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Asia-Pacific Regional Climate Change Adaptation Assessment

FINAL REPORT: FINDINGS AND RECOMMENDATIONS

April 2010

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Task Order No. EPP-I-03-06-00007-00 under the PLACE (Prosperity, Livelihoods and Conserving Ecosystems) Indefinite Quantities Contract

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ACRONYMS

A1B, B1, A1F1	climate change scenarios developed by the IPCC in its Special Report on Emissions Scenarios
ACCCA	Advancing Capacity to Support Climate Change Adaptation
ADAPT	Assessment and Design for Adaptation to Climate Change: A Prototype Tool
ADB	Asian Development Bank
ADRC	Asian Disaster Reduction Center
AIACC	Assessments of Impacts and Adaptations to Climate Change in Multiple Regions and Sectors
AIT	Asian Institute of Technology
ALM	Adaptation Learning Mechanism
APEC	Asia-Pacific Economic Cooperation
APCCAN	Asia-Pacific Climate Change Adaptation Network
ASEAN	Association of Southeast Asian Nations
AusAID	Australian Agency for International Development
CAPWIP	Center for Asia-Pacific Women in Politics
CCAI	Climate Change and Adaptation Initiative
CDM	Clean Development Mechanism
CIEAR	Climate envelopes/adaptation risk screening platform
CLACC	Capacity Strengthening of Least Developed Countries for Adaptation to Climate Change
CSIRO	Commonwealth Scientific and Industrial Research Organization
CT	Coral Triangle
CTI	Coral Triangle Initiative
CriSTAL	Community-based Risk Screening Tool – Adaptation and Livelihoods
DEWGA	Disaster Environment Working Group for Asia
DFID	Department for International Development (United Kingdom)

DRAGON	Delta Research and Global Observation Network Partnership
DRR/M	disaster risk reduction and management
EEZ	Exclusive Economic Zone
ELAN	Ecosystems and Livelihoods Adaptation Network
ENSO	El Niño Southern Oscillation
EU	European Union
FAO	Food and Agriculture Organization (United Nations)
FSM	Federated States of Micronesia
GCM	global circulation model
GDP	gross domestic product
GEF	Global Environment Facility
GHG	greenhouse gas
GLOF	glacial lake outburst flood
GMS	Greater Mekong Subregion
GTZ	Gesellschaft für Technische Zusammenarbeit (German Development Agency)
HDI	Human Development Index
ICCAI	International Climate Change Adaptation Initiative
ICEM	International Centre for Environmental Management
ICIMOD	International Centre for Integrated Mountain Development
IDS	Institute for Development Studies
IIED	International Institute for Environment and Development
IISD	International Institute for Sustainable Development
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for the Conservation of Nature
JICA	Japan International Cooperation Agency
LDC	Least Developed Country
LDCF	Least Developed Countries Fund

LMI	Lower Mekong Initiative
MDG	Millennium Development Goals
MPA	marine protected area
MPCC	Mekong Panel on Climate Change
MRC	Mekong River Commission
NAPA	National Adaptation Programme of Action
NCAR	US National Center for Atmospheric Research
NGOs	non-governmental organizations
NOAA	National Oceanic and Atmospheric Administration (United States)
OECD	Organisation for Economic Co-operation and Development
ORCHID	Opportunities and Risks of Climate Change and Disasters
PACC	Pacific Adaptation to Climate Change
PEDRR	Partnership for Environment & Disaster Risk Reduction
PPP	purchasing power parity
PRECIS	Providing Regional Climates for Impacts Studies
RCAKPA	Regional Climate Change Adaptation Knowledge Platform for Asia
RDMA	Regional Development Mission for Asia (USAID)
REDD	reducing emissions from deforestation and forest degradation
RMI	Republic of the Marshall Islands
SAARC	South Asian Association for Regional Cooperation
SCCF	Special Climate Change Fund
SEA-START	Southeast Asia Regional Center for Global Change System for Analysis, Research and Training
SEI	Stockholm Environment Institute
SENSA	Swedish Environmental Secretariat for Asia
SLR	sea level rise
SPA	Strategic Priority on Adaptation
SPC	Secretariat of the Pacific Community

SPREP	South Pacific Regional Environment Programme
START	Global Change System for Analysis, Research, and Training
UN/ISDR	United Nations International Strategy for Disaster Reduction
UN-CECAR	United Nations University Network for Climate and Ecosystems Change Adaptation Research
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNITAR	United Nations Institute for Teaching and Research
USAID	United States Agency for International Development
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USGS	United States Geological Survey
V&A	Vulnerability and Adaptation
WRI CAIT	World Resources Institute Climate Analysis Indicators Tool
WWF	World Wildlife Fund

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EXECUTIVE SUMMARY

The developing countries of the Asia-Pacific region are very diverse economically, politically, socially, and culturally. Yet, many of them face similar development and environmental challenges related to poverty alleviation, sustainable economic development, increased urbanization and greater rural-urban migration, environmental degradation, and the frequent incidence of natural disasters, such as earthquakes and tsunamis. Climate change is an additional stressor on livelihoods, ecosystems, and infrastructure that will place large populations and key sectors in the region at risk. In recognition of the region's vulnerability to climate change, its role in mitigating greenhouse gas (GHG) emissions, and the moral responsibility of developed countries to assist the most vulnerable people to adapt to climate change as expressed by the Obama administration, this report seeks to identify opportunities for USAID to deepen its regional engagement in supporting adaptation to climate change in Asia.

Assessment Objectives and Methods

The objective of the assessment is to provide an objective, up-to-date, and comprehensive regional analysis summarized in a report which assesses the climate change adaptation needs of the Asia-Pacific region. This report will be used to inform the planning process for possible future activities funded by USAID/RDMA that address regional climate change adaptation needs. The report will be shared widely with USAID bilateral missions in Asia, USAID offices in Washington, US Embassies in Asia, other US Government agencies, multilateral development banks, and other development partners.

The team of contractors and consultants conducting this assessment was tasked with determining regional priority vulnerabilities and adaptation (V&A) challenges and conducting a gap analysis of adaptation needs in the region to help USAID identify options for regional adaptation programming. The team reviewed an extensive body of literature, including a wide range of national strategies, reports, and communications as well as other papers and reports. The literature review was augmented by in-country and virtual consultations in the US and 10 countries in the region. Participants in consultations included staff from various USAID bilateral missions, other US Government agencies, national and subnational governments, and international and local non-governmental organizations (NGOs).

Geographic Scope and Methods

Nineteen countries were considered in the scope of this assessment. Stakeholder consultations were conducted in ten countries: China, Bangladesh, India, Indonesia, Laos, the Marshall Islands, Micronesia, the Philippines, Thailand, and Vietnam. In addition, the literature review provided the basis for the assessment of priority vulnerabilities and adaptation challenges in nine additional countries: Cambodia, Maldives, Mongolia, Nepal, Papua New Guinea, Timor Leste, Solomon Islands, Sri Lanka, and Vanuatu.

Findings and Recommendations

The assessment was structured to answer three key questions that pertain to priority vulnerabilities and adaptation challenges, opportunities for regional adaptation programming and potential synergies

between USAID regional and bilateral mission activities, and options for coordinating and collaborating with partners in the region. The responses to the three questions are provided below.

Question #1 *What are the priority climate change vulnerabilities and adaptation challenges of developing countries in the Asia-Pacific region?*

Priority Climate Change Vulnerabilities

Higher temperatures, changes in precipitation patterns (including flooding and drought), glacial melt, extreme events, and sea level rise are likely to impact agriculture in the region by altering cropping and grazing areas and seasons, the spread of pests and diseases, irrigation requirements, and the need for drought-, flood-, and saline-resistant crops. Water supply and quality will be impacted, with a potential increase in quantity in the near term due to the contributions of greater glacial and snow-melt to river runoff, and a likely decrease in the long term as glacier and snow cover is reduced. Terrestrial, freshwater, and marine ecosystems may be threatened by climate change impacts such as higher temperatures, glacial melt, sea level rise, warmer sea temperatures, and ocean acidification. This can lead to damage to or destruction of forests, grasslands, mangroves, and coral reefs, the irreversible loss of native flora and fauna species, and consequences for sequestration of greenhouse gases.

Extreme events and sea level rise can pose a threat to transportation, communications, energy, and other infrastructure; industries in coastal areas; and populations in coastal urban areas, including a number of Asian mega-cities. Climate change can add stress to infrastructure and systems that are already impacted by large populations, rural-urban migration, and economic development. In the area of health, climate change impacts may be direct (e.g. increased incidence of heat stroke, lowered air quality due to a higher number of smog events, morbidity or mortality because of extreme events) or indirect through the impacts on agriculture, water, and infrastructure, with poor people, elderly individuals, women, and children at greatest risk.

While most of the countries in the Asia-Pacific region will be affected by several climate change impacts, a few are identified as "hotspots" because they face multiple and imminent hazards, with large populations and important natural and economic assets at high risk. These include the Pacific Island countries, Asian coastal cities, the Mekong River Basin, the Coral Triangle, and the Greater Himalayan region and Tibetan Plateau.

Adaptation Challenges

While some countries have made strides in assessing climate vulnerabilities and developing adaptation strategies, overall progress throughout the region has been limited, particularly at the stage of implementation of adaptation options and strategies. USAID and its regional partners face a number of challenges in developing and implementing adaptation strategies. These include weaknesses in overall governance within countries as well as weaknesses related to the process for addressing adaptation within countries and among partners providing assistance.

Weak governance issues include poor structuring, coordination, and financing of sub-national governments, inadequate provisions for civil society engagement, and laws, policies, and regulations that are ineffective in addressing non-climate stressors and concerns. Capacity to cooperate and coordinate the development of transboundary management plans and adaptation strategies is also weak in the region.

Barriers related to the adaptation process include: poor understanding of adaptation concepts; low capacity to translate and apply climate information; limited knowledge of adaptation options and how to assess them; difficulty understanding and navigating donor project cycles; lack of capacities to apply for

donor funding, and to design, implement, and monitor adaptation projects; and lack of sector and stakeholder cooperation in adaptation planning.

Question #2 *With respect to future RDMA programming, what interventions, tools, and program activities are most needed and appropriate at the regional level, and how can regional activities best complement potential national-level adaptation activities to be implemented by USAID bilateral missions?*

Gaps in Regional V&A Capacity

A gap analysis of existing guidance, tools, data and knowledge platforms, interventions, and program activities reveals that a number of key needs remain largely unmet. The overarching and highest priority for regional programming is to ensure that governments, communities, practitioners, the private sector, and civil society have access to appropriate information, tools, and methods needed to carry out assessments and make informed decisions on how to address current and future climate variability and change.

Integrating Strategies to Address Climate and Non-Climate Stressors

A common theme in all V&A guidance is the importance of integrating or mainstreaming climate concerns into development and management plans and strategies. Progress in mainstreaming climate into plans and strategies in the region is limited, although efforts to mainstream have been accelerating rapidly over the last year. Just as development plans should mainstream climate concerns (climate smart development), adaptation strategies need to account for non-climate stressors. As participants in consultations and reviewers have noted, unless non-climate stressors are addressed in the near term, the challenges of adaptation will be made much more difficult.

Geographic versus Sectoral Adaptation

The vast majority of adaptation has been "stovepiped" at the sector level. V&A measures on the scale of ecosystems, river basins, or urban areas can facilitate better understanding of spatial interdependencies, potential for achieving joint benefits, and how best to manage transboundary conflicts. Healthy ecosystems are a key element in any adaptation strategy and their role in adaptation is more transparent if V&A is approached from a geographically-focused transboundary or regional perspective.

Recommendations for Regional Adaptation Initiatives

To address V&A challenges in the region and the three themes discussed above, six illustrative initiatives are recommended. The first of these, and the broadest in scope, would support a range of activities designed to build regional capacity to assess climate impacts and vulnerability, identify and assess adaptation options, and design and implement adaptation strategies (including adaptations mainstreamed into geographically-focused and sector-focused strategies and plans). The other initiatives would promote effective development of priority geographically- and sector-focused adaptation strategies. The six illustrative initiatives include:

1. ***Regional Adaptation Capacity Building and Governance Initiative*** would provide cross-cutting capacity building and governance support for adaptation planning and implementation in the region. Activities would focus on adaptation financing, guidance and tools, climate data and information, strengthening of governance, and training, education, and awareness.

2. ***Mekong Climate Initiative*** would include a Mekong region-wide vulnerability and adaptation assessment combined with dialogue, cooperation, and engagement to build support for a regional adaptation strategy, pilot adaptation projects, and capacity building and awareness.

3. ***Asian Mega-Cities Adaptation Initiative*** would provide an opportunity for large urban areas to mainstream climate into city planning, integrate disaster risk management with adaptation planning, and focus attention on the nexus of mitigation and adaptation in the energy sector.

4. ***Coastal Communities and Ecosystems Adaptation Initiative*** would adapt V&A capacity building to coastal communities and ecosystems, launch a regional climate change science network focused on coastal and marine issues, and support livelihoods for coastal communities.

5. ***Agriculture and Food Security Adaptation Initiative*** would focus on management of agriculture and food security systems to adapt to climate changes and disasters affecting production and distribution of food, as well as support for data sharing, climate and weather monitoring, and early warning systems.

6. ***Forest Ecosystems Adaptation Initiative*** would promote sustainable landscapes through greater consideration of both climate and non-climate stressors of forested ecosystems. Activities would include research on climate impacts on forested ecosystems and integration of climate vulnerability and adaptation assessments into forest ecosystem planning.

Synergies between USAID Regional and Bilateral Adaptation Programs

The illustrative regional activities proposed above are designed to address transboundary and regional adaptation issues and needs that are common across the Asia-Pacific region or are at least common to countries facing similar climate threats (e.g., low-lying islands and countries with extensive exposed coastal areas).

All of the activities under the regional capacity building and governance initiative provide a foundation that national level programs can build on or leverage. There is potential for synergy between regional and bilateral programs—the regional program can benefit from lessons learned and experiences of bilateral programs, and USAID bilateral missions can tap into the regional initiative's development of tools, guidance, training manuals and curriculums, and education and awareness materials. The regional capacity building and governance initiative will also establish partnerships with regional organizations, networks, and platforms and supply a pool of regional practitioners and trainers to support bilateral adaptation through peer-to-peer cooperation, training-of-trainers, and sharing of lessons learned. Bilateral programs could also cooperate and coordinate with the regional project preparation and public-private partnership facilities to support or facilitate access to financing for community and private sector adaptation projects.

For the proposed regional adaptation initiatives, there is the potential for close cooperation and collaboration with national-level adaptation projects on basic climate science, analyses of climate impacts and vulnerabilities, methods for developing ecosystem-based adaptation strategies, and the identification, assessment, implementation and evaluation of adaptations.

Question #3 *How can RDMA best coordinate with and leverage the efforts of regional platforms (such as ASEAN and APEC), bilateral donors, multilateral development banks, national governments, international non-governmental organizations (NGOs), universities, the private sector, and others to address priority adaptation challenges?*

This report includes a stocktaking of the large number of international donors, NGOs, and regional organizations engaged in adaptation activities and their programs, projects, networks and platforms. The report identifies strategic opportunities and potential partnerships with USAID/RDMA and specific

partners for the six regional adaptation initiatives. In assessing potential partners and forming partnerships, it is recommended that USAID/RDMA consider the following guiding principles:

- build on the Assessment Report's stocktaking of organizations and activities by continuing to monitor progress of ongoing activities and the initiation of new adaptation programs and projects by other organizations, both to avoid duplication and to identify the best and most current opportunities for cooperation and collaboration;

- engage partners, including national governmental counterparts, in dialogue to anticipate changing priorities, encourage long-term strengthening of capacity, and ensure activities are implemented at the appropriate scale;

- continue to assess gaps and build on the efforts of other donors and NGOs, particularly in instances where current programs and projects are ending or phasing out; and

- identify and participate actively in the most appropriate platforms and networks for sharing tools and methods, best practices, and project results.

1. INTRODUCTION

1.1 Background

The Asia-Pacific region is one of the world's most sensitive regions to climate change because of its topography and the high concentration of populations in vulnerable coastal areas and river basins. While many of the expected impacts of greenhouse gas (GHG) emissions on climate are gradual and decades in the future, the Asia-Pacific region is already witnessing significant impacts related to higher temperatures, storm surges combined with sea level rise, changes in precipitation patterns, and increased storm intensity. Illustrative impacts have included glacial retreat and alteration of water cycles of glacier-fed river basins; damages to agriculture and water supplies due to drought, saltwater intrusion, and sea spray; and damages to communities and infrastructure from coastal inundation and erosion. In extreme situations, residents have already been relocated from low-lying islands and atolls.

Climate change is a stressor on human and natural systems and sectors and adds an additional challenge to the already difficult task of managing ecosystems and promoting sustained economic development in view of weak institutional capacity and social and economic stresses. The Obama Administration has emphasized the moral responsibility of developed economies to help the most vulnerable people adapt to the effects of climate change. More recently, the Administration has begun to develop new climate change policies and proposed increased funding for adaptation-specific activities, some of which is expected to be directed to USAID's Regional Development Mission for Asia (USAID/RDMA).

As part of its efforts to deepen engagement on climate change, in 2008 USAID/RDMA prepared a "road map" describing the general overall priorities and direction for addressing climate change in the Asia-Pacific region.[1] Building from this road map, RDMA has been increasingly active in addressing climate change through clean energy and forestry-related activities, although to date activities directly related to adaptation have only been initiated as part of USAID/RDMA's support to the Coral Triangle Initiative (CTI).

1.2 Objectives of the Report

The objective of the assessment is provide an objective, up-to-date, and comprehensive regional analysis summarized in a report which assesses the climate change adaptation needs of the Asia-Pacific region. This report will be used to inform the planning process for possible future activities funded by USAID/RDMA that address regional climate change adaptation needs and that will be shared widely with USAID bilateral missions in Asia, USAID offices in Washington, US Embassies in Asia, other US Government agencies, multilateral development banks, and other development partners.

This report presents the findings and recommendations of the Asia-Pacific Regional Climate Change Adaptation Assessment, an up-to-date and comprehensive regional analysis of vulnerability and adaptation to climate change in the Asia-Pacific region. Drawing on an extensive review of official documents and relevant literature and consultations in 10 out of 19 priority countries, the report answers the following questions:

[1] See "Global Climate Change in the Asia-Pacific Region: An Analysis and Road Map for the USAID Regional Development Mission for Asia" available on the USAID/RDMA public website, http://www.usaid.gov/rdma/.

1. What are the priority climate change vulnerabilities and adaptation challenges of developing countries in the Asia-Pacific region?

2. With respect to future RDMA programming, what interventions, tools, and program activities are most needed and appropriate at the regional level, and how can regional activities best complement potential national-level adaptation activities to be implemented by USAID bilateral missions?

3. How can RDMA best coordinate with and leverage the efforts of regional platforms (such as Association of Southeast Asian Nations – ASEAN and Asia-Pacific Economic Cooperation – APEC), bilateral donors, multilateral development banks, national governments, international non-governmental organizations (NGOs), universities, the private sector, and others to address priority adaptation challenges?

The report is expected to inform the USAID/RDMA planning process for possible future regional climate change adaptation activities. USAID hopes that the report will also be of value to other donors, multilateral banks, and other development partners in the region.

The 19 countries prioritized for assessment include the following (consultation countries are in ***bold italics***):

- Northeast Asia – ***China*** and Mongolia
- South Asia – ***Bangladesh***, ***India***, Maldives, Nepal, and Sri Lanka
- Southeast Asia – Cambodia, ***Indonesia***, Timor Leste, ***Laos***, ***Philippines***, ***Thailand***, and ***Vietnam***
- Pacific – ***Federated States of Micronesia***, Papua New Guinea, ***Republic of the Marshall Islands***, Solomon Islands, and Vanuatu

1.3 Methods

The assessment process is illustrated in Figure 1.1 As indicated in the first three boxes, consultations with key stakeholders and a desktop review of relevant literature were conducted on parallel tracks. Information from consultations and the desktop review were analyzed to conduct a gap analysis regarding adaptation initiatives, challenges, and needs, and to determine key players and important regional platforms offering potential for collaboration and/or complementarity with RDMA.

Figure 1.1 Assessment Process

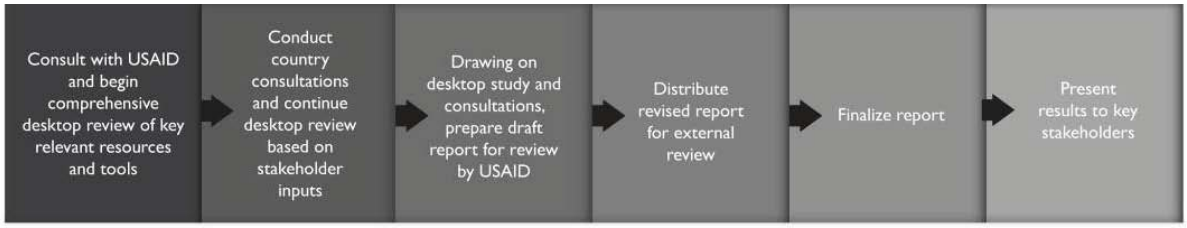


Figure 1.2 Asia-Pacific Region: Assessment Countries

Consultations

In-country consultations were conducted in 10 of the 19 priority countries by members of the Assessment team. These countries are noted above. Consultations were also conducted with USAID/RDMA, USAID bilateral missions, US Embassies and US Consulates in the region, as well as with USAID, State Department, United States Forest Service (USFS), and other organizations in Washington, DC. A list of all organizations and individuals who participated in in-country consultations is provided in Annex B. With the exception of roundtables in the Marshall Islands and Ho Chi Minh City, all consultations were conducted with individual organizations.

Desktop Review

A desktop review was conducted for all priority countries, based on a comprehensive literature review (see list of documents in Annex C) and consultation notes, where available. Information collected and assessed for the desktop review was compiled into a series of country profiles and summary tables. Official documents such as National Adaptation Programmes of Action (NAPAs) (prepared by Less Developed Countries (LDC) in the region, plus Solomon Islands and Vanuatu[2]), national development

[2] Solomon Islands and Vanuatu are not classified as Less Developed Countries because of their higher per capita income level. However, because of their high vulnerability to natural disasters and the implications for their economies, they received Global Environment Facility funding to prepare NAPAs.

and adaptation strategies, Poverty Reduction Strategy Papers, and other reports and papers provided source material for the desktop review.

1.4 Outline of the Report

The remainder of the report is organized into five chapters including conclusions and recommendations in Chapter 6 (see Figure 1.3).

Chapters 2 and 3 relate to the steps of USAID's Vulnerability and Adaptation (V&A) approach and focus on answering the assessment question pertaining to vulnerability and adaptation priorities in the Asia-Pacific region. **Chapter 2** provides an analysis of climate change impacts and describes sector and ecosystem vulnerabilities in the Asia-Pacific region. **Chapter 3** enumerates the challenges countries face in planning and implementing adaptations and adaptation strategies and describes the range of adaptations that have been identified, advanced in strategies, and, in some cases, implemented. **Chapter 4** identifies donors, multilateral development banks, NGOs and other organizations participating in networks and knowledge-sharing platforms, and providing technical and financial assistance for vulnerability and adaptation activities in the region. It is important to acknowledge and learn from these activities, avoid duplicating their efforts, and identify opportunities for joint activities.

Chapter 5 discusses key considerations for regional adaptation programming, including descriptions of vulnerability and adaptation technical assistance and capacity building activities, and potential to cooperate with and leverage the experience, expertise, and resources of regional organizations. The conclusion to the report in **Chapter 6** is structured to answer the three questions posed by USAID.

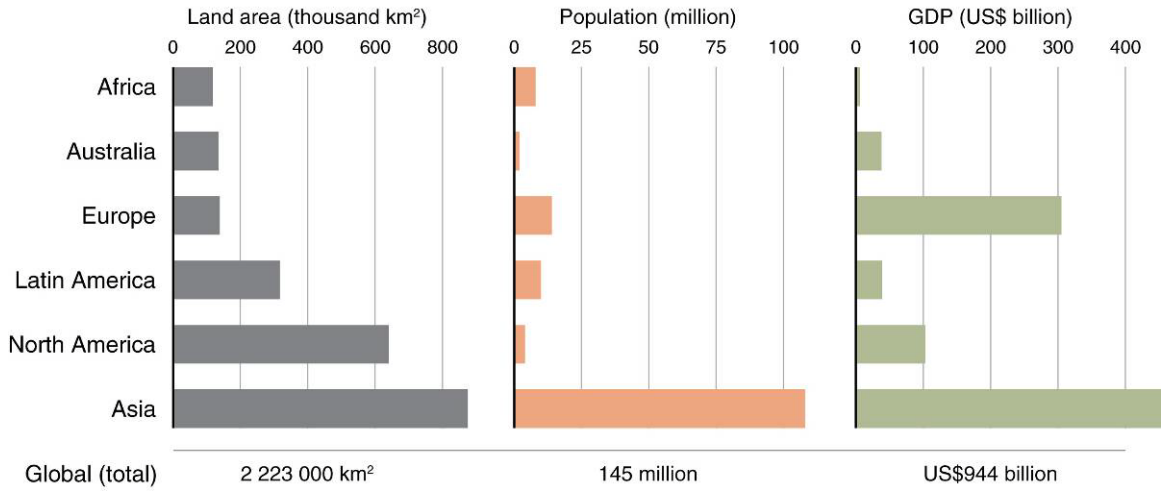
A series of **annexes** at the end of the report provide a more detailed description of information related to the execution of the assessment and trends and analyses of vulnerability and adaptation. In addition to the annexes described above (Annex B – List of Consultations and Annex C – List of Documentation), three additional annexes are included with the report: Annex A – Illustrative Regional Adaptation Initiatives; Annex D – Vulnerability to Climate Change in the Asia-Pacific Region; and Annex E – Adaptation Projects and Funds.

2. REGIONAL SYNTHESIS: CLIMATE CHANGE RISKS

Overview

Countries of the Asia-Pacific region are believed to be among the most vulnerable in the world, although the exact magnitude and timing of climate change impacts remains uncertain, and regional and seasonal variations will exist. The region's high level of vulnerability is influenced by factors of exposure and sensitivity, such as high concentrations of populations in low-lying, coastal areas, economic dependence on natural resources, and the extreme climate sensitivity of key crops such as rice and taro, as well as limited capacity to respond to and be prepared for climate change impacts such as disasters. As indicated in Figure 2.1, Asia is the most vulnerable region in the world in terms of land mass, populations and GDP to one meter of sea level rise.

Figure 2.1 Population, area, and economy directly affected by a one meter rise in sea level (estimates based on today's situation)



Cartographer/designer Hugo Ahlenius, UNEP/GRID-Arendal. Sources Anthoff, D., Nicholls, R.J., Tol, R.S.J. and Vafeidis, A.T. (2006). Global and regional exposure to large rises in sea-level: a sensitivity analysis. Working Paper 96. Tyndall Centre for Climate Change Research, Norwich

The 19 countries in the Asia-Pacific region covered in this report vary widely economically, politically, socially, and culturally, as indicated in Figure 2.2. However, many face similar sustainable development challenges related to poverty alleviation, equitable distribution and access to resources, economic growth and urbanization, effective governance at the national and sub-national levels, and environmental degradation. The climate change impacts described below are expected to exacerbate these issues, and place additional stress on these already vulnerable countries.

