs). Documents prepared by least developed countries (LDCs) identifying urgent and immediate needs for adapting to climate change. The NAPAs are then presented to the international donor community for support.

National communication. A document submitted in accordance with the Convention (and the Protocol) by which a Party informs other Parties of activities undertaken to address climate change. Most developed countries have now submitted their fourth national communications; most developing countries have completed their first national communication and are in the process of preparing their second.

"No-regrets options.". Technology for reducing greenhouse- gas emissions whose other benefits (in terms of efficiency or reduced energy costs) are so extensive that the investment is worth it for those reasons alone. For example, combined-cycle gas turbines -- —in which the heat from the burning fuel drives steam turbines while the thermal expansion of the exhaust gases drives gas turbines— -- may boost the efficiency of electricity generating plants by 70 per cent%.

Relief or response. The provision of assistance or intervention during or immediately after a disaster to meet the life preservation and basic subsistence needs of those people affected. It can be of an immediate, short-term, or protracted duration.

Resilience. The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisationorganization, and the capacity to adapt to stress and change.

Risk. The probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted, or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions.

Risk assessment. A methodology to determine the nature and extent of risk by analyzing potential hazards and evaluating conditions of vulnerability that could pose a potential threat or harm to people, property, livelihoods, and the environment on which they depend..

Saltwater intrusion. Displacement of fresh surface water or groundwater by the advance of salt water due to its greater density. This usually occurs in coastal and estuarine areas due to reducing land-based influence (e.g., either from reduced runoff and associated groundwater recharge, or from excessive water withdrawals from aquifers) or increasing marine influence (e.g., relative sea-level risesea-level rise).

Sea level riseSea level rise. An increase in the mean level of the ocean. Eustatic sea-level risesea-level rise is a change in global average sea level brought about by an increase in the volume of the world ocean. Relative sea-level risesea-level rise occurs where there is a local increase in the level of the ocean relative to the land, which might be due to ocean rise and/or land level subsidence. In areas subject to rapid land-level uplift, relative sea level can fall.

Stakeholder. Person or entity holding grants, concessions, or any other type of value that would be affected by a particular action or policy.

Sustainable development. Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Uncertainty. Uncertainty can result from lack of information or from disagreement about what is known or even knowable. It may have many types of sources, from quantifiable errors in the data to ambiguously defined concepts or terminology, or uncertain projections of human behaviour. Uncertainty can therefore be represented by quantitative measures (e.g., a range of values calculated by various models) or by qualitative statements (e.g., reflecting the judgement of a team of experts).

United Nations Framework Convention on Climate Change (UNFCCC). The international response to climate change, the objective of which is to stabilize greenhouse gas concentrations in the atmosphere at a level that will prevent dangerous anthropogenic interference with the climate system.

Vulnerability. The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity.

Appendix 6

USEFUL CLIMATE CHANGE LINKS

Subject	ADB Links
Adaptation Compendium	UNFCCC Compendium on methods and tools to evaluate impacts of, vulnerability and adaptation to, climate change: http://unfccc.int/files/adaptation/nairobi_workprogramme/compendium_on_methods_tools/application/pdf/20080307_compendium_m_t_complete.pdf?bcsi_scan_D4A612CF62FE9576=0&bcsi_scan_filename=20080307_compendium_m_t_complete.pdf
ADB and Climate Change	ADB's climate change website, highlighting our adaptation project innovations: www.adb.org/Climate-Change/cc-adaptation.asp ADB's approach to climate change in Asian Development Fund countries: www.adb.org/Documents/ADF/ADF-X/ADFX-Climate-Change.pdf Climate change brochure: www.adb.org/Documents/Brochures/Climate-Change/default.asp Technical assistance: A Regional Review of the Economics of Climate Change in Southeast Asia: www.adb.org/documents/tars/reg/41678-reg-tar.pdf Technical assistance: Addressing Climate Change in the Asia and Pacific Region: www.adb.org/Documents/TARs/REG/42167-REG-TAR.pdf Technical assistance: Promoting Climate Change Adaptation in Asia and the Pacific: www.adb.org/Documents/TARs/REG/39343-REG-TAR.pdf
Agriculture and Food Security	Impacts of climate change in the Greater Mekong Subregion: www.adb.org/GMS/phnom-penh-plan/docs/Agriculture-Food-Security.pdf
Clean Development Mechanism	Clean Development Mechanism facility: www.adb.org/CDMF/default.asp
Energy	Clean energy: www.adb.org/clean-energy/default.asp Renewable energy, energy efficiency, and climate change program: www.adb.org/Clean-Energy/reach.asp
Desertification	World Environment Day 2006: Combating desertification in Asia: www.adb.org/environment/desertification.asp
Disaster Risk Management	Disaster risk management: www.adb.org/Disaster/default.asp
Environment	Responding to climate change in Asia: www.adb.org/Environment/world-environment-day-2007.asp Environment in Asia: www.adb.org/Environment/default.asp
Gender and Development	Vice President Schäfer-Preuss's Speech at the Third Global Congress of Women in Politics and Governance, Oct 2008, on "Climate Change and Disaster Risk Management: Legislating Gender-Responsive Mitigation, Adaptation, and Women's Participation" www.adb.org/Documents/Speeches/2008/ms2008075.asp Gender and development: www.adb.org/Gender/default.asp