Figure 2.2 Selected Development Indicators

Country	Population (millions, 2007)	HDI (value, 2007)	GDP per capita (PPP US$, 2007)	Percentage of population living below national poverty line (2000-2006)	Income distribution inequity (Gini coefficient, 2009)
Bangladesh	157.8	0.543	1,241	40%	31.0
Cambodia	14.3	0.593	1,802	35%	40.7
China	1,329.1	0.772	5,383	--[3]	41.5
India	1,164.7	0.612	2,753	28.6%	36.8
Indonesia	224.7	0.734	3,712	16.7%	39.4
Laos	6.1	0.619	2,165	33%	32.6
Maldives	0.3	0.771	5,196	NA	NA
Marshall Islands	0.1	NA	NA	NA	NA
Micronesia	0.1	NA	2,802	NA	NA
Mongolia	2.6	0.727	3,236	36.1%	33.0
Papua New Guinea	6.4	0.541	2,084	37.5%	50.9
Philippines	88.7	0.751	3,406	25.1%	44.0
Solomon Islands	0.5	0.610	1,725	NA	NA
Sri Lanka	19.9	0.759	4,243	22.7%	41.1
Thailand	67.0	0.783	8,135	13.6%	42.5
Timor Leste	1.1	0.489	717	NA	39.5
Vanuatu	0.2	0.693	3,666	NA	NA
Vietnam	86.1	0.725	2,600	28.9%	37.8

Sources: UN 2009 World Population Prospects: The 2008 Revision; UNDP Human Development Report 2009, World Bank World Development Indicators, World Resources Institute Climate Analysis Indicators Tool. HDI = human development index; GDP = gross domestic product; NA = information not available

Climate Change Risk Terms and Concepts

Climate change risks are a function of climate change and weather hazards, exposure and vulnerability to them, and adaptive capacity of society and the economy.

Risks = f (hazards, exposure, vulnerability, adaptive capacity)

While ***hazards*** refer to climate change and weather impacts of concern, their nature, and severity, ***exposure*** refers to whether and to what extent the hazards have an impact on communities, ecosystems, and other assets. Measures of exposure can include number of people or categories of assets in hazard zones. ***Vulnerability*** indicates whether and to what degree the characteristics of a community or asset make it susceptible to the harmful effects of climate change hazards. ***Adaptive***

[3] Although China's poverty rate is estimated at 2.85% in the UN 2009 World Population Prospects, there has been criticism of official figures in the past for being too low. In 2006, the Chinese newspaper China Daily asserted that the Chinese poverty line did not ensure an average standard of living. More recently, a 2008 study by the World Bank estimated the consumption poverty rate at approximately 15%, and the income poverty rate at about 10%, with an increase of 130 million and 65 million people in poverty respectively (Chen and Ravallion 2008).

capacity is the ability of communities and ecosystems to anticipate and/or respond to climatic changes in order to reduce vulnerability by planting drought- and flood-resistant varieties of rice. (Adaptation options are discussed in further detail in Chapter 3.) Elements of adaptive capacity include more general considerations that are important for development such as human development, poverty levels, and social capital and networks, as well as climate-specific issues such as the existence and effectiveness of early warning systems for disasters and extreme events (e.g., floods, droughts, disease outbreaks, and crop/forest pests and diseases).

Adaptive capacity can reduce the potential impact of climate change hazards in two ways, either by improving communities' and ecosystems' preparedness and ability to respond to climate change independent of exposure to climate change risks, or by reducing exposure. While improving technical capacity is an example of the former, implementing and enforcing zoning rules that restrict development in flood- and disaster-prone areas illustrates the latter.

2.1 Climate Change and Variability: Impacts of Concern

Greenhouse Gas Emissions, Climate Change, and Ocean Acidification

Much of recent climate change is anthropogenic, caused by increased concentrations of greenhouse gases in the earth's atmosphere due to human activities. These higher concentrations of GHGs lead to higher temperatures via the greenhouse effect. Higher concentrations of carbon dioxide (CO_2) in the atmosphere also lead to increased uptake of CO_2 by the oceans. These primary impacts result in the following secondary impacts:

- Increased air temperature leads to

  a) increased sea temperatures;
  b) accelerated glacial melting, and changes in snow pack, melt dates, and phase shifts;
  c) changes in precipitation parameters (annual rainfall, rain intensity, seasonal distribution);
  d) changes in extreme events; and
  e) thermal expansion of sea water and hence sea level rise.

- Increased sea temperatures and accelerated glacial melting of the Arctic and Greenland lead to sea level rise.

- Increased ocean CO_2 leads to ocean acidification, or lowering of pH levels.

- Sea level rise and storm surges, combined with high tides, leads to salinity on land and saltwater intrusion.

There is evidence that many of these impacts have already begun to occur in the Asia-Pacific region, and that climate change will exacerbate them, although the nature and severity of the impacts (Section 2.1) as well as the implications for key sectors (Sections 2.2 and 2.3) vary depending on the location.

Overview of Impacts

Air Temperatures

Despite regional and seasonal variations, overall temperature trends in the Asia-Pacific region, including minimum and maximum temperatures, have been increasing, and are projected to go up further in all

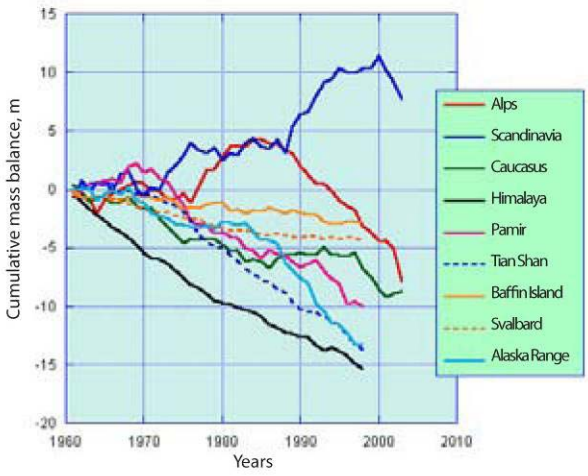
four subregions. Higher average annual mean surface temperatures have been seen in North Asia. In Mongolia they have gone up by approximately 1.8°C over the past 60 years.[4] This has had a noticeable impact on the length of cold and warm seasons over the past 40 years,[5] as well as on permafrost temperatures.[6]

In South Asia, air temperatures in Sri Lanka and India have risen by 0.3°C and 0.48°C respectively over the last 100 years, and Bangladesh and India are projected to experience a rise in temperature of between 2.5-4.9°C by the end of the 21st Century.[7] Average temperature in Southeast Asia has increased 0.1-0.3°C per decade over the last 50 years, and is projected to go up by approximately 2°C to 4°C by the end of the century under the B1 and A1FI[8] scenarios respectively, particularly in Indonesia, Thailand and Vietnam.[9] The Pacific Island countries are also situated in a zone where temperature has already increased and is projected to continue increasing, as in the Marshall Islands, where temperatures are expected to rise by approximately 2°C to 3°C.

Higher temperatures can have an impact on growing seasons and evapotranspiration rates throughout the region, which in turn can affect water resources and agricultural productivity, although higher CO_2 rates may mitigate some of the impact by skewing evapotranspiration rates. Warming can also affect natural ecosystems, causing shifts in the thermal gradients of continental and fresh water ecosystems as well as in flora and fauna structures in certain regions. Habitat degradation as a result of change in weather patterns will lead to loss of biodiversity including the extinction of several species.

Figure 2.3 Rapid retreat of greater Himalayan glaciers in comparison to the global average

Source: Dyurgerov and Meier 2005



Glacial Retreat[10]

There is some indication that glacial retreat, changes in seasonal snowpack, melt dates, and phase shifts from snow to rain may already have begun to occur in the Greater Himalayan region as a result of anthropogenic climate change and other factors such as the depositing of black soot on Tibetan glaciers.[11] Since the late 1950s, a number of the Himalayan glaciers have been diminishing in mass balance,[12] while over the past three decades they appear to have been receding at a rate higher than that seen in other parts of

[4] Cruz, et al., 2007.
[5] Batima 2006; IGES 2008.
[6] Batima 2006.
[7] ISET 2009.
[8] B1 and A1FI are emissions scenarios developed by the IPCC. Under the fossil fuel-intensive A1FI scenario, a world of high economic growth and a population that peaks mid-century and declines thereafter is envisioned. The B1 describes a world in which economic structures are rapidly moving toward a service and information economy, clean and resource-efficient technologies are introduced, and the population is projected to be the same as in the A1 family of scenarios.
[9] Cruz, et al., 2007; ADB *The Economics of Climate Change in Southeast Asia: A Regional Review* 2009.
[10] Although the IPCC has been criticized recently for overstating the issue of glacial retreat in its Fourth Assessment Report, evidence suggests that it is still an impact of concern in the Asian Himalayas. (Byers 2009).
[11] Climate change may not be the sole cause of glacial melt. According to Xu, et al., (2009), black soot aerosols deposited on Tibetan glaciers have played a significant role in observed glacial retreat, the implication being that a reduction in both greenhouse gases and black soot emissions may be required to slow further melting of the glaciers.
[12] Byers Climatology presentation 2009.

the world[13] (see Figure 2.3). The latter is due to surface temperatures rising at a slightly more rapid rate than the global average.[14]The 2007 China National Report on Climate Change estimates that the glacial area of the Tibetan Plateau has shrunk by approximately 4.5% over the past 20 years, and by 7% over the last 40 years.[15] Higher temperatures may also be contributing to a greater proportion of precipitation coming as rainfall, rather than snowfall, which in turn can cause snowmelt to occur sooner and the winter to shorten.[16] Climate change related melting of glaciers and snow can have a destabilizing effect on surrounding slopes and may contribute to an increased incidence of glacial lake outburst floods (GLOFs)[17] in areas such as the eastern and central Himalayas, mudflows, and avalanches, with harmful consequences for mountain ecosystems, human lives and settlements, and infrastructure such as bridges and footpaths.

Shifts in glacial melting patterns and in the seasonality and extent of snowpack can have major, negative implications for water supply. Climate change related melting of glaciers and snow is likely to lead to greater annual variation of river flows, with more floods in the near term as rivers receive increasing runoff from melting glaciers, and droughts in the long-term as glaciers shrink and runoff decreases. As the mountain ranges in the Greater Himalayan region are an important source for southern and eastern Asia's largest rivers, these changes will affect the supply and quality of water available for human consumption, agriculture, industry, and energy in both upland and lowland countries.

Precipitation Patterns

The impact of climate change on precipitation patterns will vary throughout the Asia-Pacific region, and there is lack of agreement regarding the nature, seasonality, and magnitude of the shifts. Historically, precipitation trends in Asia and the Pacific have been highly variable, with significant regional and seasonal differences. In North Asia, annual precipitation in China has been declining since 1965, with stronger summer monsoons during globally warmer years, and drier monsoons during globally cooler years.[18] Rainfall patterns have been more seasonally variable in Mongolia, with autumn and winter precipitation increasing by 4 to 9% over the past 60 years, and spring and summer precipitation decreasing by 7.5 to 10%.[19] South Asia has also seen greater variability in precipitation patterns over the past few decades. Extreme rains during the summer monsoon in India have increased in the northwest in recent decades, while the number of rainy days along the east coast has gone down.[20] Sri Lanka has experienced increasing rainfall during February, and decreasing during June.[21] Southeast Asian precipitation trends exhibited an overall decreasing trend between 1961 and 1998, and the number of rainy days declined, with some regional and seasonal variability.[22] While rainfall in southern Indonesia has gone down in recent decades, it has gone up in northern areas. In the Pacific, precipitation patterns have been less distinct.[23]

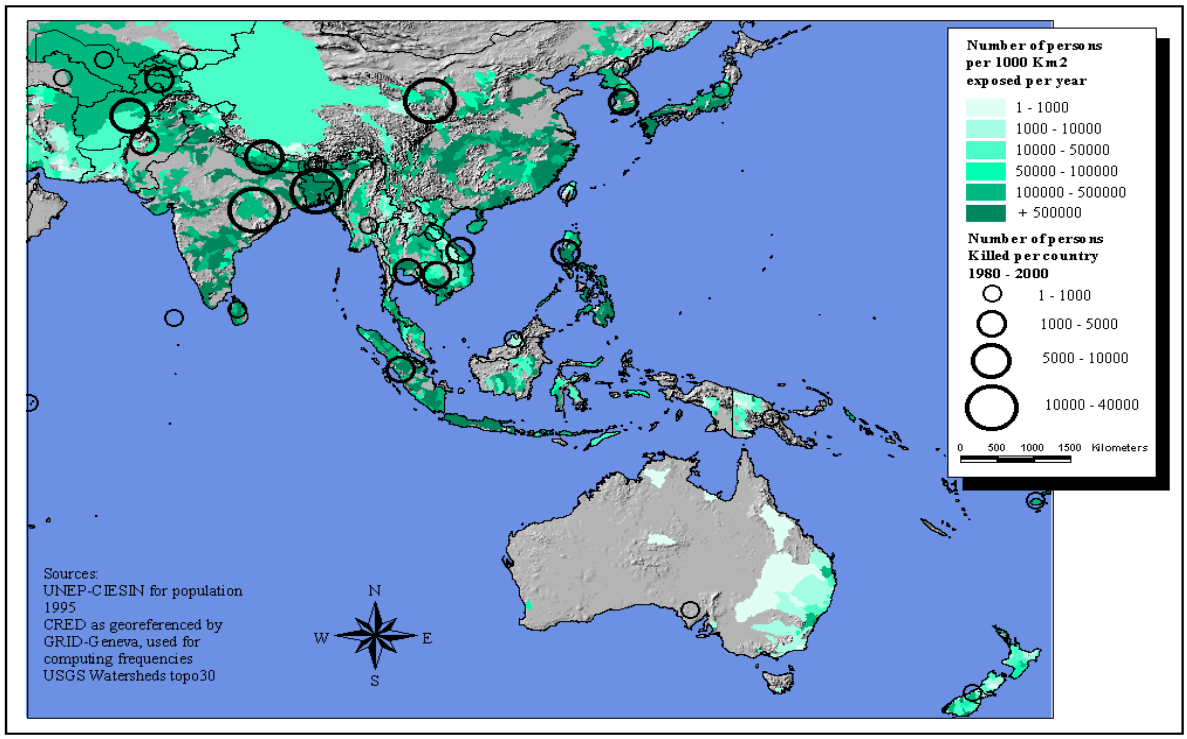
Extreme Events

Greater frequency and intensity of climatic extremes due to climate change pose a real short- and long-term risk to all sectors, communities, and subregions in Asia and the Pacific. South Asia is projected to experience more severe heat extremes, and to be at higher risk from tropical storms in coastal areas

[13] Dyurgerov and Meier 2005.
[14] Cruz, et al., 2007.
[15] Eriksson, et al., 2009.
[16] Eriksson, et al., 2009.
[17] Eriksson, et al., 2009.
[18] Alam, et al., 2007.
[19] Alam, et al., 2007; Cruz, et al., 2007; Batima 2006.
[20] Cruz, et al., 2007.
[21] Cruz, et al., 2007.
[22] Cruz, et al., 2007.
[23] Cruz, et al., 2007.

due to a potential increase in their frequency and intensity, associated precipitation and storm surges, and sea level rise. In Southeast Asia, while current models do not project a rise in storm frequency,[24] their intensity is predicted to increase.[25] Even minor storms may cause greater damage to coastal infrastructure as sea levels rise, particularly in light of the growing vulnerability of coastal areas such as Krabi, Thailand due to tourism development, urbanization and investments in small-scale aquaculture.[26] Similar to Southeast Asia, the greater intensity of tropical cyclones or typhoons is also expected in the Pacific.[27] Climate change may also exacerbate droughts associated with El Niño events, of which there has already been increased incidence in Indonesia, Laos, Philippines, Vietnam,[28] the Solomon Islands, and the Marshall Islands. Moreover, the low-lying coastal areas throughout the region are highly vulnerable to flood disasters. For example, in Southeast Asia, with a sea level rise of 40 cm, the annual number of people affected by flooding in Southeast Asia, from Thailand to Viet Nam and in Indonesia and the Philippines, would go up by approximately 16 million.[29] (See Figure 2.4.)

Figure 2.4 Density of persons exposed to and killed by floods in Asia and the Pacific, 1980-2000



Cartography and analysis UNEP/DEWA/GRID-Geneva, November 2001

Sea Level Rise

The Asia-Pacific region is highly vulnerable to sea level rise, with large populations, vital infrastructure, and key agricultural areas at risk. Sea-level rise of one meter would displace approximately 24 million people in Bangladesh, India, Indonesia, Cambodia, Vietnam, and the Philippines. Areas at extreme risk of population displacement by 2050 due to sea level rise, based on numbers potentially displaced, are the Ganges/Brahmaputra and Mekong River Deltas. Those at high risk are the Godavari and Chiangjiang

[24] Cruz, et al., 2007.
[25] Christensen, et al., 2007.
[26] WWF Assessing Implications of Climate Change at Provincial Level – Krabi, Thailand.
[27] Christensen, et al. 2007.
[28] Alam, et al., 2007; ISET SE Asia 2008.
[29] Cruz, et al. 2007.

deltas, and those at medium risk are the Indus, Krishna, Red, Chao Phraya, and Mehakam Deltas. The number of people affected by flooding annually in Asia is projected to rise from 13 to 94 million by 2100, with sea level rise of 40 cm. Sixty percent of this increase is projected to occur in coastal areas of South Asia, including in India, Sri Lanka, and Bangladesh.[30]

Due to the low-lying nature of their atoll islands, a number of small island nations are at particularly high risk from sea level rise and storm surge, as in the Federated States of Micronesia (FSM) and the Maldives, where some of the low-lying atoll islands rise no more than two to three meters above sea level. A rise in sea levels could inundate significant portions of these islands, with potential impacts on and for Exclusive Economic Zones (EEZs), border disputes between neighboring countries, and evacuation of populations to other, more heavily populated islands, or to other countries. The latter will have social and cultural impacts of unknown magnitude, and is a scenario that a number of small island nations may face. Sea level rise can also exacerbate inundation and coastal erosion, threatening vital infrastructure and settlements as well as protective coastal ecosystems such as mangroves and corals. The extent of loss will vary depending on the combination of climate and anthropogenic stressors.[31]

Sea Temperatures

The warmer sea temperatures associated with a rise in air temperatures, coupled with El Niño events, have contributed to coral bleaching events in the Coral Triangle, other South and Southeast Asian countries such as the Maldives, Sri Lanka, and Thailand,[32] and the Pacific, with corals in warmer tropical waters near the equator (e.g., RMI and FSM) more vulnerable than those in cooler waters near the limits of the tropics (e.g., southern French Polynesia). Due to the sensitivity of coral to temperature increases (a rise of greater than 1°C can lead to extensive coral bleaching), some models predict that widespread damage and biodiversity loss of coral reefs is likely.[33] Sea level rise, changes in wave climate, ocean acidification, and anthropogenic impacts can also play a role in the destruction of corals, while El Niño events, on top of changes in sea-surface temperatures from climate change, can increase the incidence and severity of bleaching. A recent risk analysis indicates that 24% and 30% of reefs in Asia could be lost over the next 10 and 30 years respectively[34], which in turn may have repercussions for marine biodiversity, aquatic resources, aquaculture, tourism, and the people who depend on them for their livelihoods.[35] Evidence of this has been seen in the Coral Triangle and elsewhere, where a decline in coral reef fish diversity has been observed after bleaching events.[36]

Ocean Acidification

The pH of the world's oceans has already been declining, due to their absorption of carbon dioxide, and has resulted in ocean acidification, with repercussions such as impeded reef accretion. Although it is difficult to separate the effects of ocean acidification from other factors, it has been observed in Thailand that coral reefs are calcifying at slower rates, similar to the 14% decrease seen in the Great Barrier Reef. Coral reefs whose growth has been compromised by warmer sea temperatures and ocean acidification will likely be more susceptible to damage should sea levels continue to rise at an accelerated rate, and to future bleaching due to a lowered bleaching threshold. Ocean acidification also affects the growth of the shells of marine organisms other than coral, which in turn can have significant ramifications for aquaculture and fishing industries. Mangrove and seagrass ecosystems may also be threatened by ocean acidification, which in turn can have an impact on the natural resources they provide and promote,

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[30] Cruz, et al., 2007.
[31] Christensen, et al., 2007; Cruz, et al., 2007.
[32] Boonprakrob 2006 *Climate Change and Thailand;* ADB 2009 *The Economics of Climate Change in Southeast Asia: A Regional Review.*
[33] WWF 2009 *The Coral Triangle and Climate Change: Ecosystems, People and Societies at Risk.*
[34] Cruz, et al., 2007.
[35] ISET 2009 *Climate Adaptation in Asia : Knowledge Gaps and Research Issues in South East Asia.*
[36] WWF 2009 *The Coral Triangle and Climate Change: Ecosystems, People and Societies at Risk.*

including wood, fish and shellfish, and honey, as well as the livelihoods dependent on them.[37] In addition, the loss of mangroves forests, which contain the second highest stores of organic carbon after peatlands, threatens to cause significant carbon dioxide emissions in the region.

2.2 Human, Economic, and Environmental Vulnerability

Climate change will aggravate existing challenges related to population growth, poverty, urban migration, and degradation of the environment and natural resources. Moreover, although the nature and severity of the consequences will differ depending on the sector, the area, and the level of adaptive capacity, the impacts of climate change will be far-reaching, and have important consequences for many communities, key economic sectors, and ecosystems in the countries of the Asia-Pacific region in the near- and long-term, particularly as impacts interact with and exacerbate each other. A useful taxonomy divides assets into people and livelihoods, natural resources and ecosystems (and their services), and material assets (infrastructure, dwellings, historical and cultural monuments and villages, and archeological sites).

People and Livelihoods

Gender

Climate change impacts will result in differential vulnerabilities for women, men, girls, and boys, due to the gender-specific nature of their economic, political, and social roles. In the case of disasters it has been estimated that they are 14 times more likely to result in death for women than for men. [38] Factors that contribute to women's greater vulnerability to climate change related disasters and extreme events such as cyclones and floods include their greater exposure and sensitivity due to reduced mobility, which is intricately related to women's role as caretakers for the most vulnerable such as children and the elderly and for material assets, and cultural dress that restricts movement. Their adaptive capacity can also be limited due to social customs discouraging women from activities outside the home such as learning how to swim.[39] Moreover, as gender issues tend to intersect with poverty, and women often comprise a larger percentage of poor people than their male counterparts, their limited access to resources such as income and land can increase their exposure as well as decrease their adaptive capacity both during and following disasters. [40] In contrast, social perceptions of men as heroes may encourage them to take more risks during a disaster, while the loss of livelihoods and the inability to provide for their families may result in additional pressure and stress.

Non-disaster related climate change impacts will have gender-specific implications as well. Both floods and droughts may disturb land-based productive systems, which may have an impact on the nutrition of women and their families, and their ability to earn.[41] Increased salinity due to climate change can reduce the quality and quantity of available water. In Bangladesh, as the responsibility for fetching water usually falls on women and girls, changes in the quality and supply of water may increase the distances they must go and the time they must invest to secure clean water in both rural and urban contexts, with repercussions for health due to the heavy burdens they must carry and potential time to be spent on education.[42] In addition, as primary caregivers, women are apt to bear the brunt of dealing with greater incidence of diseases and other health threats caused by changes in temperature and in extremes such

[37] WWF 2009 *The Coral Triangle and Climate Change: Ecosystems, People and Societies at Risk.*
[38] UNDP and AusAID 2009.
[39] UNDP and AusAID 2009; UN International Strategy for Disaster Reduction 2008.
[40] UNDP and AusAID 2009.
[41] ActionAid 2007.
[42] Ahmed, Neelormi, and Adri 2007.

as floods and droughts. Climate change related migration may also increase women's overall burden, as men migrate to other areas, particularly to urban centers, in search of livelihoods and income to maintain their families, leaving women to take on even more of the day-to-day responsibilities of caring for their homes and families.

Human Safety and Security

The developing countries of the Asia-Pacific region are among the most vulnerable in the world to natural disasters, which can result in extremely high damages to and costs of human lives, agriculture and food security, and infrastructure. The 2007 Bangladeshi flood caused 3,363 deaths, affected 10 million people, and reduced crop yields by 13%.[43] In the Pacific Island country of Vanuatu, Cyclone Ivy affected 50,000 people, and damaged 90% of water resources, 70% of roads, 60% of health infrastructure, over 80% of food crops, and 112 schools. Such extreme events can set the economy back by approximately 5 years, as much of the country's funding and assistance are diverted towards national recovery from damages. In the Philippines, which is affected by an average of 21 typhoons per year, between 1981 and 2006, 55% of crop insurance payments were made in response to typhoons and floods.

The frequency with which these countries are hit by natural disasters, both climate change and non-climate change related; their increasing intensity; as well as their limited ability to anticipate, respond to, and recover from disasters, notwithstanding some differences between countries, contributes to the high vulnerability of the countries in the region. Their limited adaptive capacity stems largely from challenges associated with high population densities in vulnerable areas, significant levels of poverty, vulnerable ecosystems, weak economies and governance structures, and inadequate social networks. Regarding gender, as indicated in the previous section, women and children tend to be significantly more vulnerable to disasters than men.[44] Due to the projected increases in the prevalence and intensity of natural disasters in the Asia-Pacific region, disaster risk reduction and management (DRR/M) will take on greater importance.

Although experience in adaptation to climate change is limited and mostly at the local level, many of the countries have disaster risk reduction and management activities, such as warning systems in Bangladesh, Cambodia, Laos, Thailand, and Vietnam. Initiatives often take place at the community level in countries such as Bangladesh, partly because of the funding available from the international community. Furthermore, there has been a reliance on donors for post-disaster recovery efforts and financing of infrastructure rehabilitation.