Subject	ADB Links
Governance	News brief: Climate Change, Governance Policies Remain Concerns for Developing Pacific Nations: www.adb.org/media/articles/2008/12383-pacific-nations-governance-policies/ Spotlight on the Environment, Social Development, and Governance: www.adb.org/Documents/Books/sustainability-report/part2.pdf
Knowledge Management	News release: ADB Establishes Climate Change Knowledge Hub at University in Beijing: www.adb.org/Media/Articles/2006/10870-regional-knowledge-hub/default.asp
Land Use and Forestry	Regional Workshop on Forests and Climate Change: Preparing for Decisions on Land Use and Forestry at the 9th Conference of the Parties: www.adb.org/Documents/Events/2003/Reg_Workshop_Forests_Climate_Change/default.asp
Small Island Development States	Climate proofing: A Risk-based Approach to Adaptation: www.adb.org/Documents/Reports/Climate-Proofing/default.asp
Water	Water for All eNewsletter: Climate Change—Preparations on the Rise: www.adb.org/Documents/Periodicals/Water/2007/issue33-Oct07.asp Water for All eNewsletter: Rain Rain, Come Again—Harvesting Rain to Fight Water Scarcity: www.adb.org/Documents/Periodicals/Water/2008/issue35-Feb08.asp Water Briefs: Climate, Water, Development: Asia Adapts through New Approaches and Investments: www.adb.org/Water/Water-Briefs/climate-change.asp Water Actions–Climate Change: www.adb.org/Water/actions/topic.asp?code=CLI
Adaptation and Disaster Risk Management	European Commission Synthesis Report on Linking climate change adaptation and disaster risk reduction for Sustainable Poverty Reduction: ec.europa.eu/development/icenter/repository/env_cc_varg_adaptation_en.pdf Disaster Risk Management in a Changing Climate: www.unisdr.org/eng/risk-reduction/climate-change/docs/DRM-in-a-changing-climate.pdf Food and Agriculture Organization Climate Change and Disaster Risk Management: ftp://ftp.fao.org/docrep/fao/meeting/013/ai786e.pdf?bcsi_scan_D4A612CF62FE9576=0&bcsi_scan_filename=ai786e.pdf
Climate Change Info Mailing List	A daily compilation of items posted to the www.climate-l.org knowledgebase of international activities on climate change. www.climate-l.org
Climate refugees	WWF-Australia: www.wwf.org.au/articles/climate-refugees-in-a-drowning-pacific/ Friends of the Earth Australia-A Citizens Guide to Climate Refugees: www.safecom.org.au/foe-climate-guide.htm Center for American Progress: www.americanprogress.org/issues/2006/12/climate_refugees.html

Subject	ADB Links
Images, Charts, Maps, Graphics, and Publications on Climate Impacts and Other Environmental Issues	Maps and graphics at United Nations Environment Programme /GRID-Arendal: maps.grida.no/ Flood maps: flood.firetree.net/?ll=16.3412,97.3388&z=12&m=7
IPCC	PCC homepage: www.ipcc.ch/ Science of climate change: www.ipcc.ch/ipccreports/ar4-wg1.htm Impacts, adaptation, and vulnerability: www.ipcc.ch/ipccreports/ar4-wg2.htm Mitigation of climate change: www.ipcc.ch/ipccreports/ar4-wg3.htm Climate change and water: www.ipcc.ch/ipccreports/tp-climate-change-water.htm
UNFCCC NAPAs	unfccc.int/national_reports/napa/items/2719.php, and http://www.napa-pana.org/
Poverty Reduction and Millennium Development Goals	www.adb.org/MDGs/default.asp www.adb.org/Poverty/default.asp
ProVention Consortium Harmonization Portal	Publications, events, and courses which deal with the interface between climate adaptation and disaster risk reduction. www.proventionconsortium.org/?pageid=95
Sea Level RiseSea level rise	International Centre for Environmental Management Rapid Assessment of the Extent and Impact of Sea Level RiseSea level rise in Viet Nam: www.icem.com.au/02_contents/06/documents/icem_slr/ICEM_SLR_final_report.pdf?bcsi_scan_D4A612CF62FE9576=0&bcsi_scan_filename=ICEM_SLR_final_report.pdf Earth Policy Institute: www.earth-policy.org/Updates/Update2.htm Department of Geosciences Environmental Studies Laboratory Research-Climate Change and Sea Level: www.geo.arizona.edu/dgesl/research/other/climate_change_and_sea_level/sea_level_rise/sea_level_rise.htm
Small Islands States Resolution (draft); Petition; Small Island Developing States Information	islandsfirst.org www.sidsnet.org/aosis/
Tuvalu's Evacuation Plan and Climate Refugees	www.wwf.org.au/articles/climate-refugees-in-a-drowning-pacific/
Urban Development	www.adb.org/urbandev/default.asp
United Nations Framework Convention on Climate Change (UNFCCC)	UNFCCC homepage: unfccc.int/2860.php Adaptation: unfccc.int/adaptation/items/4159.php

Siem Reap Province, Kompong Phluk, Cambodia. Village on piles on the edge of Tonle Sap Lake, Biosphere Reserve, at the beginning of the dry season. Changes in hydrological cycles may alter human habitats, fishing practices and traditional agriculture.

Under the Weather and the Rising Tide: Adapting to a Changing Climate in Asia and the Pacific

Many countries of Asia and the Pacific are at great risk from the anticipated impacts of human-induced climate change. Also at risk are many of the hard-won gains in poverty reduction, and the attainment of the Millennium Development Goals.

With cost estimates for climate-proofing at $10 billion–$150 billion per annum globally, it is clear that current funding is wholly inadequate for vulnerable developing countries to adapt to climate change. This funding inadequacy is especially challenging when we consider the immense scope of resources required to safeguard the livelihoods of the hundreds of the millions of impoverished people vulnerable to climate change. Add to this the need to protect vulnerable infrastructure, and sustain fragile ecosystems exposed to floods, storm surges, and water shortages brought on by climate change. The Asian Development Bank therefore has an important role to play in providing technical advice, leveraging resources, and forging innovative partnerships in Asia and the Pacific.

This booklet describes a number of adaptation strategies and actions being pursued by ADB, its country partners, and the international community. These strategies and actions reflect several important adaptation considerations for developing member countries, such as: country ownership, partnership synergies, integrating disaster risk reduction and climate risk management, and a no-regret approach. Also highlighted are emerging trends in climate adaptation strategies, including the blending of mitigation and adaptation, disaster risk management and climate adaptation synergies, community adaptation tools, and applied downscaled modeling.

About the Asian Development Bank:

ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries substantially reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to two thirds of the world's poor: 1.8 billion people who live on less than $2 a day, with 903 million struggling on less than $1.25 a day. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

Based in Manila, ADB is owned by 67 members, including 48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

Asian Development Bank
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
www.adb.org
Publication Stock No. ARM090274

Printed in the Philippines