Agriculture and Food Security

As agriculture is a highly climate sensitive sector, the climate change impacts overviewed in section 2.1 are likely to affect the growth and productivity of plants and livestock, cropping and grazing seasons, and the spread of pests and diseases in the Asia-Pacific region. Projected warming is expected to result in the northward movement of agricultural zones in Mongolia and China, such as northern China's tri-planting and double-planting zones; this is also projected to result in the reduction of single-planting regions

Photographer: Glen Anderson, IRG

[43] WB 2009.
[44] UNDP and AusAID 2009.

by 23%.[45] A similar movement of tropical plants, and a consequent shrinking of sub-tropical plant zones, may be seen in Southeast Asian countries such as Vietnam. Higher temperatures are also likely to reduce the amount of land appropriate for grazing in North Asia,[46] with implications for livestock productivity. In addition, warming may lead to greater irrigation requirements. For a rise in temperature of 1°C, irrigation demands are projected to increase by at least 10% in arid and semi-arid regions of Asia.[47]

These factors may contribute to lower agricultural yields, which may increase dependence on global grain markets and threaten food security and child nutrition, particularly of the urban poor, who are already heavily influenced by prices in global markets. In India, a change in temperature of between 0.5-1.5°C is projected to reduce wheat and maize yields by between 2-5%, and a rise of 2°C to decrease wheat and rice by 10%. Similarly, in China, warming of 2°C is projected to lower rain-fed rice yields by 5-12%,[48] although in parts of the country higher temperatures may benefit crops located where temperatures are at the low end of the crop optimum.[49]

In addition to shifts in temperature, there may be increasing variability in precipitation patterns, and changes in the timing, frequency, intensity, and spatial coverage of rainfall. The manifestations of greater variability are likely to vary regionally, with differential impacts on agriculture. In the Mekong River Basin, according to a recent study by the Australian Commonwealth Scientific and Industrial Research Organization (CSIRO), climate change would probably increase growing season rainfall for key crops such as rain fed rice, upland rice, sugarcane, and maize in nearly all sub-basins, even in the dry season. In contrast, due to higher evaporation rates and lower growing season rainfall across most of the Mekong region, the irrigation requirements for irrigated rice, which is grown during the dry season, may increase, with implications for its productivity. [50] Under these conditions, yields of rain fed rice are projected to decrease 1.5-3.3%, upland/flood-prone rice by approximately 1.5%, and irrigated rice by as much as 6%.[51]

Intense and prolonged rainfall during planting seasons can damage seedlings, reduce growth, and provide conditions that promote plant pests and diseases. Moreover, the resultant rise in the frequency and intensity of floods may contribute to soil erosion and flooding of agricultural land. This may lead to greater crop losses in low-lying countries such as Bangladesh, where annual agricultural production, particularly of the rice crop, fell short by 24% of the expected total pursuant to extensive flooding in 1998. On the other hand, drought combined with higher temperatures may lead to greater evaporation, reduced availability of water for agriculture, and added thermal stress on plants. These characteristics, often associated with El Niño, were seen periodically during the late 1990's. Moreover, decreases in water from snow- and glacial-melt could, over time, impact smallholder irrigation systems and hence food production, particularly in the Indo-Gangetic plain. However, shifts in the amount and timing of precipitation (e.g., snow falling later, melting earlier) will likely have greater impacts, at least in the near term.

Agriculture accounts for:

- 20% of GDP in Bangladesh, and 60% of people's livelihoods
- 1/3 of GDP in Philippines. In the Philippines the only year in recent history during which GDP growth was negative was 1998 when the last ENSO event and the associated drought occurred.
- 55% of Laos' economy
- approximately 30% of GDP in Timor Leste, and about 80% of the employment of the working population in production for consumption and trade

[45] Batima 2006; Cruz, et al. 2007.
[46] Batima 2006.
[47] Cruz, et al., 2007.
[48] Cruz, et al., 2007.
[49] IFPRI 2009.
[50] Eastham, et al. 2008.
[51] Eastham, et al. 2008.

Projected increases in the frequency and intensity of extreme events are likely to affect agriculture and aquaculture adversely and to threaten food security throughout the region. Impacts can include damage to crops and infrastructure, delayed effects due to pests and diseases, as well as waiting periods of several years for uprooted trees and plants to be replaced and productive. In turn, these can result in loss of crop and fishery productivity, food shortages, and elevated food prices in the absence of adaptation. The costs can be very high: in the Philippines from 1990 to 2006 the average annual damage to the agricultural sector was equivalent to $253 million,[52] with typhoons accounting for 70.3%, drought 17.9%, and flooding 4.5%.

Sea level rise may result in increases in brackish water zones, flooding, and saltwater intrusion, which may destroy crops and harm aquaculture production, particularly if saline levels become more pronounced; reduce the extent of agricultural land in countries such as the Maldives and areas such as the Mekong Basin; and diminish the productivity of key crops such as rice and taro. Although there are efforts to develop saline-resistant varieties of some key crops, these are not yet readily available in most places. In some instances, traditional varieties have been found to be hardier and less susceptible to flooding, salinization, and drought than high-yielding varieties. These climate change impacts may threaten food security and nutrition, as yields of key crops such as rice are projected to decrease. Some projections predict that rice production may decline by 3.8% across Asia by 2100,[53] while in South Asia, rice yield is expected to decrease by 6-10% for a global temperature increase of 1°C. As rice is "thinly" traded in comparison to global production, accounting for only 7% of global production in the early 2000s in comparison to 18% and 13% for wheat and maize respectively during the same time period,[54] even small fluctuations may have a considerable impact on the price and affordability of this key crop. This is likely to have implications for food security and nutrition, and may lead to future changes in diets in the Asia-Pacific region, as was seen in Indonesia in 1997 when El Nino affected the country's rice production and the economic crisis caused the devaluation of the currency, diminishing the availability and affordability of rice.[55] These changes may also have important ramifications for the health of the region's economies, for several of which agriculture comprises a significant proportion of GDP (see box on this page).

A recent IFPRI report projected the impacts of climate change on agricultural yield in 2050 based on the "wetter" model by the US National Center for Atmospheric Research (NCAR) and the "drier" one from the CSIRO, using A2 inputs. Their results suggest that without CO_2 fertilization[56], yields in Southeast and South Asia would decline substantially by 2050 in comparison to those in 2000, with the latter experiencing the greatest yield reductions for almost all crops.[57]

Human Health

Environmental factors constitute a major determinant of human health, and climate change is likely to have an impact on them through shifts in temperature and extreme events; changes in the quality of air, food, and potable water; and alterations in climate sensitive diseases. Increased temperatures can result in a range of impacts on health, including a rise in heat waves and heat spells, leading to greater occurrence of heat stroke, with poor people, elderly individuals, and laborers at higher risk.[58] Warming may also contribute to air quality problems, such as smog and particulate air pollution. Particulate matter can damage lung tissue and poses a particularly high risk for people suffering from asthma and

[52] The conversion rate for December 31, 2006 from Xe.com was used to convert 12.43 billion Philippines pesos to US dollars.
[53] Cruz, et al., 2007
[54] FAO 2004
[55] Studdert, et al., 2001.
[56] CO_2 fertilization occurs when CO_2 is sequestered in the terrestrial biosphere and acts as a fertilizer promoting plant and crop growth.
[57] IFPRI 2009.
[58] Confalonieri, et al., 2007

other chronic lung diseases. Increased frequency and intensity of extreme events may cause greater event-related morbidity and mortality, infectious diseases, and stress-related disorders.

Increased temperatures in conjunction with flooding associated with greater rainfall and sea level rise are projected to lead to changes in the prevalence of vector- and water-borne diseases, such as malaria and dengue fever[59], as well as greater intensity or spread of infectious diseases, particularly in South Asia, Southeast Asia, and the Pacific. For example, in Bangkok, for projected increases in the temperature from 1998 to 2050, the number of cases of malaria infection would rise substantially.[60] Natural disasters such as surges, storms, floods, heavy rainfall, landslides, and others that take place in a more frequent and more intense manner, in the absence of adaptation measures, can also result in a higher number of deaths and negatively affect human health by causing environmental pollution, malnutrition, and diseases. The most vulnerable people would be poor people, elderly individuals, children, and women.

Climate change can also indirectly affect human health, by increasing the risk of food contamination; reducing the availability of clean water, which can result in greater prevalence of diarrhea and dysentery; and affecting food availability, which can lead to a rise in malnutrition. This may exacerbate current poor health conditions, in South Asian countries such as Bangladesh, Bhutan, India, Maldives, Myanmar and Nepal, where the global burden of climate change-attributable diarrhea and malnutrition were the highest in the world in 2000, with the relative risks likely to increase by 2030.[61] In South and Southeast Asia, morbidity and mortality due to climate change related diarrhea is expected to increase.[62] These changes are likely to place added stress on already insufficient health infrastructure and systems, result in their damage or destruction, and/or prevent access to them.

Tourism

Due to its dependence on terrestrial and marine ecosystems and biodiversity, the tourist industry in the Asia-Pacific region is highly vulnerable to climate change impacts such as sea level rise, floods, coastal erosion, and coral bleaching. It is estimated that the annual economic net benefits per square kilometer of a healthy coral reef system in Southeast Asia ranges from $23,100 to $270,000, which reflects a combination of investments in coastal protection, fisheries, tourism, recreation and aesthetic value.[63] Thus, the damage to and loss of these reef ecosystems, some 40%, 2%, and 8% of which have already been lost in Southeast Asia, the Pacific, and Australia respectively, would have an adverse effect on tourism and on the people who depend on them for their livelihoods. Tourism in the region's coastal megacities may also be affected as impacts of sea level rise and extreme weather events damage buildings and key infrastructure, with potentially negative consequences for the industry, which accounts for $2.1 billion of income in Manila.[64]

Moreover, impacts such as sea level rise, storms, and storm surges can place tourism, transportation, and other key sectors' infrastructure at risk. In the Maldives, more than 90% of all resort infrastructure and 99% of all tourist accommodation, which make up the most crucial economic product of the country, are within 100 meters of coastline, and 45% of resorts face varying degrees of beach erosion.[65] Moreover, both international airports lie within 50 meters of the coastline, making them susceptible to storm surges. If appropriate adaptation measures are not taken to reduce vulnerability to these climatic

[59] IPCC 2001.
[60] GLF, BMA, UNEP 2009 *BKK Climate Change Assessment.*
[61] Alam, et al., 2007.
[62] Cruz, et al., 2007.
[63] WWF 2009 *The Coral Triangle and Climate Change: Ecosystems, People and Societies at Risk.*
[64] WWF Mega-stress in Mega-cities.
[65] Kelkar & Bhadwal 2007.

changes, frequent inundations could virtually obliterate critical infrastructure damaging the economy and threatening the safety and security of the people.

Natural Resources and Ecosystems

Terrestrial Ecosystems and Natural Resources

Some of the world's richest and most varied terrestrial biodiversity, ecosystems, and natural resources are found in the Asia-Pacific region, and global climate change is likely to affect them both directly and indirectly. Although the nature and severity will differ from place to place, climate change is predicted to contribute to a net loss of species globally, with up to 50% of Asia's biodiversity reported as "at risk".[66] Rising temperatures have already begun to have an impact on plant flowering, the timing of animal reproduction and migrations, and the length of growing seasons.[67] Climate change related shifts in precipitation may alter water cycles, river levels, and habitats for flora and fauna. Together with sea level rise and greater frequency and intensity of extreme events such as floods and droughts, these impacts can contribute to alterations in soil salinity, soil moisture, and the thermal regime, changes in outbreaks of pests and diseases, and the greater frequency of forest fires.

Photographer: Alton Byers, The Mountain Institute

As a result, there may be alterations in species distribution, composition, abundance, and productivity; upward movement of ecosystems such as those found in montane environments; potential loss of important ecosystems with consequences for ecosystem services and the other livelihoods dependent upon these natural resources; and reduction or elimination of important buffers against storms and other extreme events, as in the case of wetlands. Sea level rise of 45 centimeters would inundate 75% of the Sundarbans, the world's largest mangrove ecosystem shared by India and Bangladesh, while an increase in sea level rise of 67 centimeters would place the entire ecosystem at risk of loss.[68] Any reduction or loss of mangrove systems such as Sundarbans, which serve as important carbon sinks comparable to peatland forests, would also lead to significant greenhouse gas emissions.

Climate change may also indirectly affect terrestrial ecosystems, biodiversity, and natural resources. As land appropriate for agriculture and water supply shifts, and as people migrate away from low-lying coastal areas and islands seeking refuge from sea level rise and flooding, greater pressure may be placed on inland areas, potentially including those that are protected and biodiversity-rich. Estimates suggest that a one-meter rise in sea level would cause Vietnam not only to lose 12% of its best agricultural land

[66] Cruz, et al. 2007.
[67] IPCC 2002.
[68] OECD 2003.

and potentially see losses of $17 billion per year, but also 33% of its natural reserves and 27% of the known biodiversity that they contain.[69]

Water Resources

Warmer temperatures; shifts in the frequency, intensity, and timing of precipitation; changes in El Niño Southern Oscillation (ENSO) events; shifts in the Indian Ocean dipole; higher sea level rise; greater frequency and intensity of extreme events; and increased snow- and glacial-melt are likely to have largely negative implications for the quality and quantity of water in the Asia-Pacific region, with severe water shortages projected for areas such as the Pacific island countries and South Asia in the long-term. Over the next few decades the loss of ice and snow associated with glacial retreat may mean greater runoff and more frequent floods during spring and summer months in lowland countries such as Bangladesh. However, in the long-term, as the glaciers shrink and/or disappear and as the duration of seasonal snow cover shortens, runoff is expected to decrease and saline intrusion to increase, with implications for water quality and availability in both highland and lowland countries, as well as the intensity and frequency of droughts in lower-Himalayan countries.[70] This may have repercussions for large populations: according to the 2007 Stern report on the economics of climate change, 500 million people in the Himalayan region overall, and 250 million in China, depend on glacial melt for their water supply.[71]

Although there is likely to be variation from region to region, in North and Southeast Asia, more overall rainfall is projected,[72] while in South and Southeast Asia, greater rainfall is expected in the wet season, and lesser in the dry season. These shifts in precipitation patterns can directly affect water for human consumption, agriculture, and industry, by causing serious floods in the rainy season and droughts in the dry season, changing the sedimentation and morphology of rivers, and decreasing the effectiveness of practices such as rainwater harvesting.[73] Consequently, rates of evaporation and contamination are likely to increase, thus diminishing water supply and quality and causing conflicts over access and use. In the Pacific, where many islands depend primarily on rainwater for drinking and agriculture, increased variability in precipitation will be felt particularly acutely.

Extreme events may damage rooftop collection systems, disrupt the power services required to operate water infrastructure, and lead to saltwater and sea spray contamination of uncovered storage and unprotected wells. Sea level rise may result in saltwater intrusion of groundwater and freshwater, and reduce the size and volume of freshwater tables, increasing rates of evapotranspiration and making groundwater more susceptible to surface contamination. These climate change impacts may exacerbate anticipated deteriorations in water quantity and quality in the Asia-Pacific region due to urbanization, industrialization and population growth. In India, even without climate change, the country's freshwater supply is projected to fall by 40% because of population growth, water demand, and run-off within major river basins.[74] Climate change could significantly worsen the outlook in India and in the rest of Asia, adversely affecting more than a billion people in the region by the 2050s.[75]

Freshwater Ecosystems and Natural Resources

The freshwater ecosystems of the Asia-Pacific region are extremely diverse, and support millions of livelihoods through fisheries and agriculture. In the Pacific, some islands are entirely dependent on

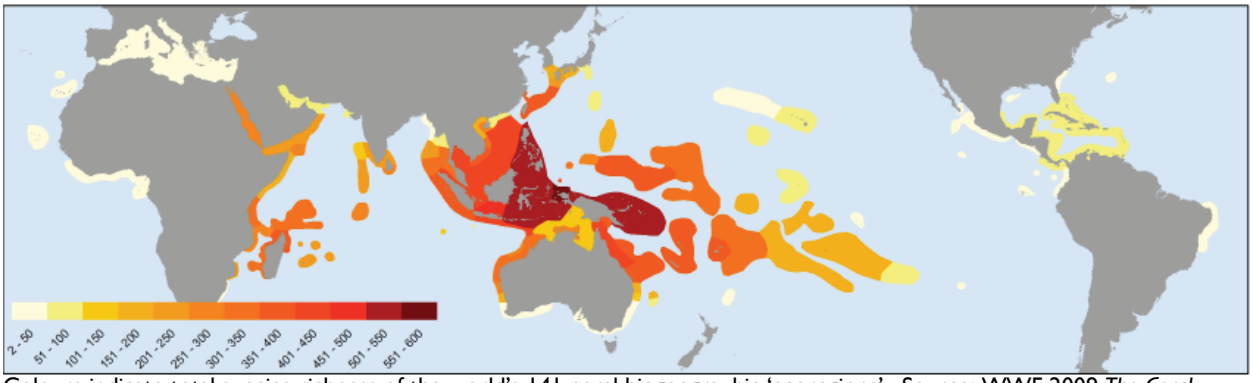
[69] IIED 2007 *Up in Smoke*.
[70] Alam, et al., 2007, Government of Bangladesh 2009 *Climate Change Strategy and Action Pla*n, IPCC 2008 *Climate change and water*.
[71] Stern 2007.
[72] Although these projections are highly uncertain, some areas such as the southern Indonesian archipelago are projected to become drier, and others including the remainder of Indonesia and the Philippines to become wetter.
[73] In the Maldives 90 per cent of atoll households used rainwater as the principal source of drinking water in 2004.
[74] Cruz, et al. 2007.
[75] Arnell 2006.

rainwater, while in Asia, the Mekong River alone supports an estimated 60 million people with fish as their main source of animal protein. The Ganges and Bramahputra are of huge importance, both for irrigation and cultural reasons. Climate change is profoundly affecting the region's aquatic biodiversity, water resources, and economy, all of which in turn will impact the region's people, and may exacerbate the impact of saltwater intrusion on water supply in the Changjiang and Zhujiang deltas, mangrove forests, agricultural production, and freshwater fish catch.[76]

Marine Ecosystems and Natural Resources

Marine ecosystems and natural resources in the Asia-Pacific region harbor a staggering richness of biodiversity and play an integral role in livelihoods and industries such as fisheries and tourism. The Coral Triangle contains 76% of reef-building coral species and 37% of coral reef fish species,[77] and climate change may affect these key assets. World Wildlife Fund (WWF) estimates that 40% of Southeast Asia's coral reefs and mangroves have been lost in the last 40 years,[78] 45% of coral reefs are under threat, and 15% are under low threat. In the Pacific and Australia, 2-8% of coral reefs have been lost, 2-35% are under threat, and 44-90% are under low threat.

Figure 2.5 The Global Biodiversity of Zooxanthellate Corals



Colours indicate total species richness of the world's 141 coral biogeographic 'ecoregions'. Source: WWF 2009 *The Coral Triangle and Climate Change: Ecosystems, People and Societies at Risk.*

Moreover, three Southeast Asian countries (Indonesia, Thailand, and the Philippines) fall within the world's top twenty for threatened marine fish species, and the probability of extinction is likely to increase due to climate change.[79] These climate change impacts may have implications for fish stocks and fishing seasons and exacerbate non-climate stressors such as illegal fishing practices. This in turn may have an impact on fisheries and the people employed in the sector, which range from 10,000 (Solomon Islands) to 7.3 million (Indonesia) in Coral Triangle countries, and account for between 1.4% (Papua New Guinea) and 12.8% (Solomon Islands) of GDP.[80] As a result, national economies, such as that of the Maldives, that are heavily dependent on fishing and tourism industries may be adversely affected.

As warming air temperatures are accompanied by a rise in sea temperatures, impacts may include: bleaching and loss of coral reef ecosystems; shifts of some marine creatures to cooler areas or depths; changes in fish spawning and migration patterns; and species loss, including of high-value tropical species, due to greater incidence of toxic algal blooms, competition, parasitism, and predation from exotic and

[76] Cruz, et al., 2007.
[77] WWF 2009 *The Coral Triangle and Climate Change: Ecosystems, People and Societies at Risk.*
[78] WWF 2009 *The Coral Triangle and Climate Change: Ecosystems, People and Societies at Risk.*
[79] Cited in Mother Nature Network http://www.mnn.com/earth-matters/wilderness-resources/stories/infographic-top-20-countries-with-most-endangered-species and RDMA's forthcoming biodiversity assessment report.
[80] WWF 2009 *The Coral Triangle and Climate Change: Ecosystems, People and Societies at Risk.*

invasive species.[81] Higher temperatures can also lead to a rise in sea levels, and if these rates are higher than that of vertical reef growth, coral reefs may not survive,[82] with adverse effects for the fish and other marine species dependent on them. Sea level rise can also have an impact on coastal habitats as well as mangrove, seagrass, and wetland ecosystems. As coral reefs and mangroves act as buffers against storms, storm surges, and sea level rise, in addition to serving as important spawning and nursery grounds for many fish and marine species, loss of these ecosystems will increase the vulnerability of coastal areas to climate change impacts.

Material Assets

Energy, Transportation, Communications, and Other Infrastructure

For the developing countries of the Asia-Pacific region, climate change can act as an additional stressor on already stretched energy, transportation, communications, and other non-water infrastructure, with coastal and delta areas and island countries particularly vulnerable to floods, storms, and sea level rise. Floods and landslides associated with snow and glacial melt can place valuable infrastructure such as hydropower plants, roads, and bridges at high risk.[83] Most of the key infrastructure of island countries may be vulnerable to cyclones, storm surges, and sea level rise. In Vanuatu much of the infrastructure, including the main commercial centers of Port Vila and Luganville, is located on the perimeter of the major islands, which are only a few meters above sea level. Moreover, much of the road network is also situated on the perimeter of the islands, making it extremely vulnerable to cyclones, storm surges, and even small increases in sea levels due to the larger surges associated with the increased frequency and intensity of tropical cyclones. In the Maldives, more than 73% and 55% of the inhabited islands have buildings less than 100 and 50 feet (30.5 and 15.2 meters), respectively, away from the shoreline,[84] putting them at high risk to the impacts of storms and sea level rise.

Even in countries where examples of early warning systems exist, as in Bangladesh, houses and infrastructure are still regularly destroyed by recurring cyclones, although the loss of life has been reduced.[85] The costs of such damage can be extremely high. For example, in Indonesia major flood events in 1996 and 2007 resulted in an estimated $572 million worth of damage to infrastructure and loss of state revenue.[86] The ramifications of these climate change impacts are often made worse by human activities, such as building in highly vulnerable areas or eliminating important coastal buffers through sand extraction or the removal of mangroves and other coastal vegetation. This often stems from lack of existing regulations or effective enforcement.

Cities and Industrial Areas

Many of Asia's cities and industrial zones are extremely vulnerable to climate change, and this may be aggravated by continued increases in urbanization, population growth, and migration from rural areas, particularly in mega-cities such as Dhaka and Kolkata.[87] Dhaka was identified by WWF as the most climate change threatened city in Asia, followed by Jakarta, Manila, Kolkata, Phnom Penh, Ho Chi Minh City, Shanghai, and Bangkok.[88] According to some projections, sea level rise of one meter would displace 24 million people, mostly in urban areas, in Bangladesh, India, Indonesia, Cambodia, Vietnam, and the Philippines, with, as mentioned earlier, extreme risk of population displacement by 2050 in the

[81] Handisyde, et al., 1990.
[82] Naseer 2006.
[83] Eriksson, et al., 2009.
[84] Kelkar and Bhadwal 2007.
[85] IIED 2007.
[86] WWF Mega-stress for Mega-cities.
[87] Christensen, et al., 2007.
[88] WWF Mega-stress for Mega-cities.

Ganges/Brahmaputra and Mekong River Deltas. According to the Organization for Economic Cooperation and Development (OECD), in Bangkok alone, the number of people at risk from flood events would increase from approximately 900,000 to more than 5 million people by 2070.[89]

Climate change impacts such as typhoons or floods act as additional stressors on urban infrastructure such as water and drainage systems that is already overtaxed due to large and increasing populations, and the high costs of extending services to peri-urban areas. For example, in Dhaka, projected to have a population of 40 million by 2050, floods are likely to place added stress on drainage and sewer systems, which already frequently clog during the monsoon system, most adversely affecting slums and posing serious health risks, while sea level rise may delay discharge from the drainage system into low-lying areas.[90] Slums tend to be particularly vulnerable to climate change impacts as poor people are usually located in more exposed parts of cities; their exposure is further increased due to the low quality of housing, roads, and other services in these areas.

Industrial zones in low-lying delta or coastal areas may be faced with increased occurrence of floods, and challenges in seeking drainage solutions as a result of floods from rivers and rising sea level. Industries may also face difficulties in obtaining water and material supplies as well as reduction of the lifespan of materials, equipment, and facilities for key industries such as manufacturing; exploitation and processing of mineral resources; agricultural, forest, and aquaculture products; and industrial and domestic construction. The infrastructure associated costs of flooding in the urban context can be immense. In Bangkok, the infrastructure losses attributable to floods are projected to increase from the current figure of $39 billion to a staggering $1.1 trillion by 2070.[91]

Urban areas are also more likely to be affected by warming, due to the "urban heat island effect"—where temperatures become elevated due to heat trapped in pavement, buildings, and other infrastructure. For example, Shanghai has experienced a greater rise in temperature than that of surrounding areas. This can have implications for future emissions of greenhouse gases, as people adopt increased air conditioner use. In an increasingly urbanized Pacific, with many people residing in informal settlements, under very crowded conditions, poor housing and limited access to basic amenities, climate change is expected to place a major burden on already stressed urban management.

Anthropogenic changes are likely to magnify many of these climate change impacts. The recent joint World Bank, Japan Bank for International Cooperation Institute, and the Asian Development Bank study, "Climate Change Impact and Adaptation in Asian Coastal Cities," found that 70% of the four-fold increase in flood loss projected by 2050 under the A1FI scenario would be caused by subsidence due to human activities. Similarly, a recent examination of the flooding associated with the September 2009 extreme rain event Ondoy in the Philippines revealed that reductions in river channel capacity due to encroachment, garbage, and increased siltation caused by deforestation; urban sprawl into flood plain areas; and subsidence due to groundwater withdrawal had contributed significantly to the severity of the event.

2.3 Geographic "Hot Spots"

Although most areas are likely to be affected by several climate change impacts, there are a number of geographical areas that can be considered hotspots, not only because they face multiple hazards, but also because they feature significant exposed populations and a range of valued vulnerable assets (e.g.,

[89] OECD 2007.
[90] Government of Bangladesh 2009.
[91] OECD 2007.

important agricultural areas, key infrastructure, and rich terrestrial, freshwater, or marine biodiversity). Environmental disasters unrelated to climate change such as earthquakes and tsunamis also tend to plague these areas. These events exacerbate the impacts of climate change by stretching resources and providing for little or no recovery time between disasters, thus reducing the overall adaptive capacity of the countries and communities involved.

Areas that have been identified as hotspots based on a comprehensive literature review and extensive in-country consultations include the Pacific Island countries, Asian coastal cities, the Tibetan Plateau and the Greater Himalayan region, the Mekong River Basin, the Coral Triangle, and the Sundarbans. (Their vulnerabilities are summarized in Figure 2.6.) The fact that each of these hotspots straddles more than one country highlights the necessity of a transboundary approach, as adaptation activities undertaken in one will necessarily affect their neighbors, and in order to avoid management practices at odds with each other. (The vulnerability of the Mekong Delta and the developing countries of the Coral Triangle are highlighted in Figure 2.7.)

Figure 2.6 Geographic Hotspots and Climate Hazards

Hotspot	Hazards							Assets							
	Droughts	Floods	Sea level rise	Storms	Glacial melt and GLOFs	Ocean acidification	Warmer sea temperatures	Agriculture/aquaculture/ food security	Water resources	Infrastructure	Ecosystems and biodiversity	Settlements	Livelihoods	Human health	Tourism
Pacific Islands	●	●	●	●		●	●	●	●	●	●	●	●	●	●
Coral Triangle	●	●	●	●		●	●	●	●	●	●	●	●	●	●
Mekong River Basin	●	●	●	●	●		●	●	●	●	●	●	●	●	●
Sundarbans	●	●	●	●	●			●	●	●	●	●	●	●	
Asian Coastal Cities	●	●	●	●	●				●	●		●	●	●	●
Tibetan Plateau and Greater Himalayan region		●			●			●	●	●	●	●	●	●	

- **Pacific Island** countries are at high risk from sea level rise and extreme events, in particular, which have an impact on key assets including coastal infrastructure, agricultural land and food security, and freshwater resources, and may ultimately lead to forced relocation for the populations of several of the island countries, with unknown social and cultural consequences.

- The richness of the marine biodiversity in the **Coral Triangle**, whose reefs include more than 500 coral species per marine zone, is unparalleled (see Figure 2.5), and the area's resources support the livelihoods and food security of more than 100 million people in the region.[92] The Coral Triangle is severely threatened by warming seas, ocean acidification, sea level rise, and changes in storm intensity and precipitation.

- The **Mekong River Basin** is considered one of the world's most vulnerable areas to climate change impacts, like greater variability of rainfall and rising sea levels (see Figure 2.7). It is home

[92] WWF 2009.

to more than 60 million people, is of great significance for rice production (rice is grown on 88% of Thailand's land used for cereal production,[93] and nearly half of Vietnam's rice is grown in the Mekong Basin), and encompasses several key biodiversity areas.

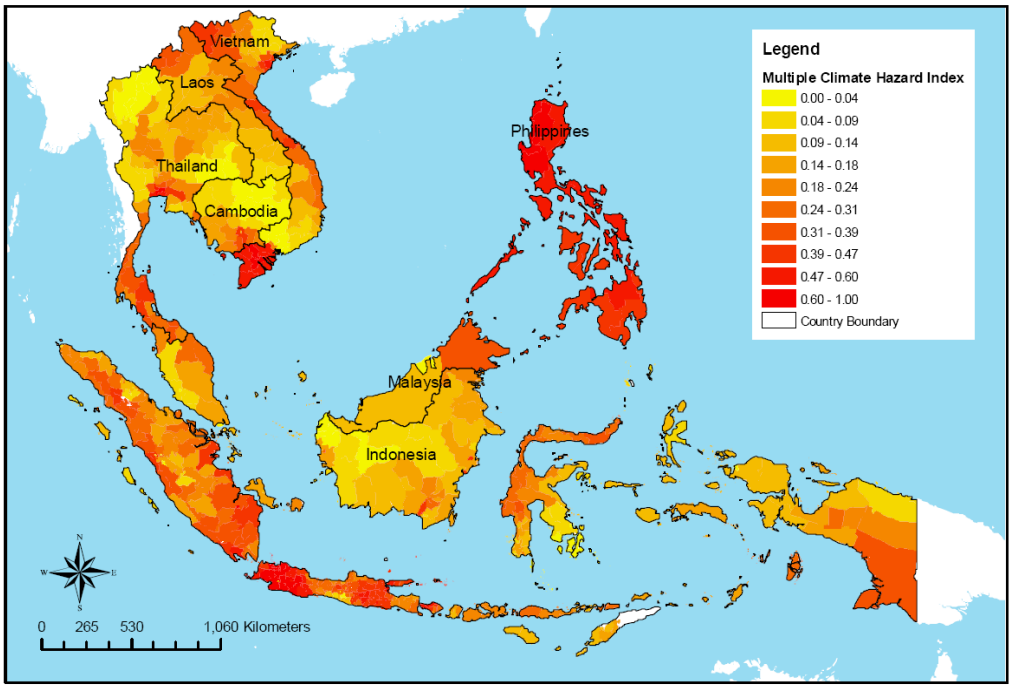
- The **Sundarbans**, the largest contiguous mangrove ecosystem in the world, which harbors unique biodiversity, including the Royal Bengal Tiger, is in increasing danger of losing several of its polders[94] due to sea level rise and extreme events, placing their populations at risk.

- **Asian coastal cities** feature high concentrations of population, key infrastructure, and important industries that are at high risk from a rise in temperature, which will have a greater effect on the urban core, sea level rise, and extreme events such as flooding and storms. Of the 24 million people in Bangladesh, India, Indonesia, Cambodia, Vietnam, and the Philippines who are projected to be affected by one meter of sea level rise, a significant proportion will be located in coastal cities.

- **Tibetan Plateau and Himalayas** face related challenges. In the Tibetan Plateau, glacial and snow melt are affecting the biodiversity of mountain ecosystems and the region's hydrology, which may have long-term implications for the water supply of both upland and lowland areas and, consequently, on agriculture and food security for the populations of Southeast Asia, and especially North and South Asia. The Himalayas, the world's "third pole," border the Tibetan Plateau but include high mountains and other important and bio-diverse ecosystem types such as foothills, glacial lakes and high-altitude wetlands. Population levels are higher, with livelihoods fundamentally dependent on ecosystem services. The Himalayas face significant climate-induced changes to glaciers, snowpack, and monsoon patterns. This may increase the risk of extreme events, and affect water, food, and energy security for hundreds of millions of people.

[93] WWF Greater Mekong Programme 2009.
[94] A polder is an area of low-lying land that has been reclaimed by water and is surrounded by dykes.

Figure 2.7 Multiple Hazard Map of Southeast Asia[95]



Source: EEPSEA 2009.

[95] EEPSEA 2009.

3. ADAPTATION CHALLENGES, OPTIONS, AND STRATEGIES

The general class of options and strategies that can be designed and implemented to reduce climate change vulnerability is referred to as adaptations. Adaptations will usually reduce exposure and sensitivity to climate impacts or increase adaptive capacity to cope with climate impacts. An extensive vocabulary has evolved to define different types of adaptation and adaptation concepts, as described in Section 3.1. On a conceptual level, it is straightforward to identify adaptations that will reduce climate vulnerability, but in practice decision-makers at all governmental levels and geographical scales face a number of challenges to design and implement effective adaptation measures, as outlined in Section 3.2. The assessment team compiled an extensive inventory of adaptation options during consultations and over the course of its literature review. In some cases, adaptation options have been prioritized in government plans and strategies, but in most cases, they have only been identified, proposed, and in a few cases, piloted. A synthesis of regional adaptations by sector and illustrative adaptation strategies well-suited to the areas under consideration are provided in Sections 3.3 and 3.4.

3.1 Adaptation Definitions and Concepts

Climate adaptation refers to the ability of a system to adjust to climate change (including climate variability and extremes) to mitigate potential damage, take advantage of opportunities, or cope with the consequences. The IPCC defines adaptation as:

> …adjustment in natural or human systems to a new or changing environment. Adaptation to climate change refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation.[96]

Other organizations have developed shorter working definitions of adaptation.[97] For example, the Asian Development Bank (ADB) defines adaptation as "adjustments to reduce costs and vulnerabilities, based on anticipated climate change impacts."[98] The World Bank defines adaptation as "efforts to protect against climate change impacts."[99]

A typology of adaptation concepts has also evolved to differentiate individual adaptation measures (e.g., planned vs. autonomous adaptation) and to characterize adaptation themes (e.g., climate proofing and climate resilience). Table 3.1 presents the adaptation concepts central to this assessment report.

[96] IPCC 2001, *Third Assessment Report, Working Group II: Impacts, Adaptation, and Vulnerability*
[97] The OECD has prepared a survey of adaptation definitions, see OECD, 2006, *Key Adaptation Concepts and Terms*, Draft Paper, Agenda Document 1.
[98] ADB 2007, *Promoting Climate Change Adaptation in Asia and the Pacific.*
[99] The World Bank 2000, *Cities, Seas, and Storms, Managing Change in Pacific Island Economies.*

Table 3.1 Adaptation Concepts

Concept	Definition
Planned adaptation	Adaptation that is the result of a deliberate policy decision, based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain, or achieve a desired state.[100]
Autonomous adaptation	Spontaneous adaptation to address a specific vulnerability element, taken by the individuals or private entities uniquely impacted by the element.
No regrets adaptation	Adaptation options (or measures) that would be justified under all plausible future scenarios, including the absence of manmade climate change.[101]
Maladaptation	An adaptive response, made without consideration for interdependent systems that may inadvertently increase risks to other systems sensitive to climate change (and important to social well-being).[102]
Climate-proofing	Enhancing resilience to, and reducing the risks posed by, climate change; for example, improving the ability of infrastructure to withstand floods and cyclones.[103]
Climate resilience	The capacity of a system, community, or society potentially exposed to hazards to adapt by resisting or changing in order to reach and maintain an acceptable level of functioning and structure.[104]
Mainstreaming	The full and systematic incorporation of a particular issue into the work of an organization so that it becomes an accepted and regular part of the organization's policies and practices.[105]

3.2 Barriers to Adaptation Planning and Implementation

Throughout the consultation process and literature review, the assessment team observed that countries in the region have made limited progress in carrying out adaptation planning and virtually no progress in implementing adaptations. In part, this reflects the nascent nature of adaptation planning and an initial focus on the preparation of National Adaptation Programmes of Action (NAPA) for the least developed countries.[106]

In addition, donors, multilateral banks, and international NGOs have been testing assessment tools and piloting adaptation planning, often in individual economic sectors. For example, the Pacific Adaptation to Climate Change (PACC) Project focuses on adaptation planning for one of three sectors prioritized by

[100] IPCC 2001, Third Assessment Report.
[101] Adaptation Guidance Notes – Key Words and Definitions, http://beta.worldbank.org/climatechange/content/adaptation-guidance-notes-key-words-and-definitions.
[102] Scheraga, Joel D., and Anne E. Grambsch. 1998. *Risks, Opportunities, and Adaptation to Climate Change*. Climate Research, Volume 10, page 92. Washington, DC.
[103] International Institute for Environment and Development. *Climate Change & Poverty Reduction*. Irish Aid Key Sheet (www.irishaid.gov.ie/Uploads/5%20Climate%20Change%20%20Poverty%20Reduction.pdf).
[104] UN/ISDR 2004. *Living with Risk – A global review of disaster reduction initiatives*.
[105] ADB, *Understanding and Responding to Climate Change*, 2009.
[106] While a number of interviewees and reviewers expressed dissatisfaction with the NAPA process, few critiques have been published. An exception is the report prepared by Balgis Osman-Elasha and Thomas Downing, *Lessons Learned in Preparing National Adaptation Programmes of Action in Eastern and Southern Africa,* European Capacity Building Initiative, 2007. Current weaknesses in the NAPA process include: (1) lack of free flow of information; (2) poor communications within and between different levels of government; (3) insufficient financial resources; (4) lack of local technical capacity to participate effectively in the NAPA process; and (5) sluggish follow-up implementation due to project processing and funding delays.

each country (agriculture and food security, coastal management, or water resources) in 13 Pacific Island countries (see Annex E – Adaptation Projects and Funds).

While financial and technical support for adaptation planning and implementation is gaining momentum in Asia-Pacific countries, a number of barriers need to be overcome for adaptation planning to be successful. The barriers fall into two categories: (1) barriers related to the process of adaptation planning; and (2) barriers related to governance issues that impede the successful implementation of adaptation measures.

Barriers: Adaptation Process

Poor Understanding of Adaptation Concepts

The lack of knowledge about adaptation concepts can be attributed to limited in-country capacity to tailor this information to different audiences, translate it into local languages, and communicate it to decision-makers and stakeholders. Because adaptation concepts are so novel, many have not been translated into local languages. Without access to this information, many decision-makers do not understand the linkages between adaptation and development, the differences between adaptation and mitigation, or the synergies between adaptation and mitigation. Without an understanding of climate as a stressor, not a sector, policy-makers will not realize that efforts to address climate impacts are no different from addressing other types of development constraints and stressors. In addition, the distinction between phenomena caused by climate change vs. other factors needs to be made clearer.

Weak Capacity

Adaptation planning and implementation requires capacity at all stages of the process, from understanding climate impacts and scenarios, through vulnerability and adaptation assessment, mainstreaming adaptations into sector plans, preparing adaptation strategies, and designing and implementing adaptation projects. Specific capacity needs include:

- Access to climate information and climate scenarios relevant to the scale of vulnerability assessments, compounded by weak local capacity to conduct climate research. Data sharing within and between countries emerged as a constraint in a number of consultations.

- Knowledge of adaptation including: adaptation options, their effectiveness, costs, and potential benefits; lessons learned from adaptation projects in the region which have addressed similar climate impacts; and research on new adaptations (e.g., climate-resilient crops, best practices).

- Understanding of donor project cycles, and application procedures for accessing financing for adaptation projects; guidance and capacity building to design, implement, and monitor adaptation projects.

Lack of Coordination on Adaptation Planning

To be most effective, adaptation planning requires leadership to guide the planning process, coordination among major sectors and stakeholder groups to ensure that integrated assessments consider cross-sector impacts, and consensus building to promote widespread support for adaptation strategies. In developing adaptation plans, governments need to recognize that most adaptation to date is *autonomous adaptation* undertaken by individuals, households, communities, and businesses. The inputs of these stakeholders need to be considered in adaptation planning to ensure that desirable autonomous adaptations are encouraged while autonomous adaptations that may be maladaptations when viewed on the larger scale are discouraged.

Limitations of the assessment toolkit

Many of the available vulnerability and adaptation assessment tools are not data-relevant or appropriately scaled to adaptation planning at the national, provincial and local levels. Therefore, guidance is also needed on decision-making under uncertainty, given the level of understanding of and confidence in the climate science and timing and magnitude of impacts.

Barriers: Governance

Weak governance structures

The benefits of adaptation measures can be significantly attenuated if effective governance structures at both the national and sub-national levels are not in place or underfunded. Successful adaptation requires governmental accommodation for civil society engagement in adaptation planning, and commitment and resources available for enforcement of laws, policies, and regulations. In addition, governments need to address non-climate stressors such as inefficient public service delivery, water pollution, illegal logging, destructive land use practices, and overfishing. However, strengthening governance structures is a long-term and uncertain process. Opportunities may be missed to facilitate effective adaptation if good governance is viewed as a pre-condition for engagement.

Poor transboundary coordination

Jurisdictional constraints or rigidities may impede cooperation and coordination on the development of transboundary adaptation strategies. Sharing of information and analyses of potential economic and environmental impacts of actions taken by one country on its neighbors is critical to understanding and promoting mutually-supported transboundary objectives and programs to effectively address climate impacts on a broad geographic scale.

3.3 Adaptation Options

Adaptation options most appropriate to the Asia-Pacific region will address/mitigate vulnerability related to specific climate impacts, valued assets, and specific sectors. Adaptations can be divided into measures to reduce exposure and/or sensitivity and measures to increase adaptive capacity (Table 3.2). For both types of measures, emphasis in the near term should be on "no regrets" measures. These measures can be justified in terms of meeting development objectives and responding to current climate risks. They are referred to as "no regrets" because the implementation of these measures is beneficial even if the magnitude and timing of future climate change is different than expected. In addition, there are important linkages between adaptations, GHG mitigation, and carbon sequestration.

Adaptation, Mitigation, and Sequestration

Many adaptation measures not only reduce climate vulnerability but also mitigate GHG emissions or facilitate increased carbon storage in biomass and soil. Examples of adaptations with GHG benefits include:

- Reforestation of degraded lands, revegetation of watersheds, and improved soil management;
- Improved building designs and landscaping to reduce air conditioning costs in urban heat islands; and
- Improved storage and utilization of rainwater in agriculture to avoid costly pumping of groundwater.

On the other hand, adaptations may involve new energy requirements in order to improve water and wastewater systems, climate proof infrastructure, or develop back-up water supplies, communications and transportation networks, or emergency energy supplies.

Table 3.2 Adaptation Options

Adaptations to Reduce Exposure and Sensitivity	
Option	**Description**
Policies to avoid exposure	Land use zoning, use restrictions, relocation policies
Sector-level best practices	Selection of climate-resilient crop and tree varieties, water harvesting, use of natural floodplains for water storage, energy-efficiency in buildings, water management, and lighting
Climate proofing of infrastructure	Increasing resilience to climate impacts through building designs, selection of construction materials, elevated structures
Adaptations to Increase Adaptive Capacity	
Option	**Description**
Promote economic development and improved and diversified livelihood	Higher incomes and more diversified livelihoods[107] enable individuals and households to cope with climate change and particularly floods, droughts, and extreme events
Strengthen disaster risk management capabilities	Helps civil society and communities respond to droughts, floods, and extreme events with fewer fatalities and injuries and recover more quickly
Improve management of public services	Better management of water supply and demand may reduce impact of droughts, complement disaster risk management
Implement early warning systems	Monitoring and decision support systems related to floods, drought, health outbreaks, and crop/forest diseases and pests
Build multiple support systems	Includes systems such as water supplies, emergency energy systems, transportation, and communications, plus food banks
Maintain healthy ecosystems	Ecosystems provide variety of services such as water regulation and sediment control that can help reduce the impacts of droughts, floods, extreme events, maintain biodiversity, and support natural resource-based livelihoods

3.4 Illustrative Adaptation Measures and Strategies

The assessment team's consultations and literature review identified a large number of adaptation measures that have been considered for or included in strategies at a variety of levels. In some cases, such as NAPAs or national adaptation strategies, sectors have been prioritized for near-term projects and programs, but actual on-the-ground adaptation across the region was observed infrequently. To illustrate the range of adaptations under consideration in the Asia-Pacific region, this section takes two

[107] In rural areas throughout Asia, seasonal and year-round migration is an important adaptation option at the household level for diversifying livelihoods into activities that are less vulnerable to climate change and variability. Remittances can be a key component of household income and a buffer against fluctuations in agricultural incomes. In some countries where agricultural production is not adequate to meet local food requirements, remittances are key to regional food security. Remittances may also fund new infrastructure, education, and new businesses – all key elements of adaptive capacity. However, as men typically leave their villages for wage labor and full-time employment, women have taken on added roles and responsibilities, a transition that has been termed the "feminization of agriculture" in the Himalayas. (See http://www.tiempocyberclimate.org/newswatch/xp_report091218.htm)

different perspectives. First, adaptation options are enumerated on a sector-by-sector basis in Table 3.3. This extensive list of options includes many of the adaptations that have been recommended for inclusion in geographically-focused adaptation studies and strategies. Second, key geographically-focused adaptation options are described, drawing from recent studies, analyses, and stakeholder processes.

Sector Adaptations

Table 3.3 Illustrative Adaptations by Sector

Sector	Illustrative adaptation options
Agriculture and food security	• Adaptation of crops to salinity, droughts, temperature, and floods; integrated pest/disease management • Improved soil management; increased/improved water storage and irrigation • Improved food production, processing, and distribution networks; crop/disaster insurance; promotion of traditional knowledge related to management and food processing methods • Greater diffusion of information and communication technologies (ICT) to enhance access to information on seasonal weather forecasts, markets, pests and diseases, and best practices • Diversification of locally-available crops and animal husbandry to enhance livelihoods and address dependence on food imports • Early warning system for food security; development of emergency food banks and distribution networks
Water resources	• Improved water management systems; demand-side management; water conservation and efficiency improvements in water utilization • Sustainable management of groundwater sources; protection of water quality; water reuse; climate-proofing of water supplies against salinity, floods, and storm surges • Development of redundant/emergency water supplies; integrated water resource management and disaster risk management
Forests and grasslands	• Improved forest management, reforestation, and restoration of forest wetlands and grasslands • Promotion of community-based forest and grasslands management and protected area co-management • Promotion of forest-based livelihood options, including non-timber forest products and tourism • Selecting trees and plants with resistance to drought, fire, disease, and pests • Improved monitoring and early warning systems
Fisheries	• Addressing overfishing problems; live bait management; area closures; marine protected areas; integrated reef fishery management • Diversification of fisher livelihoods (e.g., ecotourism); promotion of sea ranching and aquaculture • Control of wastewater and storm water discharges; restoration of mangroves and other nursery areas
Infrastructure	• Implementation and enforcement of building codes, zoning laws, and setbacks • Incorporation of climate concerns into environmental impact assessments of new infrastructure planning and investment; climate-proof existing infrastructure against salinity, floods, storm surge, and sea level rise
Disaster risk management	• Improved disaster preparation and planning; training disaster staff and volunteers; applying traditional knowledge to risk reduction strategies

Sector	Illustrative adaptation options
	• Drought/storm early warning systems; awareness and education programs • Integration of risk reduction principles into environmental permitting; integration of disaster risk management with adaptation strategies to reduce exposure to floods and extreme events
Health	• Surveillance/monitoring of water and vector-borne diseases, particularly in aftermath of disasters • Improved health care capacity; integration of health care and disaster risk management planning • Implementation of preventive health maintenance programs; promotion of healthy lifestyles and improved nutrition and hygiene

Geographic and Ecosystem Adaptations

Using national documents, academic literature, practitioner reports, and in-country consultations, the assessment team has identified adaptation options for a selected set of high-risk geographic zones. These include the Yangtze River Basin, coastal cities, the Mekong Delta, the Majuro Coral Atoll, the Sunderbans, and glaciated mountains.

Yangtze River Basin

The Yangtze is China's longest river (6,300 km), draining 1.8 million km^2. The basin accounts for 41% of China's gross domestic product (GDP), 35% of its national grain production, 35% of its water resources, and 31% of its forested area. The basin is also home to world-class biodiversity, including giant panda, Yangtze River dolphin (Baiji dolphin and finless porpoise), snow leopard, and Chinese sturgeon.

The *Yangtze River Basin Climate Change Vulnerability and Adaptation Report*[108] provides an overall assessment of climate impacts on water resources, agriculture, forests, grasslands, wetlands, and the coastal mega-city of Shanghai. Rising temperatures and changing precipitation are the primary climate changes of concern, with impacts on the range of vegetation, high altitude wetland ecosystems, glaciers, aquatic species, migratory birds, and agricultural productivity. Extreme events such as droughts, floods, heat waves, and snow storms are concerns throughout the basin.

The Report provides general guidance on adaptation, such as implementing "no regrets" actions, building adaptation capacity through other socioeconomic activities, employing an ecosystem-based adaptation approach, and recognizing adaptation as a dynamic optimizing process by embracing new knowledge and advancements in technology. It recommends specific adaptation measures for the basin such as:

- ***Building socioeconomic capacities*** to cope with climate change;
- Incorporating climate change mitigation and adaptation efforts into ***integrated river basin management***;
- ***Improving climate resilience*** through adjustment of cropping systems, breeding new climate-resistant varieties, and adopting integrated soil and water management practices;

[108] World Wildlife Fund, Summary of the First-ever Yangtze River Basin Climate Change Vulnerability and Adaptation Report, Beijing, China, 2009.

- ***Improve forest management*** by protecting natural forests from logging through innovative financing schemes such as payment for ecosystems services, and replanting with climate-resistant species;

- ***Protecting the headwaters*** through better management of grasslands and livestock grazing, and improving the fodder reserve system for extreme events in high-altitude areas;

- ***Maintaining freshwater ecosystem integrity*** through protecting and restoring environmental flows;

- ***Promoting low-carbon development*** in urban areas, while promoting the integration of mitigation and adaptation efforts; and

- Helping rural communities to ***identify and monitor climate changes*** themselves.

Coastal Cities

Coastal cities in Asia are vulnerable to extreme weather events (cyclones, flooding, and drought), sea level rise and salinity, and increased temperature. These climate impacts may result in significant economic, social, and environmental costs in coastal cities, in part because of the physical exposure of populations, infrastructure, and natural resources to climate impacts.

Multiple non-climate issues are expected to exacerbate costs: (1) challenges associated with poor communities, resulting from location, low quality of dwellings, and limited access to public services; (2) nonexistent or inadequate social and economic safety nets related to disaster response and recovery; (3) lack of backup systems (e.g., energy, water and sanitation, food reserves, and medical supplies); and (4) absence of or weak enforcement of policies on land use, building codes, and environmental regulations.

Numerous adaptations for Asian cities are being discussed as part of the Asia Cities Climate Change Resilience Network, funded by the Rockefeller Foundation. The priority areas for adaptation response being considered are the following.[109]

Urban Flood Management – Clearing of channels; improved solid waste and drainage management; structural controls (e.g., dikes, flood barriers, and levees), with the understanding that such structures may have a high risk of maladaptation; flood-adapted design and relocation into lower risk areas (with careful consideration of the political, social, and cultural sensitivities of relocation); and post-disaster reconstruction planning;

Water Supply – Improved access to water for the informal sector; policies to address cost inequities and access to emergency supplies; improved management of piped water; demand-side management; development of emergency supplies; protection of private and public groundwater supplies;

Urban Heat Islands – Heat-dissipating best practices, green buildings, heat-related medical support, urban green spaces, landscaping and tree and shrub planting; and

[109] The adaptations listed here are also drawn from the assessment team's consultations.

Emergency Food Distribution and Public Services – Increased awareness and policy advocacy related to food security and emergency food distribution; development of social support systems, food stocks and banks, and assistance programs for the poor; redundant/emergency energy and water services; transportation; and communications.

Mekong Delta

The Mekong Delta drains one of Asia's longest rivers, is home to more than 17 million people, and is an important contributor to Vietnam's economy. With 2.4 million of its 4 million hectares devoted to agriculture, the Mekong Delta accounts for 80% of Vietnam's food exports and supplies 50% of Vietnam's rice and 70% of tropical fruit for domestic consumption. The delta is also an important fishery, providing 65% of Vietnam's seafood for domestic consumption.

The Mekong Delta has already experienced changes in climate related to the timing and amount of rainfall, with the rainy season starting later and less rain falling at the beginning of the planting season in May and significantly more at the end of the season in September. By 2030, it is expected that the rainy season will start two weeks later and annual rainfall will be reduced by 20% compared to the 1980s. In addition to changes in precipitation patterns and levels, the major climate impacts of concern are sea level rise and temperature. Sea level rise and increased salinity will directly impact agriculture and public water supplies. Sea level rise, storm surges, and flooding will similarly impact all types of infrastructure, while temperature increases—particularly increases in the number of days with maximum temperatures above 40 degrees Celsius—will impact agricultural yields, require higher energy consumption, and increase incidence of water and vector-borne illness and disease.

Water is a key resource in the delta which must be accounted for in a cross-cutting way for all sectors. Adaptation strategies for the delta will have to deal with seasonal water flows, drought, and flooding; water quality issues associated with upstream management practices; urban and rural wastewater; discharges from industry and aquaculture; and management of salinity.

Within the delta, adaptation strategies might include restoration of freshwater wetlands as natural water storage reservoirs, combined with water diversion to these natural floodplains, replanting of coastal mangroves, and assessment of a delta-wide network of dikes and other water conveyances. Upland management practices are expected to alter the flow and water quality characteristics of the Mekong as it enters the delta and reduce beneficial sediment transport and deposition associated with hydropower development. At a minimum, the Government of Vietnam and provinces in the delta will have to account for upstream management practices. Dialogues with riparian countries upstream could provide an arena to assess and promote schemes to value upstream biodiversity and payment for ecosystem services.

Specific adaptation measures that have been discussed or proposed for the Mekong Delta include the following:

- ***Infrastructure*** – Climate-proofing of roads, bridges, and communications; development/ improvement of public water supply infrastructure, new construction, and building codes (for example, Can Tho City now requires all new construction at 2.5 meters above sea level);

- ***Agriculture*** – Development of salt-resilient rice varieties, crop substitution, shifting structure of animal husbandry, research and application of best practices, including improved management of drainage of rain and flood waters;

- ***Aquaculture*** – Adoption of aquaculture species that can cope with climate changes, management of warm, nutrient-laden discharges from aquaculture operations; and management of aquaculture that is more sustainably integrated with fisheries and biodiversity;

- ***Fisheries*** - Improved monitoring of fish movements and fishing grounds; establishment of fisheries fingerling supply areas; protection of coastal mangrove and wetland ecosystems; and

- ***Energy*** – Improved effectiveness of energy use and conservation, and promotion of renewable energy sources.

All of these measures would be designed to increase adaptive capacity and resilience in vulnerable communities and development sectors.

Majuro Coral Atoll

Majuro is the capital of the Republic of Marshall Islands (RMI) and home to half of the country's population of 64,000. Its average elevation is about 2 meters above sea level. The main climate change impacts of concern are: (1) sea level rise in combination with storm surges causing flooding, coastal erosion and saltwater intrusion; (2) periodic droughts associated with El Niño Southern Oscillation events; and (3) coral bleaching resulting from increased temperature and ocean acidification (in combination with extreme low tides).

Adaptation options to address current and future climate impacts in Majuro include:

- ***Coastal and marine resources*** – Diversification of fisheries; reducing catch and sea ranching; fostering closer regional cooperation and information exchange; new technological advances, creation of marine protected areas (MPAs), monitoring and early warning; land reclamation, implementation of a coastal forest management plan, planting trees to reduce erosion and increase wildlife and fisheries habitat, and increasing knowledge regarding the role of plants in erosion control;

- ***Freshwater resources***[110] – Improved management of public water supply, including monitoring of flows in distribution network, leak detection, increased household access to water and sanitation, expanded coverage and maintenance of rainwater catchment and storage systems; protection of freshwater lens, including implementation and enforcement of pollution and waste management laws and regulations; managing demand, developing policies and incentives for water conservation, and training and equipping inspectors to support water conservation and emergency measures;

- ***Infrastructure and dwellings*** – Setbacks from shoreline for new construction; use of improved construction materials; implementing and enforcing building codes and zoning laws; requiring building at raised elevation (higher foundation, building on stilts); applying traditional knowledge to housing construction; climate-proofing public services and health care facilities; and

[110] Freshwater resource adaptation measures drawn from Climate Change Vulnerability and Adaptation Workshop, February 4-5, 2009 in Majuro and USAID Report, *Adaptation to Climate Change: Case Study – Freshwater Resources in Majuro, RMI*, August 2009.

- ***Disaster risk management***[111] – Identifying infrastructure measures; adopting and awareness-raising program; strengthening drought emergency capacity; procuring emergency equipment; designing and implementing drought early warning systems; integrating disaster risk reduction into school curriculums; research on the application of traditional knowledge for risk reduction; integrating risk reduction principles into environmental permitting processes; and promoting sustainable water management and coastal zone protection.

One of the key challenges in developing adaptation strategies for low-lying islands, given storm-related threats and sea level rise, will be to determine the scale and timing of investments needed to avoid relocation. Decision-makers and practitioners must establish how far will "no regrets" options can take low-lying islands and how investments should be prioritized and sequenced.

Sunderbans

The Sundarbans is the world's largest active delta and includes the Ganges-Brahmaputra estuary between India and Bangladesh. It includes many islands that are intersected by a complex network of tidal waterways, mudflats, and salt-tolerant mangrove forests. The mangroves of the Indian Sundarbans, for instance, cover approximately 9,630 square kilometers. The Sundarbans are a hotbed of biodiversity that host the world's largest Bengal tiger population, serve as a critical nursery for many fish and shellfish species, and support the livelihoods of coastal communities. The mangrove forests help to protect coastlines from erosion and cyclones.

However, the mangroves are at increasing risk from sea level rise – as are the region's islands, some of which have already been submerged. Changes in the frequency and severity of cyclones are another impact of primary concern. A range of adaptation activities that are already being carried out include:

- ***Mangrove reforestation*** – planting appropriate species mixes in vulnerable sections of shoreline, with the objective of reducing future erosion and buffering against cyclones and storms;

- ***Climate-adaptive agriculture*** – introduction of improved and traditional varieties of salt-tolerant paddy rice in low-lying and vulnerable areas that are being affected by saline intrusion and degraded soil quality due to storms**;**

- ***Co-management of wildlife sanctuaries*** – adoption of natural resources management schemes to help reduce threats to wildlife and habitat from surrounding communities; sharing of revenues from entry fees to provide funding for community projects to promote livelihood diversification;

- ***Climate-adaptive aquaculture*** – development of appropriate technical and management inputs, including the selection of species that can survive in a broad salinity range given more frequent flooding of inland water bodies during storms;

- ***Installation of early warning systems*** – installation of tide gauges and adoption of mobile phone text messaging systems to spread early warnings, based on reliable weather data;

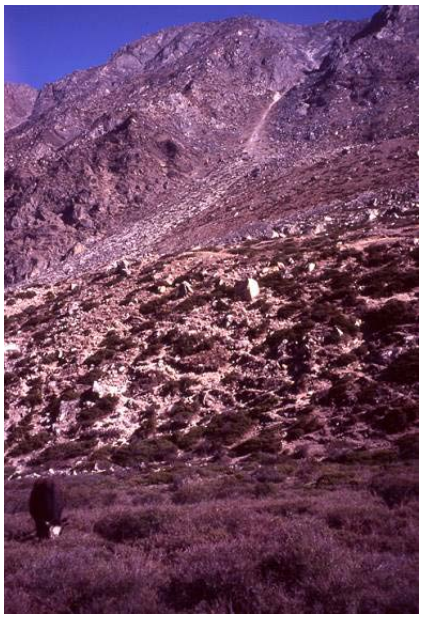
- ***Community-based disaster response*** – training and capacity building of disaster response teams within local communities through workshops, trainings, and other outreach activities; improvement of cyclone shelters and strengthening of embankments;

[111] Adaptation measures drawn from the National Action Plan for Disaster Risk Management 2008-2018, Government of the Marshall Islands, National Task Force for Disaster Risk Management, 2007.

- ***Community monitoring and capacity building*** – information-sharing and capacity building among local communities to enhance awareness of the potential impacts of climate change and to build community resilience to future extreme events; recording, analyzing, and communicating community perceptions of climate change impacts; community identification of risk, hazard, and vulnerability factors.

These adaptation measures are mostly community-based, and their overall success will also depend on improved policies and institutions at all levels, including transboundary management by the two governments. Upstream watershed management practices and new investments in water infrastructure have the potential to attenuate the potential benefits of adaptations in the Sunderbans.

Glaciated Mountains



The Himalayas hold the largest ice mass and contain more glaciers than anywhere outside the polar regions. Its "water towers" provide water and food for more than 1 billion people in the region. Its dramatic topography has produced a wide range of distinct ecological zones, making it rich in biodiversity and cultural heritage.

The Himalayas already face significant impacts from climate change, including glacial retreat, changes in seasonal snowpack, monsoonal shifts; increasing temperatures, and changes in soil which are affecting species composition and human livelihoods. Floods and wildfires have increased in recent years. Impacts on food, water, and political security could be considerable at all levels in coming decades.

Activities of WWF and its partners in the region provide some examples of important adaptation response measures, including:

- ***Modeling impacts*** of climate change on wildlife habitats and conducting research to understand impacts on biodiversity;
- Community-based ***"water watch" programs*** where local communities monitor the quality, quantity, and timing of the water flow based on simple hydrological stations;
- ***Community-based forest fire management***;
- Adoption of ***water efficient technologies*** like drip irrigation, rainwater harvesting, conservation ponds, and drought-resistant crop varieties;
- ***Improved weather data*** through installing automatic weather stations and hydrological stations in glaciers, and installing ***early warning systems***;
- ***Participatory watershed restoration*** to reduce threats from flooding and landslides, such as through bio-engineering and afforestation to stabilize slopes, and promotion of mixed-species forestry;
- Adoption of ***rotational grazing practices*** and improved livestock management to increase productivity within existing sites;

- ***Hazard and risk management of infrastructure***, such as the planned reduction of water levels when there is a risk of glacial lake outburst floods (GLOFs);
- ***Mainstreaming adaptation*** into local land-use and development plans and relevant national policies, such as National Water Plans; and
- Promoting ***high-level dialogue*** on climate change and its impacts at both sub-regional and regional levels.

4. KEY REGIONAL PARTNERS

There is a wide range of activities currently being undertaken by bilateral and other donors, multilateral development banks, international NGOs, and research and technical institutes with which USAID and other USG agencies could coordinate and partner with in the area of climate change adaptation in the Asia-Pacific region. After a brief discussion of some constraints facing regional partners in addressing adaptation challenges, this chapter provides an overview of institutional support on: data, modeling, and tools (Section 4.2); knowledge platforms and networks (Section 4.3); and adaptation financing (Section 4.4).

4.1 Key Constraints Facing Regional Partners

As a result of various stakeholders' efforts, there is more information on and greater awareness of the risks posed by climate change. However, key gaps remain, due to the fact that efforts have tended to cluster towards certain kinds of initiatives (e.g., knowledge platforms) and geographic areas.

Data and Tools

Data and tools are often not available at appropriate scales or specific to sectors, and there are significant limitations with regard to downscaled data of climate projection models, sharing of data between countries, and tools to assess the benefits and costs of adaptation measures. Despite their growing number, regional knowledge-sharing platforms and networks tend to focus on the requirements of researchers, practitioners, and experts, and on planning. A prevailing English-language bias has also limited the accessibility of knowledge platforms and networks to non-experts; there remains a need for information at different scales and in terms and languages that resonate with policymakers and other stakeholders.

Adaptation Financing

The bulk of adaptation financing has been used to carry out assessments, strategies, and pilots, rather than implementation, which can partly be explained by continued uncertainty regarding how to prioritize actions identified in assessments such as National Adaptation Programmes of Action. Moreover, the vast majority of initiatives are targeted to either the regional, national (e.g., NAPAs or other policy related activities), or community level, with very few targeting sub-national levels such as states/provinces, districts, and municipalities which play an integral role in adaptation planning and implementation. These tendencies have generally followed funding trends. As the range of adaptation tools, networks, and initiatives expands, donor coordination will become increasingly important to avoid duplication of efforts, increase complementarity and potential for leverage, and meet the needs of different stakeholders.

Private Sector Engagement

The private sector has been conspicuously absent from the adaptation arena, and yet it will likely play a key role in the development of relevant technologies and innovative financing and insurance mechanisms, particularly as climate sensitive industries (e.g., tourism, agribusiness, fishing and aquaculture, and construction) find it increasingly necessary to protect their interests from the impacts of a changing climate. Although the private sector's engagement is often recognized as important, few efforts have been made to involve it, which may partly be explained by uncertainty regarding the best means to do

so. This suggests that effective partnering between governments and the private sector may require training for both parties on how to identify and prioritize adaptation actions and how to work together to achieve adaptation goals.

4.1 Data, Modeling, and Tools

Most climate data and information tools focus on national-level vulnerability. However, vulnerability assessments and adaptation planning often require data at sub-national scales (e.g., state/provincial, local, and community), as well as data that is relevant to specific sectors and accessible to users of varying capacities. Data that address these criteria are often not readily available or accessible. Additionally, the need for downscaled data of climate projection models, which facilitates assessments of future vulnerability as well as the design and implementation of adaptation options, is not being met, partly due to weak modeling capacity in the region. Countries and institutions with the most noteworthy technical capacity in the region include Japan, Australia, China, and India, and institutes such as Southeast Asia Regional Center for Global Change System for Analysis, Research and Training (SEA-START) in Bangkok and the Delta Research and Global Observation Network (DRAGON) Institute in Can Tho, Vietnam. In addition to the general lack of appropriate data, sharing of data between countries tends to be limited, whether due to political sensitivities or logistical problems; this significantly impedes important transboundary approaches to adaptation.

Different tools are geared towards different types of audiences. As a result, those that cater to experts examining climate change issues at the global level are not relevant for local contexts and are inaccessible to the lay user, while those that are developed for general users are often more difficult to apply. In some instances, better training or instructions would improve the user-friendly nature of tools. There is also a gap in the area of tools for sector-specific experts who require guidance to facilitate the integration of climate change considerations into their work in, for instance, urban planning. In terms of risk screening and assessment tools, although a number of them exist, such as the Community-based Risk Screening Tool – Adaptation and Livelihoods (CRiSTAL), many tend to focus on the project level; to ignore how the landscape and system level changes in eco-, urban, and human systems will affect the areas in question; and to target practitioners. Consequently, risk and vulnerability screening and assessment tools at different scales that are data-relevant and capacity sensitive are lacking. Another remaining gap is adaptation assessment or decision-support tools that facilitate analysis of the true benefits and costs vs. those associated with business-as-usual, feasibility of adaptation options, and bundling of measures into strategies.

Examples of existing climate tools available for use in the Asia-Pacific region are:

Regional Tools and Platforms

- ***Forecast Mekong*** – Forecast Mekong is funded by the US Government and is part of the US Geological Survey's DRAGON partnership. It is a data integration, modeling, and visualization system with the objective of assisting various stakeholders to understand and project the impact of climate change on development projects in the Mekong River Basin. Activities include the promotion of data sharing and joint research through collaboration with institutions in Southeast Asia, the development of future sea level rise scenarios for the Delta, the demonstration of data integration and scientific visualization at the national scale, the obtainment of downscaled GCM climate data for the region, and the generation of data to monitor flood levels and vegetation.

Global Tools and Platforms

- ***Adapting to Climate Variability and Change: A Guidance Manual for Development Planning*** – USAID developed this guidance to assist missions and other partners to screen for vulnerability of development projects to climate change and to identify adaptation options.

- ***Assessment and Design for Adaptation to Climate Change: A Prototype Tool (ADAPT)*** – This multisector computer-based tool developed by the World Bank conducts a sensitivity analysis for specific projects, and is targeted to development practitioners.

- ***Climate Analysis Indicators Tool (CAIT)*** – CAIT has been developed by World Resources Institute (WRI) to serve as a climate information and analysis tool, and comprises a database of national level climate relevant indicators. There is a series of tools and indicators focused specifically on vulnerability and adaptation.

- ***Climate envelopes/adaptation risk screening platform (CIEAR)*** – CIEAR is a work-in-progress by the Stockholm Environment Institute (SEI), with the intention of being an open platform featuring a range of climate risk software tools, databases, guidance, examples/prototypes, and communications to support advisors of end users operating in various sectors at various scales.

- ***Climate Vulnerability and Capacity Analysis (CVCA) Handbook –*** The methodology presented in the CVCA Handbook is geared toward assessing vulnerability and adaptive capacity at the community level and prioritizes local knowledge in the data gathering and analysis process. Targeting project managers and field staff, local government and NGOs, and communities, the CVCA Handbook builds on CARE's Community Based Adaptation framework, and employs a series of guiding questions to analyze information at national, local government/community, and household/individual levels. The information can then be used for the design of appropriate interventions to support adaptation.

- ***Community-based Risk Screening Tool – Adaptation and Livelihoods (CRiSTAL)*** – CRiSTAL is a project-based decision-support tool developed by the International Institute for Sustainable Development (IISD), the International Union for the Conservation of Nature (IUCN), and SEI, to help project planners and managers understand the relationship between livelihoods and climate, examine a project's impact on livelihood resources significant for adaptation, and formulate adjustments for mitigating a project's impact on these key livelihood resources. It will be trialed in the Pacific through the Pacific Adaptation to Climate Change Project through SPREP.

- ***Costs to Developing Countries of Adapting to Climate Change: New Methods and Estimates*** – This World Bank resource offers estimates of total adaptation costs up to the year 2049 by region as well as by sector.

- ***Gender into Climate Policy –*** GenderCC's new toolkit for climate experts and decision-makers offers an introduction to mainstreaming gender into climate policy.

- ***NAPA Platform*** – The purpose of this platform by the United Nations Institute for Teaching and Research (UNITAR) is to provide multisector information geared to the program and project level to support parties involved in country NAPA processes, including the country teams, implementing agencies, and adaptation experts.

- ***Opportunities and Risks of Climate Change and Disasters (ORCHID)*** – An initiative of the Institute for Development Studies (IDS) in partnership with the UK Department for International Development (DfID), ORCHID is a climate risk management methodology that examines the relevance of climate change and disaster risks for an organization's portfolio of development projects.

- ***Preparedness for Climate Change*** – A process-based tool developed by the Red Cross/Red Crescent Climate Centre to assist their national societies in assessing the climate change risks threatening vulnerable people in the country and programs of the national society.

- ***PRISM*** – Software and knowledge base system by Oregon State University and ANE Associates that uses climate data inputs to generate suitability zones for various plant species in China and in Taiwan.

- ***Providing Regional Climates for Impacts Studies (PRECIS)*** – PRECIS is a regional climate modeling system developed by the UK Met office to provide regional climate information for impact assessment studies. Rather than being a decision-making tool, it is designed to facilitate climate change vulnerability and adaptation research by Annex I countries to help them meet the UNFCCC reporting requirements.

- ***Risk Screening Tool*** – The ADB's pilot risk screening tool relies on current project data, and prescreens and analyzes risk against a number of impact and risk tables and risk-related assumptions, including location in climate sensitive zones, sector risks, capacity development, and known disaster hotspots.

4.2 Knowledge Platforms and Networks

Adaptation knowledge platforms and networks tend to share certain characteristics, such as a target audience of researchers, practitioners, and experts; a focus on planning rather than implementation; and presentation of materials in English. As a result, despite the considerable number of initiatives, important gaps remain, such as platforms/networks that target regional needs at the appropriate scale, and offer information and resources in terms that are accessible to other relevant stakeholders such as policymakers and communities. There is also a need for donor coordination in order to avoid replication and to ensure that the adaptation information needs of various user communities are being met.

Examples of existing knowledge platforms and networks include:

Regional Knowledge Platforms and Networks

- ***Asia-Pacific Climate Change Adaptation Network (APCCAN)*** – Jointly hosted by the UNEP Regional Resource Centre for Asia and the Institute for Global Environmental Strategies (IGES), the network seeks to strengthen the climate resilience of human, economic, and environmental systems by: bettering the availability and accessibility of adaptation knowledge and best practices; strengthening knowledge support and advisory services to governments, planners, and practitioners; and improving the capacity of developing country institutions working on adaptation issues.

- ***Asian Cities Climate Change Resilience Network (ACCCRN)*** – ACCCRN is funded by the Rockefeller Foundation and is being implemented by ISET, Arup, ProVention, and ICLEI-Local

Governments for Sustainability. The initiative focuses on a few select cities in India, Vietnam, Thailand, and Indonesia, and seeks to: build capacity to plan, finance, coordinate, and implement strategies to improve climate change resilience; engage a wide range of stakeholders; and implement urban resilience building projects, with the aim of replicating successes in the final phase.

- ***Center for Asia-Pacific Women in Politics (CAPWIP)*** – CAPWIP is a regional NGO focused on promoting women's participation in politics and political decision-making, which also engages in various climate activities such as hosting a conference on gender and climate change with UN/ISDR in 2008 in the Philippines.

- ***Disaster Environment Working Group for Asia (DEWGA)*** – DEWGA was established in 2007 by SEI, and partners include WWF, IUCN, CARE, the Asian Disaster Preparedness Centre, and the Laboratory of International Environment and Disaster Management at Kyoto University. It is supported by the UN International Strategy for Disaster Reduction and UNEP. Its objective is to promote research, development, and capacity building to reduce vulnerability and build resilience to disasters in Southeast Asia.

- ***Regional Climate Change Adaptation Knowledge Platform for Asia (RCAKPA)*** – UNEP has recently launched the Platform, a three-year initiative that aims to: (1) establish a regional system for synthesizing and sharing knowledge on adaptation to climate change, (2) generate new knowledge, and (3) facilitate the application of both existing and new knowledge about climate change in Asia at the regional level. RCAKPA endeavors to address country needs and demands by way of a bottom-up needs assessment and an analysis determining the gaps in knowledge, which it then tries to fill. The program has been funded by the Swedish International Development Cooperation Agency, and UNEP is implementing it in conjunction with SEI and the Swedish Environmental Secretariat for Asia. In its first phase (2009-2012), RCAKPA will cover 13 countries in Asia, including Cambodia, China, Lao, Myanmar, Thailand, Vietnam, Bangladesh, Indonesia, Malaysia, the Philippines, and Sri Lanka.

- ***University Network for Climate and Ecosystems Change Adaptation Research (UN-CECAR)*** – An initiative of the UN University, the network seeks to build adaptive capacity in the Asia-Pacific region by assisting higher education and research institutions in filling existing gaps pertaining to adaptation educational and research programs.

Global Knowledge Platforms and Networks

- ***Adaptation Learning Mechanism (ALM)*** – The ALM is a collaborative knowledge-sharing platform funded by the GEF, the Swiss Agency for Development and Cooperation, and the Institut de l'Énergie et de l'Environnement de la Francophonie, and is being implemented by the United Nations Development Programme/GEF, in partnership with the World Bank, the Secretariat of the UNFCCC, and UNEP. The ALM seeks to develop resources to support adaptation practices; integration of adaptation into development policy, planning, and operations; and capacity building.

- ***Advancing Capacity to Support Climate Change Adaptation (ACCCA)*** – ACCCA uses pilot projects to build capacity to identify and prioritize climate risks of concern; assess available knowledge about risks and adaptation opportunities; develop risk communications materials for use in stakeholder forums to facilitate the formulation of recommendations; and identify critical knowledge gaps and design assessment activities to generate the needed knowledge. It is jointly managed by Global Change System for Analysis, Research, and Training (START), UNITAR, the

Climate System Analysis Group of the University of Cape Town, and Environmental Development Action in the Third World.

- ***Assessments of Impacts and Adaptations to Climate Change in Multiple Regions and Sectors (AIACC)*** – The AIACC funds collaborative research, training , and technical support to strengthen developing countries' ability to assess climate change vulnerabilities and adaptations, and provide informational support for the design and implementation of adaptations. It was developed in collaboration with UNEP and World Meteorological Organization and the Intergovernmental Panel on Climate Change (IPCC), and is financed by the GEF, with collateral funding from USAID, US Environmental Protection Agency (USEPA), the Canadian International Development Agency, and the World Bank.

- ***Capacity Strengthening of Least Developed Countries for Adaptation to Climate Change (CLACC)*** –CLACC is a network of fellows working on climate change issues and aiming to build the capacity of civil society in 15 LDCs, including three in South Asia, working to improve adaptive capacity amongst the most vulnerable groups, to establish a climate change information and knowledge system, and to mainstream the NAPA process. The initiative was begun by the International Institute for Environment and Development (IIED), and now has several international and local partners, including SEI, the Bangladesh Center for Advanced Studies, CARITAS Bangladesh, and Rangpur Dinajpur Rural Service Bangladesh.

- ***CLIMASCOPE*** – This web portal that is being developed by the Tyndall Centre for Climate Change Research will be geared towards the needs of adaptation planners and will offer access to projected potential local and regional climate changes and possible impacts.

- ***Climate and Development Knowledge Network*** – The network is an initiative of the UK Department for International Development, whose objective is to support better adaptation planning and policy-making through the provision of up-to-date information in relevant terms, high priority research and analysis, technical assistance, and partnerships to strengthen developing country research capacity and the international climate knowledge system.

- ***Ecosystems and Livelihoods Adaptation Network (ELAN)*** – ELAN is a global ecosystem-based adaptation network being developed by IUCN and WWF in order to build capacity; accelerate application of existing knowledge, create new knowledge and additional adaptation options, and inform national, regional, and international bodies about adaptation needs and solutions. It is intended to link the science, practice, and policy of ecosystem management that underpins sustainable adaptation to climate change, and to link the ecosystem-focused adaptation efforts of the global conservation community. ELAN will explicitly collaborate with and support existing initiatives, linking those elements that have an ecosystems perspective and bring an ecosystems perspective to those that currently do not.

- ***GenderCC – Women for Climate Justice*** – This platform seeks to draw greater attention to the nexus between climate change and gender, and to serve as a clearinghouse for information on the topic.

- ***GRID-Arendal –*** An official UNEP collaborating centre, GRID-Arendal aims to support environmental decision-making through environmental information management and assessment, capacity building, as well as tools, methodologies, and products for awareness-raising.

- ***Partnership for Environment & Disaster Risk Reduction (PEDRR) –*** PEDRR is a global forum seeking to promote an integrated approach to disaster risk reduction, adaptation, ecosystem

management, and livelihoods, and to facilitate the translation of policy into practice. The forum is coordinated by UNEP, with partners including IUCN, WWF, and SEI.

- ***weADAPT*** – weADAPT is a collaborative platform for adaptation developed by SEI and others. It features up-to-date information on vulnerability and tools for screening adaptation options to manage current and future climate risks for analysts and decision-makers.

4.3 Adaptation Financing and Implementation

Financing Needs, Trends, and Projections

Estimates of the costs of adaptation in developing countries range from $10 to $150 billion annually.[112] A recent World Bank study has estimated that for East Asia and the Pacific, the total annual costs of adaptation will go up from $22.7 billion in 2010-19 to $27.3 billion in 2040-49 under the NCAR "wet" scenario, and from $16.4 billion to $21 billion under the CSIRO "dry" scenario during the same period. In South Asia, costs are expected to increase from $10.1 billion to $14.3 billion under the "wet" scenarios in 2010-19 and from $11.9 billion to $15.3 billion under the "dry" scenarios in 2040-49.[113]

In recognition of these costs, donors and multilateral development banks have provided funding and support for a range of adaptation activities. Most of the adaptation financing available to date has been for assessments, strategies, and pilots, and *not* adaptation implementation. (See Annex E for a more comprehensive list of funding and initiatives.) This stems partly from the fact that although assessments and strategies such as the National Adaptation Programmes of Action under the UNFCCC have facilitated determination and articulation of adaptation priorities, they have rarely resulted in a clear expression of how to *act* on these priorities, which has impeded national and sub-national governments as well as other stakeholders from implementing adaptation options. Insufficient follow-up financing has also contributed to the slow progress on adaptation implementation. In addition, similar to the arena of tools development, the numerous assessments and other activities taking place necessitate greater coordination of efforts at different levels and amongst donors, multilateral development banks, and organizations, potentially through agreement on and/or development of common guidelines, methodologies, and indicators.

The GEF-5 replenishment will have a strong adaptation focus, and the commitment under the Copenhagen Accord by developed countries to mobilize $100 billion a year by 2020 to assist developing countries cope with the effects of climate change. As donors and recipient countries prepare to move beyond NAPAs and other similar processes into a more strategic and programmatic phase, long-term sustainable financing and new aid delivery methods such as budget support and micro-finance will become increasingly important to consider. The latter has been forwarded recently as a means to target the most vulnerable and impoverished communities by leveraging microfinance organizations' existing networks, particularly those from the portions of their portfolios overlapping with adaptation.[114] The distribution of adaptation funds through microfinance mechanisms would also enable poor recipients to directly access and manage adaptation funds.

[112] ADB *Under the Weather and Rising Tide* 2009; World Bank 2006; Stern 2006; Oxfam 2007.
[113] Billion dollars are in 2005 prices. World Bank *The Costs to Developing Countries of Adapting to Climate Change–New Methods and Estimates: The Global Report of the Economics of Adaptation to Climate Change Study Consultation Draft.*
[114] OECD 2010.

Barriers to Financing

Despite the numerous adaptation initiatives and capacity building to date, a number of barriers to adaptation planning and implementation remain. Rather than financing itself being a barrier, absorptive capacity may become an issue. As identified in Chapter 3, these include a poor understanding of adaptation concepts; weak capacity to translate and apply climate data, develop and assess adaptation options, and to navigate donor funding processes; and gaps in the range of tools available.

In terms of both understanding and capacity, capacity is particularly lacking at the sub-national level. This is largely due to the fact that although the range of adaptation activities undertaken by donors and the multilateral development banks is broad, much of the funding offered by these two groups has been for initiatives targeted at the national or community levels. For instance, many of the strategies and assessments conducted under the UNFCCC have been carried out at the country level, while pilot and demonstration projects are carried out at the local level.

Even in instances where efforts are made to engage simultaneously at various levels to support the development of adaptation strategies or to implement pilot projects, such as under the EU's Global Climate Change Alliance which aims to facilitate mainstreaming of climate change at the national level, subnational governments are often bypassed. There are a few exceptions such as the Australian Agency for International Development (AusAID) Mekong Delta Vulnerability and Adaptation Initiative, which seeks to improve understanding of climate change impacts and adaptive capacity at the province level in 12 provinces of the Mekong Delta, and the Rockefeller Foundation's ACCCRN, which takes an integrated approach to risk assessment and the development of adaptation options at the municipal level in a select group of Asian cities. This also tends to be true in the NGO sphere – due to their nature, international NGOs are better geared for national or local initiatives, while local NGOs are often focused on community-level initiatives.

Access to available project funds has been problematic for some countries, because application processes vary by funder, and because country capacity to navigate processes and to write effective proposals and project design documents is frequently insufficient, partly due to a weak understanding of how to design adaptation projects. Moreover, as the cadre of knowledgeable adaptation specialists is often small and their time is limited due to competing demands, they are not always readily available to provide inputs for applications. The issue of accessing funding in the Asia-Pacific region is likely to take on greater importance as the adaptation funding increases in recognition of the high costs

Examples of existing financing and implementation mechanisms include:

Regional Platforms

- ***Asia Pacific Economic Cooperation (APEC)*** –APEC has a number of climate change initiatives including a Climate Change Center geared toward assisting its member countries apply climate information and prediction techniques to protect their economies from the impacts of climate change.

- ***Association of Southeast Asian Nations (ASEAN)*** – ASEAN is in the process of developing a climate change action plan, which will include consideration of adaptation challenges, such as food security, risks associated with infrastructure, and natural resources.

- **South Asian Association for Regional Cooperation (SAARC)** – Although adaptation is one of the six thematic areas of SAARC's regional action plan on climate change, and priorities

include promotion of the exchange of climate change data and information, they do not yet have any climate change adaptation initiatives in place.

UNFCCC

- ***Least Developed Countries Fund (LDCF)*** ($172 million) – The purpose of the LDCF is to support the NAPA process in LDCs and is administered by the GEF. It also provides financing for adaptation projects ($35 million from the LDCF and SCCF), often building on NAPA processes, many of which are supported by UNDP.

- ***Special Climate Change Fund (SCCF)*** ($90 million) – The SCCF was established in 2001 to finance projects in the following areas: adaptation; technology transfer and capacity building; various economic sectors including industry, agriculture, forestry, and waste management; and economic diversification. The SCCF is helping to finance the Pacific Adaptation to Climate Change Project ($58 million), which will implement long-term adaptation measures to strengthen resilience in the key sectors of water resources management, food production and security, and coastal infrastructure. UNDP is the supporting agency.

- ***Adaptation Fund*** – The Adaptation Fund was set up to fund adaptation activities in developing countries party to the Kyoto Protocol, and is financed by 2% of Certified Emission Reductions proceeds from CDM transactions.

- ***Strategic Priority on Adaptation (SPA)*** ($50 million – fully obligated) – The SPA was created within the regular GEF Trust Fund to finance pilot and demonstration projects addressing local needs and resulting in global benefits in GEF focal areas.

Multilateral Development Banks

- ***ADB*** – The ADB's Climate Change Fund (initially $40 million) will fund mitigation and adaptation support.

- ***ADB, World Bank, and bilateral donors*** – the Climate Investment Fund ($6 billion pledged) is funded by donations from the World Bank, ADB, and bilateral donors. It has two funds and four financing windows, including a financing window for the Pilot Program for Climate Resiliency, for an estimated $500 million. Vietnam, the Philippines, and Thailand were recently awarded $800 million for energy efficiency and renewable energy activities.

Donors

- ***Japan International Cooperation Agency (JICA)*** – JICA established the Cool Earth Partnership ($10 billion, including $2 billion for adaptation and clean energy) to provide grant aid, technical assistance, and aid through international organizations for adaptation and clean energy activities to developing countries striving to achieve "green" economic development. In the area of adaptation, the funds aim to assist developing countries take adaptive measures. Adaptation support includes grants through the Grant Aid for Environment and Climate Change and technical assistance directly to countries or through international organizations. Grants are targeted for policy reform and project implementation. Agreements under the Cool Earth Partnership include a $300 million Climate Change Program Loan for Indonesia, to be used for forestry, integrated water resource management, and energy and commercial sectors. JICA has also pledged $1.2 billion to the Climate Investment Fund.

- ***AusAID*** – AusAID is investing A$150 million (A$25 million for bilateral adaptation activities) over 3 years in the International Climate Change Adaptation Initiative (ICCAI), which is focused on helping Australia's vulnerable neighbors meet priority adaptation needs through development assistance. The initiative consists of four interlinked components: improved scientific information and understanding; vulnerability assessments; implementing, financing, and coordinating adaptations; and multilateral support for adaptation. Activities currently being implemented include: the Pacific Climate Change Science Program (A$20 million, 2009-2011), the Asia-Pacific Community-based Adaptation Small Grants Program (A$6 million, 2009-2013, including approximately A$4 million for Pacific Island countries and East Timor), the Pacific Future Climate Leaders Program (A$3 million, 2010-2011), and the Mekong Delta Vulnerability and Adaptation Initiative (Australia's contribution A$1.14 million, 2009-2010). AusAID and the Asian Development Bank are also providing $1.3 million in technical assistance grants to Vietnam to support an assessment of the climate change threats to the country's Mekong Delta region and of potential adaptations. In addition, AusAID is providing $3.5 million to the Mekong River Commission to support the development and implementation of adaptation strategies through the Climate Change and Adaptation Initiative (CCAI); the total budget for the CCAI through 2015 is $15 million.

- ***Government of Spain*** – Millennium Development Goal (MDG) Challenge Fund is funded by the Spanish government/UNDP (€528 million, 2007-11) and implemented through UN agencies such as UNDP, UNICEF, and FAO. One area of focus is climate change, particularly environmental and natural resources management for the promotion of rural development and food security. Climate and environment programs are focusing on capacity building being implemented in China (China Climate Change Partnership Framework) and the Philippines (Joint Programme on Strengthening the Philippines' Institutional Capacity to Adapt to Climate Change).

- ***European Union*** – The purpose of the Global Climate Change Alliance (€50 million, 2008-2010, including access to €100 M for climate change and €100 M for disaster risk reduction) is to help the most vulnerable developing countries increase their capacity to adapt to the effects of climate change in support of the millennium development goals. The program will focus on five priority areas: measures for adaptation to climate change including NAPAs, reducing emissions from deforestation and forest degradation (REDD) in developing countries, the Clean Development Mechanism (CDM), DRR, and poverty reduction strategies and programs.

- ***UNDP*** – UNDP is currently supporting the implementation of a number of adaptation projects financed with more than $35 million from the LDCF and SCCF, and has leveraged more than $70 million in co-financing from the UN and other partners. Many of these initiatives have been built on their past engagement in supporting the NAPA process and National Communications to the UNFCCC. They also have initiatives seeking to promote donor coordination with a focus on strategic priorities, as in the Cambodia Climate Change Alliance.

5. KEY CONSIDERATIONS FOR REGIONAL ADAPTATION PROGRAMMING

The assessment team has identified several elements of regional adaptation programming that will be key to achieving success. In addition, the assessment team documented priority sectors and geographic areas as well as strategic opportunities for partnerships and coordination with existing initiatives.

5.1 Options for Addressing Adaptation Challenges in the Asia-Pacific Region

Adaptation activities most suited to the Asia-Pacific region are divided into five categories: (1) guidance and tools; (2) capacity building; (3) education and awareness; (4) regional networks and knowledge sharing platforms; and (5) research.

Guidance and Tools

Guidance and tools[115] can be developed (or adapted) and promoted at the regional level. These tools should be useful in facilitating vulnerability assessments and the assessment and design of adaptations and should be developed at a level of detail suitable for replication across the region.

A considerable amount of effort has already been invested in developing vulnerability and adaptation tools globally and within the Asia-Pacific region. The starting point for tool development in the region would be a two-pronged assessment of on-the-ground needs and capacity, combined with a review of appropriateness and potential for direct or tailored use of existing tools. Some important considerations in the development of tools include the following:

- Are tools scaled to the appropriate level at which assessments need to be conducted and decisions taken on adaptation measures or strategies? Scales might include national, provincial, local, ecosystem, community, or sector.
- Do tools promote or incorporate participatory processes into their design? Do they facilitate the development of local capacity and the capture of local knowledge?
- Are tools data-dependent? Can they be applied if data are limited or variable in quality?
- Are tools flexible, sensitive, and appropriate to differences in human capacity and financial resources?

[115] For a detailed review of methods and tools, see UNFCCC, *Compendium on methods and tools to evaluate impacts of, vulnerability and adaptation to, climate change* (2008) http://unfccc.int/adaptation/nairobi_work_programme/knowledge_resources_and_publications/items/2674.php

Climate Impact Guidance and Tools

A first step in assessing vulnerability to climate change and variability is to understand the basic climate science and expected impacts. This involves explaining the climate science and anticipated climate change impacts in lay terms for decision-makers and civil society. It is important for such guidance to explain how global circulation models (GCM) work, the scale of data used in these models, the differences between models, and the uncertainty inherent in the results. It is important to help people understand the limitations of the models and the implications for vulnerability assessments. Downscaling[116] of regional GCM results to local levels represents a useful tool for refining the understanding of the directional change and magnitude of climate impacts, but involves computational costs and does not reduce the uncertainty inherent in GCM models. Such guidance should provide practical recommendations for interpreting climate impacts, assessing benefits and costs of adaptation measures, and monitoring climate trends.

Groups such as SEA-START already have the capacity to downscale regional GCM results and have conducted such work in the Mekong River Basin. The Tyndall Climate Change Centre in the United Kingdom recently launched a new web portal that will provide access to projections of potential future local and regional climate changes and potential future climate impacts.[117] Teams in a number of countries are building GCMs which use considerably more data points and will not require downscaling. These models are expected to be available for review in 2010 or 2011.

Vulnerability Assessment Tools

The assessment of vulnerability has evolved from initially involving general guidance on vulnerability concepts and process to further refinements that feature detailed step-by-step tools, often combined with electronic spreadsheets (e.g., CRiSTAL). Much of this development has been supply-driven and ad hoc, and tools are rarely sophisticated enough to address important linkages between vulnerabilities at different spatial scales (e.g., community, landscape, basin). If these tools are to be used, they need to be responsive to the local needs of practitioners and decision-makers in the region and designed to address the issues raised at the beginning of this section.

Adaptation Assessment Tools

In reviewing NAPAs and other adaptation strategy documents, it is clear that assessment of adaptations both in terms of the evaluation of strengths and weaknesses of individual measures and comparative analyses of measures and priorities has involved a range of criteria and evaluation and prioritization processes. There is a need for adaptation assessment tools (or guidance) that provides users with a range of evaluation criteria, processes, and illustrations. Such guidance or tools should be adaptable to both sector- and geographically-focused adaptation planning, help users select individual measures, and bundle measures into strategies while accounting for capacity and resource constraints.

Guidance on Mainstreaming Climate Change

Mainstreaming or integrating climate change concerns into existing and proposed sector and geographically-focused plans and strategies has been identified as a priority throughout the region and is referred to as mainstreaming, climate-proofing, and climate resilience. Guidance should cover a range of plans and mainstreaming at both the national and sub-national levels, and should provide practical

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[116] Downscaling climate data involves mathematical or statistical procedures for generating locally relevant data from global circulation models (GCMs) or regional GCMs. Previous GCMs have been constructed with a limited number of data points, often separated by thousands of miles and significantly different climate regimes. Downscaling involves procedures to estimate future changes in range of climate variables on a smaller geographical scale. See, for example, http://www.climate-decision.org/2_Downscaling%20Climate%20Data.htm.

[117] National Climate Change Adaptation Research Facility Seminar Series Announcement, July 2009 www.isr.qut.edu.au/downloads/nccarf_price&warren_speci.pdf.

examples of mainstreaming and links to other guides. For example, USAID has supported the development of guidance for mainstreaming climate concerns into local coastal resource management plans in the Marshall Islands (Reimaanlok).

Guidance on Developing Adaptation Strategies

Countries in the region will likely be incentivized to prepare national adaptation strategies to access donor resources. A number of concerns have been raised on content, process, ownership, and integration of the NAPA process as well as coordination of adaptation strategies with other development and management plans and strategies. Therefore, it is now an ideal time to develop guidance to facilitate preparation of national adaptation strategies and pilot alternative strategy designs and processes.

Guidance and Tools on Evaluation of Adaptations

While there has been considerable effort focused on the ex ante assessment of adaptations,[118] less attention has been centered on methods for evaluating adaptations that have been implemented. There is a need to develop methods for evaluating adaptations at the project, program, and strategic levels.

Capacity Building

In examining opportunities for regional capacity building, three design issues need to be addressed (see Table 5.1):

- What types of organizations and staff should be targeted for capacity building?
- What mechanisms are appropriate for delivering capacity building activities?
- What types of regional capacity building activities are needed?

Capacity building audience/beneficiaries

- ***Climate adaptation practitioners*** – Regional capacity building should strengthen skills of practitioners in the region to sustainably promote cost-effective and efficient delivery of training and technical assistance. In many cases, practitioners will have expertise in technical areas besides climate V&A and will be acquiring V&A skills.
- ***Public and private managers of natural resources*** – Improved management of terrestrial, coastal, and marine resources represents an effective option for increasing adaptive capacity and supporting the potential role of ecosystems in adaptation. Managers of these resources need to understand and develop the capability to assess vulnerability and integrate adaptation measures into their resource management plans (see box on next page).
- ***Sector planners and decision-makers*** – These stakeholders are in key positions to mainstream climate concerns into policies, programs, projects, and plans.
- ***Private sector*** – In making investments in livelihoods, business development, and infrastructure, and carrying out similar activities under government contract, the private sector (e.g., insurance, construction, agri-business, tourism, and transport industries) would benefit from an understanding of V&A basics and the concepts of climate-proofing and climate resilience.

[118] For example, the World Bank and the Governments of the UK, Netherlands, and Switzerland, have developed a methodology for assessing the economics of adaptation to climate change. See the World Bank's *The Economics of Adaptation to Climate Change, Final Methodology Report* (February 2009).

- ***USAID regional and bilateral missions*** – With anticipated increases in funding for adaptation activities, USAID missions should have the capacity to integrate V&A elements into program and project design.

Adaptation Training for Land Managers

PORTLAND, Ore. December 10, 2009. USDA Forest Service Research and Development has released an interactive short course that presents current scientific knowledge on adapting to climate variability in wildland management. Titled "Adapting to Climate Change: A Short Course for Land Managers," the course is available as a DVD or online at the Climate Change Resource Center (http://www.fs.fed.us/ccrc). The self-paced course provides an up-to-date synthesis of scientific and technical information and can help resource managers and decision-makers plan for future climate-driven uncertainties. It is organized around three central themes: climate variability and projections, ecological responses to climate variability, and management responses to climate variability.

Capacity building mechanisms

- ***Training-of-trainers*** – A key to sustainability is the transfer of training capabilities to regional organizations and practitioners. Training-of-trainers would involve training adaptation practitioners to deliver courses and provide side-by-side technical assistance in the region.

- ***Training workshops*** – Training workshops are the most common method of building capacity but need to be combined with practical applications to maximize their effectiveness. A key lesson learned from V&A training is that assessment and design training material is better received if trainees can apply the training directly to their concerns issues and technical needs (e.g., design project, mainstream climate into a sector plan, develop a strategy).

- ***Technical assistance*** – Technical assistance helps address practical design and implementation problems, often identifying gaps in the recipient's understanding of V&A. Technical assistance is most cost-effective if provided by practitioners in the region or country.

- ***Technical assistance facilities*** – These include centers, programs in regional research institutes, and university or donor-funded projects that are equipped to respond to a range of capacity building and technical assistance needs.

All of these options are most effective when delivered with technical guidance, tools, and resources.

Regional capacity building activities

- ***V&A assessments*** – During a number of regional consultations, participants indicated a need to build up national and local capacity to conduct V&A assessments in support of strategy development, mainstreaming, and project design (including climate-proofing). As noted in the previous section, there is a need for guidance and tools that are appropriate to the scale of assessments and availability of data and information.

- ***Mainstreaming V&A into resource management and other sector plans*** – In most countries, economic development is implemented through national development strategies and sector plans. In the assessment team's review of NAPAs, other strategy documents and Pacific Adaptation to Climate Change (PACC) Reports for several Pacific nations, it has been noted that climate change has not been taken into account in strategies and management plans. Much of the demand to conduct V&A assessments and ensure that strategies and plans are climate-resilient will be mandated in government policies and/or driven by incentives to access donor technical assistance and adaptation funds. One important opportunity for mainstreaming is to find ways to better connect ADB, World Bank, and JICA large-scale investments in infrastructure and major development projects in the region to adaptation planning efforts.

- ***Strategy development*** – Adaptation strategies articulate priorities for implementating adaptation options and building supporting capacity. Although many decision-makers are aware of the benefits of developing adaptation strategies and integrating adaptation into economic development programs, the potential for receiving donor support will provide a greater short-term incentive for preparation of adaptation strategies. To date, NAPAs prepared by less developed countries worldwide have been the primary mechanism for enumerating adaptation priorities. In preparing NAPAs, countries have expected that funding for project implementation would follow the NAPA process, so these documents include the elaboration of project descriptions. As noted previously, funding for implementation has been sluggish and demand for assistance to develop adaptation strategies is not likely to increase until there is clear evidence that adaptation funding is flowing. There is an opportunity to learn from the NAPA process and develop adaptation frameworks and processes that are flexible and can be tailored to the unique institutional structures of countries in the region to facilitate coordination, networking, and information flows.

- ***Project/program preparation, design, and financing*** – Assistance at the national and local level is needed to write proposals and apply for adaptation financing, design projects and programs, and to monitor implementation. As noted in Chapter 4 and Annex E, a number of donors (e.g., JICA, AusAID, Spain/UN MDG Challenge Fund, etc.) have recently established financing mechanisms for adaptation projects. Donors are also working to mobilize billions of dollars for adaptation (per commitments at the UNFCCC Conference of Parties in Copenhagen in December 2009). While some of the funding will be in the form of commercial or concessional loans, the G-77 countries have lobbied for grants for adaptation. Ideally, development of in-country capacity would be developed and then applied to these tasks, but adaptation funding is expected to be widely available before capacity realistically can be built. This necessitates urgent, targeted project and program preparation to ensure that countries can access resources effectively. Project preparation can be conducted in parallel with capacity building, however, particularly if it involves side-by-side technical assistance with local or regional practitioners.

Table 5.1 Capacity Building Opportunities

Capacity Building Activity	Target Audience	Delivery Mechanism
V&A Assessments Mainstreaming V&A Strategy Development	▪ Asia-Pacific climate adaptation practitioners ▪ Public and private resource managers ▪ Sector planners and decision-makers ▪ USAID regional and bilateral mission staff ▪ Private sector	▪ Training-of-trainers ▪ Technical assistance
▪ Project Preparation	▪ Asia-Pacific climate adaptation practitioners	▪ Training-of-trainers ▪ Technical assistance ▪ Technical assistance facilities
	▪ Public and private resource managers ▪ Sector planners and decision-makers ▪ Private sector	▪ Technical assistance facilities ▪ Training workshops ▪ Side-by-side assistance

Education and Awareness Building

Adaptation can be viewed as a process of capacity building and iterative learning and it is important that education and awareness on climate impacts and V&A be integrated, sequenced, and targeted to ongoing adaptation planning and implementation. Because local political, economic, social, and cultural context is important in determining how messages are stated and delivered, most education and awareness programs should be adapted and implemented locally. There may be opportunities for USAID to support education and awareness activities on a regional scale. Ideally, these activities should be innovative, replicable, and sustainable. In ramping up the regional adaptation program, there may be opportunities to develop immediate, demand-driven education programs that can be piloted on the local level and integrated into a regional education and awareness program. For example, two needs for education and awareness identified during consultations were:

- Awareness training in Vietnam, targeted for environmental officers[119] in national, provincial, and local governments on basic climate change issues and solutions; and
- Writing workshops for regional journalists, conducted by leading journalists who write on climate adaptation topics.

These education and awareness activities might be conducted on a one-time basis or if demand is significant, replicated by regional partners. Another demand for education and awareness activities that is ubiquitous and could be sustained by regional universities is curriculum development that includes explicit consideration of climate impacts, vulnerability and adaptation assessments, and analytical tools. Targets for curriculum development would be engineering, life sciences, and social sciences. Such programs would be helpful in preparing a cadre of practitioners to respond to the regional capacity for V&A expertise to assess, design, and implement adaptation measures and strategies.

Regional Networks and Knowledge Sharing

As discussed in Chapter 4, considerable resources have been invested in the development of networks and knowledge sharing worldwide and within the region. Much of this effort focuses broadly on all aspects of climate change, including mitigation, sequestration, and adaptation. An opportunity exists to address adaptation knowledge sharing gaps and improve regional targeting of adaptation information and lessons learned.

Two types of gaps exist in the adaptation knowledge base for the Asia-Pacific Region—comprehensive annotated lists of adaptation projects, and technical information on adaptation options (technical descriptions, assessments, implementation experience). This report provides a starting point for addressing these gaps, but new developments are occurring rapidly; successful adaptation programming will require continuous coordination with regional organizations to stay up-to-date.

Adaptation planning would benefit from the convening of an annual adaptation forum in the region, incorporating thematic meetings with technical sessions, case studies, break-out groups offering side-by-side assistance, private sector, and NGO exhibits. The forum would bring together a broad range of regional stakeholders like the Asia Clean Energy Forum. To date, although the private sector has been

[119] As one of the reviewers of this report noted, the "need," if not the demand, for awareness training is probably greater in other sectors besides the environment. Environmental officials have been more heavily involved in UNFCCC workshops and negotiations and have a basic familiarity with climate change and adaptation terms. If climate issues are to be mainstreamed into sector and geographically-based planning, a broad-based awareness program will be needed among public and private sector organizations and civil society.

very much in the background of adaptation planning and implementation and largely absent at international workshops and events, it will be affected by climate change and tasked to help find and implement solutions to climate problems.

Research

Practical research on vulnerability and adaptation presents the opportunity to investigate and address a number of important issues:

- Development of vulnerability assessment methodologies that are appropriate to regional needs, can practically inform adaptation planning, and incorporate different scales, sectors, and impacts.
- Development of integrated adaptation frameworks that advance understanding of the integration of approaches such as ecosystem-based adaptation with national, community, and sector approaches.
- Development of frameworks that integrate disaster risk management with national, community, and sectoral approaches.
- Analysis of the impacts of climate change on water and food security in the region, looking at potential responses and linkages with migration.
- In-depth analyses of the efficacy and costs of adaptation measures, analysis of hot spots, or thematic applied research on the costs and benefits of contentious problems such as relocation. Autonomous adaptations merit additional analysis in terms of their potential role in adaptation strategies, in part because they represent a significant proportion of currently implemented adaptations, and in part to better inform debates on their worth as "no regrets" adaptations or maladaptations.

Mechanisms for delivery of research include collaboration with regional research institutes and universities, incorporating a research component into the center of excellence currently in the assessment phase, or the creation of a multi-partner panel to coordinate related research activities. One specific idea promoted by START and endorsed by Mekong River Commission (MRC) is to establish a Mekong Panel on Climate Change (MPCC), which would be a smaller "cousin" to the IPCC. It would promote research and knowledge sharing on climate change science, impacts, and adaptation in the region, and eventually would provide the region a stronger voice in international forums. It would also allow the governments and other institutions in the region to rely less on foreign aid and outside technical support.

5.2 Key Elements of Regional Programs and Activities

Table 5.2 below lists key issues that should guide the evaluation of adaptation activities and the design of regional adaptation initiatives.

Table 5.2 Design Issues

Issue	Description
Regional replication	Promote regional cooperation, strengthening of regional institutions and platforms, and regional sharing and exchanges of best practices and lessons learned (such as between countries on bilateral efforts/projects).
Lessons learned	Lessons should be evaluated, compiled, and communicated to regional partners.
Program consistency and coordination	Activities should be consistent with USAID climate change priorities and strategies and coordinated with programs implemented by other USAID missions, United States Government agencies, and other donors.
Manageable interests	Regional programming should be matched to the manageable interest of USAID. Specifically, costs of options, staff capacity, timeframes, and overall regional strategic priorities will need to be considered.
Portfolio options	In taking a holistic approach to adaptation programming, a number of tradeoffs must be considered: ▪ **Diversified vs. focused** – a diversified portfolio is riskier but facilitates testing of assistance options while more focused portfolio may be more successful ▪ **Sectoral vs. integrated** – most adaptation work is at the sector level but there are advantages of focusing on place-based activities with climate impacts considered for a number of sectors ▪ **Targeted vs. comprehensive** – targeted activities address narrower set of objectives, but can often be achieved more quickly and at lower cost than comprehensive activities ▪ **Short-term vs. long-term climate impacts** – sustainable solutions take longer than government budget cycles or political trends ▪ **Quantitative benefits vs. improved adaptive capacity** – it is necessary to consider tradeoffs between opportunities to achieve measurable results (lives saved, damage avoided, livelihoods improved) vs. planning, policy reform, and capacity building activities

5.3 Priority Adaptation Areas of Focus

An adaptation intervention is described in USAID's V&A approach as an activity that involves one or more steps designed to address climate impacts in specific development sectors or geographic areas. Priority economic sectors for the Asia-Pacific region include:

- Agriculture and food security;
- Human settlements and infrastructure (water and non-water);
- Forests and other ecosystem biodiversity;
- Resource-based livelihoods (fisheries, aquaculture, and tourism);

- Disaster management; and
- Health and sanitation.

Although considerable adaptation work has been conducted at the sector level, the assessment of vulnerability and development of adaptation strategies on a geographic basis provides an opportunity to integrate climate impacts and solutions across economic sectors; promote ecosystem-based approaches that may have multiple benefits for different sectors; and avoid maladaptive responses to individual impacts or vulnerabilities. Specific geographic areas of interest include:

- Watersheds, glacial and river basins, and river deltas;
- Terrestrial, coastal, and marine ecosystems (terrestrial and marine);
- Regional economic alliances, nations, and sub-national jurisdictions; and
- Urban areas, cities, communities.

The types of V&A activities that might be undertaken as interventions for either geographically-focused or sector-based adaptation include:

- Vulnerability assessments and hazard/risk mapping;
- Adaptation identification and assessment;
- Detailed design and implementation of new adaptation projects, policies, plans, or strategies;
- Mainstreaming climate concerns and adaptation measures into existing projects, policies, plans, or strategies;
- Climate-proofing of infrastructure investments; and
- Promoting climate resilience.

Sector and Adaptation Priorities

Much of the adaptation work in the region has been concentrated on addressing climate issues in specific sectors. Continued sector-level analysis and design is important in determining what assets are valued and at risk and in gleaning lessons learned from the implementation of specific climate change adaptations. Illustrative adaptation options for priority sectors are briefly described below.

Water Resources (Cross-Cutting)

Adaptations in the Asia-Pacific region will be needed to ensure secure supplies of water resources. As discussed in Chapter 3, water resources is a cross-cutting priority that needs to be integrated into adaptation planning for most economic sectors because of its importance to agriculture; municipal, commercial and industrial users; hydropower development; and environmental water flows for ecosystems and biodiversity. Options will include improved planning and management of water resources; development of additional or alternative supplies both to augment current supplies and meet demands during emergencies; and implementation of policies and best practices to encourage more efficient utilization in industry and agriculture and conservation of water among households, government, and business; greater use of multi-objective decision support systems and river basin

allocation models and restoration of natural flood control and water storage systems; and payment for environmental services for more sustainable water resources management.

Agriculture, Aquaculture, Fisheries, and Food Security

Throughout the Asia-Pacific region, agriculture faces one or more of three major problems: drought, salinity, and lack of capacity to adapt to chronic and acute shortages of food and manage food distribution. Adaptation options to address drought issues may include identification and application of water/temperature resilient varieties, crop substitution, improved soil management, and development or improvement of irrigation systems. To address salinity issues in salt-sensitive crops such as rice, breadfruit, and taro, adaptations will mainly focus on the development of salt-tolerant varieties; small-scale cultivation of breadfruit and taro will be protected by raising beds and protection soil and plants from salt spray. Livelihood diversification options include animal husbandry, tourism, and migration, although the latter option engenders additional burdens for women and children to assume responsibilities for men who migrate for seasonal wage labor and full-time employment. Another option is the restoration of ecosystems and ecosystem services, such as restoring the hydrologic connectivity of a floodplain to allow freshwater to be stored in soil, and to recharge aquifers in order to mitigate drought, reduce saltwater intrusion in groundwater, and reduce salinity levels in soil. Crop insurance is available in a few countries in the region and may be considered elsewhere to protect investments and livelihoods. Food distribution systems and food banks are under discussion and/or development and should be considered in concert with improved disaster management.

Health and Sanitation

In the health sector, adaptation needs relate to strengthening capacity to respond to disaster and vector-related outbreaks and diseases, building health service capacity, increasing health care resources, and climate-proofing health care infrastructure. The promotion of safe access to water and sanitation services will also increase capacity to adapt to extreme events and minimize post-disaster water-borne outbreaks.

Human Settlements and Infrastructure

All adaptation options for human settlements must account for dynamic population and migration trends motivated by economic opportunity, climate change, and natural disasters, and to a lesser extent in the Asia-Pacific region, civil strife, and security issues. Immediate adaptation needs include protection of communities and infrastructure by building adaptive capacity to protect communities during disasters, reducing exposure to impacts such as storm surges and wind, and retrofitting and repairing buildings, roads, and communications systems to withstand storm-related damages. A number of countries are already assessing transportation infrastructure (roads, bridges, and airports) to address current and anticipated impacts. Planning for new infrastructure should consider ecosystem options (e.g., mangrove restoration and reestablishing vegetation to stabilize shorelines) and measures to minimize exposure and sensitivity to climate impacts (e.g., setbacks, zoning regulations, building codes, and standards). Throughout the region, the challenge will be to complement policies and promotion of best practices with effective enforcement mechanisms. Although it is a very sensitive issue, relocation policies and strategies will be needed in low-lying islands and coastal settlements with reasonable lead times to address land requirements, accommodate cultural and social issues, and provide for alternative livelihoods of displaced people.

Disaster Risk Management

In many consultations, the primary focus of climate discussions has been on improving management of current disasters, particularly cyclone-related flooding as well as wind damage and droughts associated with ENSO events, and many organizations are looking at frameworks to integrate disaster risk management and climate adaptation. The primary advantage of such integration is to give more attention

to reducing exposure to disasters through better land use practices and climate-proofing (adaptation) and building capacity to cope with disasters and enhance adaptive capacity (disaster risk management).

Resource-Based Livelihoods

Fisheries, aquaculture, timber, and non-timber harvesting are important part- and full-time occupations for many island, coastal, and river basin residents. Even without climate impacts, fisheries resources are at risk from overfishing, destructive fishing techniques, and water pollution. In addition, fisheries and aquaculture play an important role in terms of food security, particularly for isolated island dwellers. Adaptation options will likely focus on improved management of fisheries stocks, regulation of fishing gear and practices, and promotion of alternative livelihoods (switching from fishing to aquaculture, developing markets for non-timber forest products, tourism, crafts, and small scale manufacturing such as wooden boat construction). In all of these cases, considerable capacity building and capital resources will be required.

Geographically-Focused Adaptation Priorities

Brief descriptions of adaptation interventions for specific geographic or political areas are provided below. In general, geographically-focused adaptations provide for a more holistic treatment of both climate and non-climate stressors and ensure that externalities are identified and addressed as much as possible. Adaptations that are desirable when assessed on a sector basis may be viewed as maladaptations on an ecosystem or landscape scale. Watersheds, river basins, and ecosystems will often be situated in more than one country and require assessment and design on a transboundary level. A key consideration for future initiatives is supporting countries in their efforts to take a regional, integrated approach to adaptation that relies on cross-border cooperation.

Watersheds, Glacial and River Basins, and River Deltas

Climate impacts can be readily considered in management regimes that are already integrated by design. Integrated management plans are promoted for watersheds, river basins, and large deltas such as the Mekong and the Ganges-Brahmaputra Deltas. Watersheds with their sources in the Himalayas are home to more than 1.3 billion people and feature some of Asia's most important rivers (Yellow and Yangtze in China, Mekong, Ganges, Irrawaddy, and Brahmaputra). An integrated approach that emphasizes the role of healthy ecosystems as well as the need for larger scale (e.g., basin or transboundary) approaches is crucial and provides a scale that accommodates adaptive management and facilitates consideration of climate impacts and other management challenges in allocating water resources among competing economic demands, ensuring stream flow requirements for biodiversity, and maintaining water quality. Other important points to consider include the following:

- There is uncertainty in predictions for rainfall, water cycles, and hydrology. Water resources management systems will need to consider and monitor for a range of precipitation assumptions and respond to unexpected changes through adaptive management.
- All water management systems must include environmental flows and should take a watershed approach that looks to protect and/or restore natural habitats/functions such as hydrologically connected floodplains and the attendant water storage that comes from floods/floodplains.
- Water demand should be controlled through conservation measures and water should be properly priced to ensure the economical use of water. Water resources need to be managed at a basin scale while implementation of water allocation, habitat restoration/protection, and other measures should occur at the local scale.

Terrestrial, Coastal and Marine Ecosystem Biodiversity

Because many key biodiversity areas in the Asia-Pacific region are transboundary, it is critical to adopt a regional ecosystems approach to maintaining climate change resilience. Large, healthy, and well-connected ecosystems reduce disaster risk, support livelihoods, and also provide resilience to climate change. Thus, maintaining overall regional resilience to climate change is strongly dependent upon conserving large, healthy, biologically diverse ecosystems. One of the challenges is to encourage transition from jurisdictional management to more effective transboundary management, training, data sharing, piloting cross-border ecosystem-based adaptation projects, and collaborative cross-border infrastructure development (or controlling such development with cross-border impacts, i.e., mainstem dams along the Mekong).

Sub-regional Cooperation

These interventions focus on geographical areas where there is a common thread of climate impacts, vulnerability, and adaptation options. Countries that do not directly impact each other by sharing cross-border ecosystems would still benefit by sharing lessons learned, best practices, and experiences in designing and implementing adaptations. Possible regional configurations might include:

- Pacific Island nations – All of these countries will be significantly impacted by sea level rise, have vulnerable agriculture and fisheries sectors, and have weak adaptive capacity to deal with droughts and floods. While the low-lying atoll nations are the most exposed to sea level rise, storms, and tides, other nations with mountainous regions have significant coastal populations and limited availability of arable land and suitable sites to relocate those communities.

- Coral Triangle countries – While the six CTI countries (Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands, and Timor Leste) vary significantly in size, capacity, governmental structures, and socio-economic indicators, they are connected in terms of the importance of coral reefs/marine and coastal ecosystems to their livelihoods and economies, and face similar climate and non-climate problems. They have already launched the Coral Triangle Initiative (CTI) with USAID support, and signed onto the CTI Plan of Action, in which regional climate change adaptation is included as a key theme. Joint or regional activities to demonstrate adaptation measures are already recognized as an area of clear benefit.

- Tibetan Plateau and Greater Himalayan region – Countries in the region with glaciated mountains and dry highland grasslands face similar challenges in protecting biodiversity, responding to changes in ecological zones due to glacial retreat and precipitation variability, diversifying livelihoods and protecting grasslands from overgrazing, and preparing for and responding to localized disasters due to GLOFs and flooding.

- Mekong River Basin – Challenges in the Mekong basin focus on improved coordination and mitigation of conflicts among riparian nations and balancing of economic and environmental priorities. There are already mechanisms for coordination among Mekong countries through the Mekong River Commission and the Greater Mekong Sub-region (GMS). Japan and Mekong countries issued the Tokyo Declaration in November 2009, describing cooperation on range of development activities, and in July 2009 US Secretary of State Hillary Clinton outlined a suite of development activities designed to continue and strengthen US cooperation with Lower Mekong countries.

- Association of Southeast Asian Nations (ASEAN), South Asian Association for Regional Cooperation (SAARC), and Asia Pacific Economic Cooperation (APEC) – Countries in Southeast Asia, South Asia, and the Pacific already cooperate on a range of economic and environmental issues. Established mechanisms of cooperation might facilitate more effective

sharing of lessons learned, building capacity, and transferring tools and technology. ASEAN is already cooperating with bilateral donors on topics such as agriculture, deforestation and forest fire prevention, and climate change, and there are opportunities to build on this cooperation to build capacity and address common climate impacts.

National, Provincial, and Local Government

As noted in Chapter 4, most of the support for adaptation has been focused at the national level and local government or community levels rather than at the provincial or state level. With a few notable exceptions (e.g., strategic planning at the provincial level in the Philippines), there has been considerably less support at the provincial level. Adaptation planning at the provincial level would be an appropriate scale to consider financing, policies and regulations, as well as to implement adaptation strategies and plans and build capacity to conduct V&A assessments and design implementation programs. Replication potential for capacity building and piloting at the sub-national level would be promising both within national boundaries and between any countries which have delegated planning and implementation responsibilities to provincial, state, and local governments.

Urban Areas, Cities, and Communities

Similar to other geographically-focused options, adaptation at the urban, city, or community levels enables planners to consider both conflicts and synergies between sectors. Most importantly, integrated adaptation strategies at these levels facilitate assessment of measures in terms of their benefits across multiple sectors, provide for better coordination of disaster risk management with other sector policies and programs, and foster a holistic view to climate-proofing of infrastructure and climate resilient cities.

5.4 Strategic Opportunities for Partnership and Cooperation

The assessment team identified multiple opportunities for cooperation and coordination between USAID and other bilateral and multilateral donors; international, national, and local NGOs; research institutions; regional forums; and other US governmental institutions in the area of climate change adaptation in the Asia-Pacific region. Benefits USAID may derive from collaboration with other organizations and/or leveraging existing capacity and resources include:

- Enabling coordination and complementarity of resources and skills with other donors and NGOs in terms of capacity building, technical assistance, and other adaptation activities and initiatives;
- Building on the efforts of other donors and NGOs as a means to achieve more effective and sustainable adaptation;
- Encouraging long-term strengthening of capacity and sustainability of initiatives in the Asia-Pacific region, particularly by working with local governments as well as local technical and research organizations;
- Developing and implementing activities that are at the correct scale and are targeted appropriately;
- Sharing experiences in order to promote the distillation of lessons learned and their integration into the implementation of "best" practices; and

- Avoiding duplication of efforts by other donors and NGOs as a means to ensure that priority unmet needs are addressed and value added synergy is facilitated.

Important factors for RDMA to consider in promoting successful partnerships include: (1) consistency with overall USG, USAID, and State Department climate change guidance, strategies, and priorities; (2) targeting specific gaps that USAID could effectively fill, thereby increasing interest of regional organization in cooperation with USAID; (3) the most appropriate types of interventions, tools, or regional activities for attaining these goals and filling gaps; (4) the scale and scope of proposed activities; (5) the degree to which cooperation or support would enhance RDMA's ability to reach its aims and fill identified gaps; (6) the degree of potential leverage; and (7) complementarity of resources, skills, capacity, and vision by USAID and potential partner organizations.

Regional organizations and their current adaptation activities are described in Chapter 4 and Annex E. Briefly, potential partners include:

- ***Regional Platforms*** – In addition to ASEAN, APEC, AP-Net, SAARC, MRC, Secretariat of the Pacific Community (SPC), and South Pacific Regional Environment Programme (SPREP), there are also a number of other regional platforms, regional knowledge hubs, and regional initiatives.

- ***Bilateral Donors*** – In addition to USAID, key bilateral donors in the Asia-Pacific region include AusAID, JICA, DFID, and GtZ. New Zealand supports Pacific Island adaptation. The EU and several European donors including France, Denmark, and Finland invest in the region.

- ***Multilateral Development Banks*** – Key players in the region are the Asian Development Bank and the World Bank.

- ***NGOs*** – The major international and regional environmental NGOs, groups focused on disaster response and management such as Mercy Corps and the Asian Disaster Preparedness Center (ADPC).

- ***Universities and Research Institutions*** in the region, including Asian Institute of Technology (AIT), University of the South Pacific, University of Guam, and the Chinese Academies of Science.

- ***Private Sector*** – Organizations such as Chambers of Commerce and commercial associations, including representatives of the insurance industry, agri-business, construction, and tourism.

Potential Partners – Tools and Guidance

Cooperation with regional (and global) partners is essential in pursuing any of the opportunities to develop guidance and tools for the region because of the potential for duplication and redundancy, and the very strong likelihood that off-the-shelf guidance and tools will likely need to be tailored according to requirements of decision-makers, practitioners, and civil society elicited in the regional needs assessment proposed in the previous chapter. Cooperation also provides an opportunity to pool resources and expertise in developing the five types of tools and guidance (i.e., climate impact guidance and tools, vulnerability assessment tools, adaptation assessment tools, guidance on mainstreaming climate change, and guidance on developing adaptation strategies).

It is important to note that the landscape of adaptation guidance and tools is already well populated (see Table 5.3). However, very few are specific to the Asia-Pacific region, and findings from the consultations suggest that a key limitation is not lack of tools but lack of understanding of how to apply them.

Table 5.3 Potential partners/leverage by type of guidance and tools

Activity	Type of coordination/leverage and illustrative partners/funds	Partnership Benefits
Climate impact guidance and tools	■ Training workshops on basic climate science and expected impacts for policymakers through regional forums such as ASEAN, APEC, MRC, SAARC, and SPREP ■ Providing technical assistance and/or financial support to local organizations with the technical or modeling capacity (e.g., SEA-START) to develop climate tools	■ Use existing forums to reach out to stakeholders ■ Leverage existing technical capacity of local organizations
Vulnerability assessment tools	■ Providing technical assistance and/or financial support to technical organizations (AIT, SEA-START, DRAGON Institute/Can Tho University, and the Manila Observatory) and/or research institutions (ICIMOD) to develop tools of appropriate resolution and sensitivity to existing capacity. Collaboration with Manila Observatory would be especially pertinent in assessing vulnerability related to disaster risk assessment and management.	■ Address key needs identified in local and sectoral vulnerability assessments ■ Address "missing middle" by working with state, district, and municipal level governments to develop vulnerability assessment tools ■ Leverage existing technical capacity of local organizations
Adaptation assessment tools	■ Developing tools that facilitate Asia-Pacific context-specific analysis of the costs and benefits, feasibility, and bundling of measures. Using adaptation assessment guidance developed by USAID (*Adapting to Climate Change and Variability: A Guidance Manual for Development Planning*, as well as V&A guidance specific to the coastal and to the water (forthcoming) sectors) as points of departure. Potential collaborator is ADB, which has already applied the Stern methodology to assess the costs of climate change in Southeast Asia, and plans to carry out a number of country adaptation studies as part of their Climate Change and Adaptation Road Maps Program. The World Bank is another possible partner, particularly in the area of infrastructure.	■ Leverage technical capacity and financial resources of other donors
Guidance on mainstreaming climate change	■ Adapting existing guidance, such as that recently developed by the OECD on mainstreaming climate change adaptation, for the Asia-Pacific region. OECD would be an important potential partner to consider in terms of training on mainstreaming, particularly if drawing on their publication *Policy Guidance on Integrating Climate Change Adaptation into Development Co-operation*.	■ Build on previous organizations' efforts. ■ Leverage knowledge and capacity of other key actors in the area
Guidance on developing adaptation strategies	■ Offering technical and financial assistance to countries to help them prepare vulnerability assessments and develop adaptation strategies. AusAID and SENSA are potential collaborators, particularly as they have been supporting national communications.	■ Draw on and complement capacity and skills of organizations that already have some experience in this area

Potential Partners – Regional Program Activities

Considerations for regional program activities include the value added of proposed initiatives, the possibility of leveraging existing human and financial resources, and replicability. Potential partners are presented in Table 5.4 in the categories of capacity building, education and awareness, networks and knowledge sharing, and research.

Table 5.4 Potential partners/leverage by regional program activity

Activity	Type of coordination/leverage and illustrative partners/funds	Partnership Benefits
Capacity building	▪ Likely to be taken on by RDMA directly and its implementing partners	▪ Lends itself particularly well to leveraging existing capacity and resources ▪ Complements and feeds into adaptation work carried out and financing offered by other bilateral donors such as JICA, AusAID, UNDP-Spain, and the EU, as well as by multilateral donors such as ADB and the World Bank
Education and awareness	▪ Training of environmental officers in national, provincial, and local governments on basic climate change issues and solutions. At the national and provincial level, collaboration useful with regional forums such as ASEAN, APEC, MRC, SAARC, and SPREP. Reaching environmental officers in local governments may be more difficult in collaboration with regional platforms, and will likely require working directly with the local governments. ▪ Pooling financial resources or offering complementary financial and logistical support with other donors or NGOs for a journalists' forum	▪ Provide opportunities for reaching a number of countries simultaneously, including some in which RDMA does not have a presence ▪ Working with local partners, such as journalists' associations, will improve awareness of the program and facilitate accessibility
Networks and knowledge sharing	▪ Creating an adaptation forum drawing on financial and logistical resources, pooled with other donors (e.g., AusAID) and NGOs (e.g., WWF)	▪ Leverage existing mechanisms and capacity to facilitate a dialogue between countries ▪ Scope for greater and more effective impact through collaboration with other donors, regional forums and NGOs

Activity	Type of coordination/leverage and illustrative partners/funds	Partnership Benefits
Research	▪ Given transboundary nature of many ecosystems, collaboration or coordination with regional forums such as the MRC or SAARC may be useful in promoting ecosystem-based activities. Potential for leveraging GEF-5 replenishment. ▪ Developing frameworks that integrate disaster risk management with national, community, and sector approaches working with the Asian Disaster Reduction Center (ADRC) in Japan ▪ Helping to establish Mekong Panel on Climate Change, a smaller "cousin" to IPCC promoting research and knowledge sharing on climate change science, impacts, and adaptation in the region. Potential collaborators include the MRC (policy), the DRAGON Institute/Can Tho University (climate science), START (climate science), and ICEM (research).	▪ Use existing forums to promote discussion and cooperation between countries ▪ Leverage and strengthen technical knowledge, skills, and capacity of key organizations as a means to promote integrated and holistic frameworks as well as more sustainable initiatives

Potential Partners – Regional V&A Interventions

USAID and its partners have several opportunities to leverage existing capacity and resources by playing a gap-filling role on V&A interventions funded by other donors and multilateral development banks, particularly in terms of technical assistance, sharing of best practices, and building capacity through training and side-by-side assistance. Table 5.5 details the types of coordination and/or leverage that could take place for each type of proposed V&A activity, as well as illustrative partner organizations.

Table 5.5 Potential leverage opportunities for V&A interventions

Activity	Type of coordination/leverage and illustrative partners/funds	Partnership Benefits
Technical assistance	▪ Supporting priority projects/programs identified in National Communications and NAPAs, supplementing/complementing UNFCCC's Least Developed Countries Fund. ▪ Assisting in development of pilot projects, leveraging funding under Climate Investment Fund's Strategic Climate Fund (initial program to be Pilot Program for Climate Resilience) ▪ Working alongside local technical organizations (e.g., Can Tho University's DRAGON Institute), policy forums/institutions (e.g., ASEAN, MRC, and SPREP), and national as well as local governments to address key capacity needs. Potential implementation partners include NOAA, the US Geological Survey (USGS), and USFS.	▪ Leverage existing financing ▪ Complement work of other multilateral and bilateral donors ▪ Provide organizations with more in-depth and detailed assistance as needed to address adaptation challenges
Sharing of lessons learned and best practices	▪ Establishing a forum, such as an annual conference or meeting, with regional organizations such as ASEAN, the MRC, SAARC, and SPREP	▪ Distil and promote integration of lessons learned into project/program implementation ▪ Encourage participation of countries in which RDMA

		does not maintain a presence
Training	▪ Training-of-trainers to build capacity of individuals capable of translating the science of climate change into the practical considerations of adaptation implementation, working with partners such as NOAA and USFS as well as local technical institutes including the DRAGON Institute at Can Tho University (Vietnam), SEA-START (Thailand), the Manila Observatory (Philippines), the Centre for Natural Resource Studies (Bangladesh), and the Centre for Global Change (Bangladesh) ▪ Training of land and resource managers in collaboration with USFS, which has an online training course for land mangers that it may be possible to adapt to meet specific regional needs	▪ Fill important gaps by moving beyond focusing on a specific technical skill, and targeting groups other than policymakers ▪ Leverage existing technical knowledge, capacity, and financial resources of local and US partner organizations/agencies

6 CONCLUSIONS AND RECOMMENDATIONS

As noted in Chapter 1, the Assessment Report was designed to answer three questions posed by USAID. This chapter is organized to provide concluding remarks on the three questions and recommendations on options for regional adaptation programming, potential synergies between regional adaptation programming and USAID bilateral mission programs, and opportunities for coordinating USAID regional adaptation programming with regional partner organizations.

Question #1 *What are the priority climate change vulnerabilities and adaptation challenges of developing countries in the Asia-Pacific region?*

Priority Climate Change Vulnerabilities

Based on the desktop review and consultations, a number of priority human, economic, and environmental vulnerabilities emerged for the Asia-Pacific region. Higher temperatures, changes in precipitation patterns, glacial melt, extreme events, and sea level rise are likely to have impact agriculture in the region by altering cropping and grazing areas and seasons, the spread of pests and diseases, irrigation requirements, and the need for drought-, flood-, and saline-resistant crop varieties, with repercussions for the productivity of key crops such as rice, food security in both rural and urban areas, and livelihoods.

These climate impacts are also projected to affect water supply and quality, with a potential increase in quantity in the near-term due to the contributions of greater glacial and snow-melt to river runoff, and a likely decrease in the long-term as glacier and snow cover is reduced. Terrestrial, freshwater, and marine ecosystems as well as the biodiversity and natural resources they harbor may be endangered by climate change impacts such as higher temperatures, glacial melt, sea level rise, warmer sea temperatures, and ocean acidification. This can lead to damage to or destruction of forests, including mangroves, and coral reefs (which act as important natural buffers against coastal erosion and storm surges), and the irreversible loss of native flora and fauna species. These impacts on ecosystems and their natural resources may also have consequences for sequestration of greenhouse gases.

Extreme events and sea level rise can pose a threat to important transportation, communications, energy, and other infrastructure; industries in coastal areas; and large concentrations of populations in coastal urban areas, including a number of Asian mega-cities. In urban contexts, climate change can place added stress on infrastructure and systems that are already under great pressure from large populations, rural-urban migration, and economic development, and may result in maladaptations, such as greater use of air-conditioners, which further raises challenges in efforts to for mitigate greenhouse gases. In the area of health, climate change-related ramifications may be both direct (e.g., increased incidence of heat stroke, lowered air quality due to a higher number of smog events, morbidity or mortality because of extreme events) or indirect through the impacts on agriculture, water, and infrastructure, with poor people, elderly individuals, women, and children at greatest risk.

While most of the countries in the Asia-Pacific region will be affected by several climate change impacts, a few were identified as "hotspots" because they face multiple and imminent hazards, with large populations and important natural and economic assets at high risk. These include: the Pacific Island

countries, Asian coastal cities, the Mekong River Basin, the Coral Triangle, and the Greater Himalayan region and Tibetan Plateau.

Adaptation Challenges

The effects of climate change and the vulnerabilities of important sectors and systems may be reduced through appropriate adaptation measures. While some countries have made strides in assessing climate vulnerabilities and developing adaptation strategies, overall progress throughout the region has been limited, particularly at the stage of implementation of adaptation options and strategies. USAID and its regional partners face a number of challenges in developing and implementing adaptation strategies. These include weaknesses in overall governance within countries as well as weaknesses related to the process for addressing adaptation within countries and among partners providing assistance.

Weak governance challenges include poor structuring, coordination, and financing of sub-national governments; inadequate provisions for civil society engagement; and laws, policies, and regulations that are ineffective in addressing non-climate stressors and concerns. Weak policy usually further limits the capacity of actors to effectively cooperate and coordinate the development of transboundary management plans and adaptation strategies.

Barriers related to the adaptation process include poor understanding of adaptation concepts; low capacity to translate and apply climate information, limited knowledge of adaptation options and how to assess them, difficulty understanding and navigating donor project cycles and application procedures, and lack of sector and stakeholder cooperation in adaptation planning.

Question #2A *With respect to future RDMA programming, what interventions, tools, and program activities are most needed and appropriate at the regional level?*

Gaps in Regional V&A Capacity

Despite the broad range of adaptation initiatives that has been undertaken by different donors, NGOs, and research institutions in the Asia-Pacific region, a gap analysis of existing guidance, tools, data and knowledge platforms, interventions, and program activities reveals that a number of key needs remain largely unmet. These gaps and opportunities for addressing them have been discussed in detail in Chapter 5. The overarching and highest priority for regional programming is to ensure that governments, communities, practitioners, the private sector, and civil society have access to appropriate information, tools, and methods needed to carry out assessments and make informed decisions on how to address current and future climate variability and change.

Integrating Strategies to Address Climate and Non-Climate Stressors

A common theme in all V&A guidance is the importance of integrating or mainstreaming climate concerns into development and management plans and strategies. Progress in mainstreaming climate into plans and strategies in the region is limited, although efforts to mainstream have been accelerating rapidly over the last year. Just as development plans should mainstream climate concerns (climate smart development), adaptation strategies need to account for non-climate stressors. As participants in consultations and reviewers have noted, unless non-climate stressors are addressed in the near term, the challenges of adaptation will be made much more difficult. Notably, stakeholders in the Coral Triangle countries indicated that there is an urgent need to address barriers to effective fisheries management or there will be few viable options for adapting to future climate change.

Geographically-Focused versus Sector-Focused Adaptation

The vast majority of donor assistance to and development planning among partner countries has been "stovepiped" at the sector level. Even for comprehensive plans at the national or regional levels, plans are aggregated up from the sector level. There is a clear pattern emerging in the region to focus V&A assessments on sector-level development. As discussed in the previous chapter, geographically-focused V&A on the scale of ecosystems, river basins, or urban areas facilitates better understanding of spatial interdependencies, potential for achieving joint benefits, and managing externalities and transboundary conflicts. Among the many participants in consultations and reviewers, there is a strong conviction that healthy ecosystems are a key element in any adaptation strategy and their role in adaptation is more transparent if V&A is approached from an geographically-focused perspective.

Recommendations for Regional Adaptation Initiatives

To address V&A challenges in the region and the three themes discussed above, six illustrative initiatives are recommended. The first of these, and the broadest in scope, would support a range of activities designed to build regional capacity to assess climate impacts and vulnerability, identify and assess adaptation options, and design and implement adaptation strategies (including adaptations mainstreamed into geographically-focused and sector-focused strategies and plans). The other five initiatives would be targeted to promote effective development of priority geographically- and sector-focused adaptation strategies. All illustrative initiatives aim to promote regionally-focused programming addressing multi-country/transboundary challenges appropriate for USAID/RDMA, including activities that: promote regional cooperation; identify and share regional best practices and lessons learned; demonstrate and replicate best practices from country to country; and strengthen key regional institutions, platforms, and networks.

A brief description of the six initiatives is provided below and additional detail on each initiative is presented in Annex A.

Regional Adaptation Capacity Building and Governance Initiative

This initiative would provide cross-cutting capacity building and governance support for adaptation planning and implementation in the region. The initiative would be comprised of several linked activities designed to respond through a regional approach in both a comprehensive and gap-filling way to adaptation needs at the national and sub-national levels of government and a wide spectrum of stakeholders. This initiative, if undertaken by USAID, would complement the other five initiatives and provide leverage to other initiatives in terms of technical guidance, data, tools and methodologies, training and awareness materials, and a network of regional organizations and practitioners. Proposed activities include: (1) a regional project preparation facility to help countries access donor funding for adaptation projects; (2) a public-private partnership facility to stimulate regional collaboration on adaptation development and implementation by the private sector; (3) support for climate data and regional information sharing and platforms; (4) adaptation tools and guidance; (5) V&A training, technical assistance, and replication of best practices within the region; (6) adaptation education and awareness; and (7) strengthening governance to support adaptation planning and implementation and promote regional cooperation.

Mekong Climate Initiative

This regional initiative would build an understanding of the benefits of an integrated regional approach and ultimately support development of a regional adaptation strategy across Lower Mekong Initiative (LMI) countries (Vietnam, Thailand, Cambodia, and Laos) and China. Given that climate change impacts will be transboundary and that the Mekong River and many critical terrestrial ecosystems connect the

region's countries, maintaining resilience will depend on enhanced regional cooperation and coordination. The Greater Mekong sub-region is one of Asia's most vulnerable to climate change impacts because of the large numbers of people living in floodplains and low-lying coastal areas and because the people and economies of the region depend strongly on agriculture and ecosystem services. The region's extraordinary biodiversity is also at risk from both the direct and indirect impacts of climate change. Specific components of this initiative might include: (1) a focused Mekong watershed-wide vulnerability and adaptation assessment combined with dialogue, cooperation, and engagement among LMI countries and China to build support for a regional adaptation strategy; (2) pilot and replicate adaptation projects combined with capacity building, awareness, and sharing of lessons learned and best practices; and (3) regional capacity building support for national, provincial, and local governments in developing adaptation strategies that feed into and support a regional adaptation strategy. This initiative could be replicated to other transboundary areas in the Asia-Pacific or to major river basins in the Tibetan Plateau and South Asia.

Asian Mega-Cities Adaptation Initiative

This regional initiative would provide an opportunity for large urban areas to mainstream climate into city planning, integrate disaster risk management with adaptation planning, and focus attention on the nexus of mitigation and adaptation in the energy sector. Coastal mega-cities face a number of current and future climate impacts including temperature increases, extreme weather events, sea level rise, flooding, and drought. As these large cities are expected to experience increased population growth due mainly to increased longevity and migration from rural areas, vulnerability to climate change will increase as larger numbers of people are exposed and adaptive capacity will be stressed while cities try to extend services and disaster risk management to their residents. Activities might include: (1) regional analysis and development of solutions to a range of urban climate change concerns such as reducing exposure and sensitivity of the urban poor, integrating ecosystem best practices into urban planning, and plotting a low-carbon development trajectory; (2) regional capacity building support for integrated urban planning and implementation of adaptation options; and (3) promoting regional sharing and replication of best practices.

Coastal Communities and Ecosystems Adaptation Initiative

As coastal communities throughout the region (Pacific Islands, South Asia, and other areas with important coastal and marine areas) face common vulnerabilities to climate change, there is an opportunity to build on, extend, and replicate activities undertaken under the Coral Triangle Initiative. Sea level rise, changing storm paths, warming ocean temperatures, and ocean acidification are regional changes that will impact coastal communities, fisheries, marine ecosystems including coral reefs, and coastal infrastructure on regionally coherent scales. This initiative would adapt V&A capacity building to coastal communities and ecosystems, launch a regional climate change science network focused on coastal and marine issues, and support improved livelihood initiatives for coastal communities with potential for regional replication.

Agriculture and Food Security Adaptation Initiative

This initiative would focus on management of agriculture and food security systems to adapt to disasters affecting production and distribution of food, as well as support for data sharing, climate and weather monitoring, and early warning systems. As agriculture is vulnerable to climate change throughout the region, this initiative or individual components of it could be combined with other initiatives, particularly the regional capacity building, Mekong, and coastal initiatives above. Proposed activities would include: (1) integrated regional diagnosis of climate and non-climate concerns in agriculture and food security, linking climate and disaster risk with other value chain concerns in the production and marketing of agricultural products; (2) regional capacity building and technical assistance for mainstreaming adaptation

and disaster risk options into agriculture, land use, and food security strategies; and (3) regional replication of best practices and sharing of lessons learned.

Forest Ecosystems Adaptation Initiative

This initiative would promote sustainable landscapes through greater consideration of both climate and non-climate stressors of forested ecosystems. A transboundary, ecosystem-based approach to adaptation places important emphasis on the inherent resilience of the cohesive biological diversity of intact nature preserves and furthers the related objectives of promoting biodiversity conservation, forest-based GHG mitigation, and other valued ecosystem services. Many forested ecosystems are likely to be challenged beyond their capacity to adapt over the course of the century by an unprecedented combination of climate change, associated disturbances such as forest fires, forest degradation, and food and water supply. Specific activities would include support for regional research on climate impacts on forested ecosystems, integration of climate vulnerability and adaptation assessments into forest ecosystem planning, and promoting transboundary cooperation and sharing of best practices.

Question #2B *How can regional activities best complement potential national-level adaptation activities to be implemented by USAID bilateral missions?*

It is anticipated that national-level adaptation activities implemented by USAID bilateral missions will be of three types: (1) national and sub-national capacity building activities such as training, education and awareness, and technical assistance in applying adaptation guidance and tools; (2) stand-alone adaptation projects such as development and implementation of local adaptation strategies; and (3) integrated activities to mainstream adaptation components into development projects .[120]

The illustrative regional activities proposed above are designed to address transboundary and regional adaptation issues and needs that are common across the Asia-Pacific region or are at least common to countries and communities facing similar climate threats (e.g., low-lying islands and countries with extensive exposed coastal areas).

All of the activities under the regional capacity building and governance initiative provide a foundation that national level programs can build on or leverage. USAID bilateral missions can tap into the regional initiative's development of tools, guidance, training manuals and curriculums, and education and awareness materials. The regional capacity building and governance initiative will also have established partnerships with regional organizations, networks, and platforms, and recruited and trained a pool of regional practitioners and trainers that could support national level adaptation through peer-to-peer cooperation and sharing of lessons learned, training-of-trainers, and technical assistance. National-level projects could also cooperate and coordinate with the proposed project preparation and public-private partnership facilities to support or facilitate access to financing for community and private sector adaptation projects.

For the proposed regional geographically-focused and sector-focused adaptation initiatives, there is the potential for close cooperation and collaboration with national-level adaptation projects on basic climate science, analyses of climate impacts and vulnerabilities, methods for developing ecosystem-based adaptation strategies, and the identification, assessment, implementation, and evaluation of adaptations. There is the potential for sharing lessons learned between RDMA's regional activities and those implemented by USAID bilateral missions.

[120] For example, USAID Indonesia recently announced two requests for proposals with climate components: Indonesia Forestry and Climate Support and Indonesia Marine and Climate Support.

Question #3 *How can RDMA best coordinate with and leverage the efforts of regional platforms (such as ASEAN and APEC), bilateral donors, multilateral development banks, national governments, international non-governmental organizations (NGOs), universities, the private sector, and others to address priority adaptation challenges?*

Chapter 4 and Annex E provided a stocktaking of the large number of international donors, NGOs, and regional organizations engaged in adaptation activities including project financing and implementation, development of tools and guidance, implementation of knowledge sharing platforms, and participating in regional or global adaptation networks.

Chapter 5 identified strategic opportunities and potential partnerships for USAID to consider in developing its regional adaptation program. In assessing potential partners and forming partnerships, it is recommended that USAID/RDMA consider the following guiding principles:

- Build on the Assessment Report's stocktaking of organizations and activities by continuing to monitor progress of ongoing activities and the initiation of new adaptation programs and projects by other organizations, both to avoid duplication and to identify the best and most current opportunities for cooperation and collaboration;
- Engage partners, including national governmental counterparts, in dialogue to anticipate changing priorities, encourage long-term strengthening of capacity, and ensure activities are implemented at the appropriate scale;
- Continue to assess gaps and build on the efforts of other donors and NGOs, particularly in instances where current programs and projects are ending or phasing out; and
- Identify and participate actively in the most appropriate platforms and networks for sharing tools and methods, best practices, and project results.

In addition to the listing of organizations active in the region in platforms, networks, and as implementing and funding entities (Chapter 4; Section 5.4 in Chapter 5; and Annex E), the report also provides a range of potential partner organizations for each of the six illustrative initiatives.

ANNEX A – ILLUSTRATIVE REGIONAL ADAPTATION INITIATIVES

This annex provides additional detail on the six illustrative regional adaptation initiatives recommended in Chapter 6. The first of the six regional initiatives focuses on a broad set of capacity building activities and provides the foundation for adaptation strategy development and implementation across the region. Ideally, this initiative also would provide capacity building support and serve as a regional platform for sharing adaptation lessons learned and best practices that are developed in the five initiatives described in Sections A.2 through A.6. Each initiative is described briefly below in terms of content, objectives, illustrative activities, geographical scope, opportunities for coordination with regional organizations, and expected results.

A.1 Regional Adaptation Capacity Building and Governance Initiative

This illustrative initiative would provide cross-cutting capacity building and governance support for adaptation planning and implementation in the region. The initiative would be comprised of several linked activities designed to promote both comprehensive and gap-filling measures to adaptation needs at the national and sub-national levels of government and a wide spectrum of stakeholders

Objectives

The objective of this initiative is to promote effective development of public and private adaptation options and strategies and facilitate improved access to and utilization of adaptation funding. Specific sub-objectives include:

- Facilitating access to donor funding for adaptation projects;
- Catalyzing private sector engagement in climate adaptation planning and implementation;
- Building capacity to use data and assessment tools in adaptation planning; and
- Promoting broad-based awareness of climate change, impacts, and adaptation.

Illustrative Activities

- ***Adaptation Project Preparation Facility*** – combining technical assistance to prepare projects, capacity building to transfer project preparation skills to regional organizations, and development of a clearinghouse on adaptations proposed and/or implemented in the region. USAID would provide centralized regional technical assistance to help national and sub-national stakeholders design adaptation projects, prepare financing and implementation plans, and submit applications to bilateral and multilateral donors, multilateral banks, and other funding organizations. Specific components might include:

- Developing regional guidelines on what constitutes a "good" adaptation project, considering different governance regimes and local design, assessment, implementation, and monitoring capacities;
- Organizing multi-donor workshops to discuss adaptation funding processes, eligibility, and application and project cycle procedures with the goal of identifying opportunities for streamlining and standardizing the application process;
- Strengthening regional capacity by identifying and training regional partner organizations and practitioners in project preparation;
- Setting up a regional screening process to review project preparation requests from participating countries and field technical assistance teams;
- Exploring options for pooled regional funding for adaptation – illustrated by the pooled financing program administered by the Micronesia Conservation Trust;
- Assessing options and capacity building requirements for sustainable self-financing of adaptation strategies at the national, regional, or local levels with potential for replication across the region;
- Offering regional trainings to relevant government officials and program and project developers to build their understanding of vulnerability and adaptation issues and their capacity to develop and implement projects;
- Providing technical assistance to develop, implement, and manage adaptation projects and programs, with the objective of generating lessons learned and best practices to be shared and used across the region; and
- Building capacity, once projects are financed, to monitor and evaluate implementation progress, articulate adaptation benefits, and adaptively manage projects.

- ***Adaptation Public-Private Partnership Facility*** – facilitating partnerships between the public sector and private industry to work collaboratively to incorporate adaptation issues into private decision-making and identify opportunities for the public and private sectors to work together to implement adaptation measures. Key private sector partners include banks and financial intermediaries, insurance companies, agri-business and tourism trade associations, chambers of commerce, and manufacturers of energy and water systems and equipment. Specific components might include:

  - Convening annual regional climate change forums targeted at private sector and public-private partnerships in adaptation, featuring information sessions, V&A training and mainstreaming, special topics on adaptations with mitigation and sequestration benefits;
  - Preparing series of papers on private sector adaptation options and strategy development relevant to the region;
  - Creating a regional mechanism to identify and assess donor and multilateral development bank funding opportunities for private investments that promote adaptation priorities and facilitate access to climate financing for private sector businesses in the region;
  - Facilitating the establishment of public-private partnerships on adaptation investments in cities, water and agriculture, and tourism; and
  - Collaborating with regional knowledge sharing platforms to add private sector "button" to showcase private sector adaptation topics and case studies.

- ***Climate Data and Information Sharing and Platforms*** – facilitating links to current and future climate and other data platforms in Asia and the Pacific, including guidance on accessing and using data, support for regional efforts to make current and historical data available in electronic formats, a clearinghouse on data sources, and coordination with international and

regional organizations to support sharing of downscaled data. Specific components might include:

- Using regional trainings or technical assistance to strengthen local capacity for interpreting climate data, using it in vulnerability assessments and adaptation strategy development, and communicating climate data;
- Providing basic regional training in understanding data limitations and assessing data quality;
- Improving access to and regional sharing of weather station data and supporting efforts to increase access to, regional sharing of, and coverage of water flow and tide gauge/sea level data—this could include downloading of historical climate data (e.g., *Climate Mapper* data featured on the Climate 1-Stop web portal; http://arcserver4.iagt.org/climate1stop/) onto CD-ROMs to overcome limited internet access and bandwidth; and
- Collaborating with one of the providers of downscaled data (e.g., Tyndall Center's Community Integrated Assessment System) to convert data request screens and outputs into the principal languages in the region.

- ***Adaptation Tools and Guidance*** – developing and/or tailoring vulnerability and adaptation assessment tools and guidance at the national and sub-national levels, with priorities determined through a rapid needs assessment. The overall effort would be coordinated with other donors and regional organizations. Specific components might include:
  - Conducting workshop on tools and guidance for regional practitioners, divided into two sessions: 1) review and demonstration of international adaptation tools and guidance; and 2) facilitated analysis of gaps and tailoring requirements for application of tools in the Asia-Pacific region;
  - Organizing regional working group to develop and implement a joint work plan on regionally-tailored adaptation tools and guidance; and
  - Collaborating with regional knowledge-sharing platforms to feature links to regionally tailored adaptation tools and guidance.

- ***V&A Training and Technical Assistance*** – developing training materials, providing training of trainers to facilitate diffusion, and providing selected technical assistance to build regional capacity to support adaptation strategy development. Given the lack of depth in local capacity in V&A and the need to conduct training in local languages, training of trainers may involve two steps: training regional partner organizations and practitioners on all V&A topics, followed by training of trainers at the national and local levels. Specific components might include:
  - Assessing regional training capacity and identifying training partners;
  - Developing training manuals and conducting V&A training for regional training partners on:
    - Vulnerability assessments;
    - Adaptation assessments;
    - Adaptation strategy development (prioritization, mainstreaming climate concerns into sector plans, ecosystem based adaptation, and adaptation strategies); and
    - Implementation, monitoring, evaluation, and adaptive management;
  - Collaborating with regional training partners to deliver training-of trainers workshops in participating countries;
  - Establishing learning processes for integrating and updating information on global climate science, case studies, illustrative adaptation strategy development, and adaptations into regional training materials and programs; and
  - Convening refresher workshops for regional training partners.

- ***Adaptation Education and Awareness*** – supporting a regional integrated program to share information and develop education and awareness materials on climate change impacts, vulnerability, and adaptation with communities and stakeholder groups. Specific components might include:

    - Facilitating development of education and awareness materials and training regional organizations to communicate messages;
    - Identifying and promoting regional peer-to-peer sharing of adaptation experiences;
    - Collaborating with universities in the region to add V&A components to curriculum development; targeting degree programs including environmental, water, civil and agricultural engineering, architecture and urban planning, public policy and administration, and agricultural and environmental sciences; and
    - Coordinating regional delivery of adaptation education and awareness materials and campaigns with geographically- and sector-focused initiatives.

- ***Governance and Adaptation*** – addressing issues related to weak governance, which represents a fundamental impediment to effective development and successful implementation of adaptation strategies. While the majority of the activities featured in this initiative focus specifically on V&A, failure to address governance issues will attenuate the potential benefits of other proposed activities. There is potential for synergy between USAID's Asian Environmental Compliance and Enforcement Network (AECEN) program Asia and future adaptation efforts. Specific components might include:

    - Reviewing policies for engaging civil society and provisions for devolving planning authority and resources to regional and local governments;
    - Analyzing legal and policy rigidities that impede mainstreaming of climate concerns into strategies and plans;
    - Designing incentive-based adaptation approaches (including mitigation and sequestration measures with adaptation benefits) to overcome weaknesses in compliance monitoring and enforcement; and
    - Working with a regional forum to promote sharing of lessons learned.

- ***Regional Programming Approach*** – all of the above activities should promote USAID/RDMA's core regional principles and approach by:

    - Fostering regional cooperation through the convening of workshops, establishing working groups, and through co-implementation and financing of regional activities of mutual interest;
    - Facilitating effective sharing and replication of adaptation best practices and dissemination of methods and tools;
    - Nurturing sustainability by working with and strengthening regional institutions; and
    - Promoting regional strategies, plans, and policy frameworks, consistent with geographically-focused adaptation.

Geographic Focus

This initiative is appropriate for the entire Asia-Pacific region although it might be necessary to target its scope because of resource constraints. Options for targeting the initiative might include: (1) responding to highest demand for capacity building (i.e., the Pacific Islands, weaker Mekong countries, Nepal, Bangladesh, and the Maldives); or (2) linking the initiative to specific sector or geographically-focused adaptation initiatives and other projects (e.g., agricultural and food security, biodiversity, economic growth and livelihoods, health, etc.) implemented by USAID as well as other USG agencies.

Suggested Program Partners

- ADB, GtZ, DFID, UNDP, and ASEAN on tools and guidance;
- SEA-START, AusAID, and Tyndall Climate Change Centre on data and downscaling;
- National Climate Programs on all capacity building activities;
- WWF and IUCN's Ecosystems and Livelihoods Adaptation Network (ELAN); and
- Regional research institutes and universities (AIT, DRAGON Institute, Chinese Academies, Manila Observatory, universities, regional organizations and international NGOs).

Key Results

- Increased access to and leverage of multilateral and bilateral funding resources for adaptation programming;
- Increased ability of country planners to address climate risks, optimize investment decisions, and avoid costly maladaptation in targeted sectors and geographical areas; and
- Increased adaptive capacity of technical experts and decision-makers for coping with impacts of climate variability and change in the Asia-Pacific region.

A.2 Mekong Climate Initiative

The Greater Mekong Sub-region is one of the Asia-Pacific's most vulnerable to climate change impacts because of the large numbers of people living in floodplains and low-lying coastal areas and because the people and economies of the region depend strongly on agriculture and ecosystem services. The region's extraordinary biodiversity also is at risk from both the direct and indirect impacts of climate change. Adaptation challenges are enormous in the basin and current activities (including those funded by other donors) are piecemeal and largely uncoordinated. Given that climate change impacts will be transboundary and that the Mekong River and many critical terrestrial ecosystems connect the sub-region's countries, maintaining resilience will depend on enhanced regional cooperation and coordination.

The activity would directly contribute to the Lower Mekong Initiative (LMI), and there are opportunities to scale up or replicate this work to other transboundary areas in the Asia-Pacific or to major river basins originating in the Tibetan Plateau and the Greater Himalaya region. There are also potential synergies between this initiative and initiatives pertaining to capacity building, agriculture and food security, and coastal areas. The LMI provides a framework for regional activities addressing problems that transcend national borders and account for the inevitable tradeoffs and conflicts between economic sectors. The Mekong Climate Initiative would leverage and build on other USG activities supporting LMI, such as the sister-river partnership between the Mississippi and Mekong River Commissions and the USGS DRAGON partnership, but with a deeper focus on climate change.

Objective

The objective of this initiative is to undertake a combination of assessment, design of policy options, capacity building, and integrated modeling of climate impacts on watersheds, and analysis of benefits and costs in support of the development of an integrated regional adaptation strategy. This initiative would

build an understanding of the benefits of an integrated regional approach and ultimately support development of a regional platform for adaptation cooperation and action.

Illustrative Activities

- ***Vulnerability and Adaptation Assessment for the Greater Mekong*** – providing the foundation for regional dialogue, increased regional cooperation, and, ultimately, development of a regional adaptation strategy on a scale that would facilitate consideration of climate and non-climate stressors on a transboundary scale. Specific components might include:
    - Organizing a panel of regional experts to develop the structure for the regional vulnerability and adaptation assessment and promote the concept with national governments in the region; identifying co-financing for the assessment (the National Natural Science Foundation in China has indicated interest in supporting such an initiative);
    - Convening regional experts to conduct the regional vulnerability and adaptation assessment, consolidate data, identify key gaps in data, tools, and understanding of impacts and vulnerabilities, and address the gaps; assessment would include recommendations for the regional adaptation strategy.

- ***Regional dialogue, cooperation, and engagement*** – involving a number of components designed to build up the scientific and institutional support for a regional adaptation strategy including:
    - Discussing and advancing the concept of a Mekong Panel on Climate Change to document, monitor, direct, and coordinate research and analysis;
    - Promoting peer-to-peer exchanges between lower Mekong and international river basin and delta researchers and policy specialists;
    - Providing institutional support for a consultative regional dialogue that leads to development of a regional adaptation agreement signed by all of the GMS governments; and
    - Strengthening regional institutions (e.g., Mekong Forum idea) in order to engage all relevant stakeholders in the development and adoption of climate-resilient approaches across the region. Sub-regional forums that emphasize grassroots participation could be replicated across the region and ultimately linked to the regional forum.

- ***Regional demonstration and replication of best practices (pilot adaptation projects)*** – organized and coordinated with MRC and CCAI to ensure complementarity in approaches and to ensure value added to pilot projects to be undertaken by CCAI. Illustrative technical areas for regional adaptation demonstrations might include agriculture, food security, forests and biodiversity, water, and diversification of livelihoods. Specific components might include:
    - Reviewing CCAI pilot methodology and holding discussions with MRC to identify opportunities in priority communities for site/landscape level pilots in key vulnerable areas;
    - Building V&A capacity in pilot regions or communities, using participatory processes to engage local stakeholders and familiarize them with climate change, vulnerability, and adaptation basics;
    - Supporting processes to assess vulnerability from an ecosystem-based adaptation perspective, and prioritizing and implementing adaptations through local pilot projects with potential for replication; and
    - Collecting and synthesizing lessons learned from pilot adaptation projects and developing best practices for mainstreaming adaptation into national and sub-national policies to be shared through regional forums and networks.

- ***Regional support for national, provincial, and local governments in development of adaptation strategies*** – regional capacity building, technical assistance, and peer-to-peer exchanges. USAID/RDMA has opportunities to coordinate with AusAID and ADB, which are working with 13 provincial governments in the Mekong Delta on vulnerability and adaptation assessments to identify lessons learned which may be applied in Cambodia, Laos, and Thailand. Specific components might include:
    - Engaging local and provincial governments to initiate disaster preparedness and recovery plans for impacted transboundary communities;
    - Technical support to help governments implement their National Adaptation Plans of Actions (NAPAs) or develop alternatives to NAPAs in non-LDCs (e.g., Vietnam, Thailand) and better incorporate them within the regional GMS framework**;**
    - Building capacity within key government agencies to integrate climate change planning across all relevant economic sectors, and provide a forum for sharing lessons learned across the region;
    - Supporting transboundary cooperation on integrated spatial planning to assist both provincial and national governments in anticipating and addressing climate-related challenges; and
    - Supporting regional sharing of best practices on sub-national efforts to mainstream climate into sectoral policies.

Geographic Focus

Four lower Mekong countries – including Cambodia, Laos, Thailand, and Vietnam – plus China

Potential Program Partners

- Mekong River Commission, Asian Development Bank's GMS Core Environment Program;
- AusAID-funded CCAI and other donor-funded projects in the Mekong;
- DRAGON Institute at Can Tho University in Vietnam, SEA-START, and Mekong Delta Rice Research Institute;
- US Geological Survey and the DRAGON partnership of international collaborators on delta and river basin research and policy, and the Mississippi River Commission;
- WWF, UNEP, UNDP, and other institutions working on these issues ;
- GEF-5 (opportunities to leverage large-scale financing); and
- National Academies of Science and of Social Science in riparian countries.

Key Results

- Specific examples and best practices of ecosystem-based adaptation are developed and disseminated through regional knowledge sharing platforms throughout the Mekong region and elsewhere in the Asia-Pacific region;

- Increased capacity[121] to assess vulnerability, and plan and implement adaptation, among a variety of institutions across the region (including but not limited to governments);

- Resilience-building strategies integrated into relevant planning processes by national and regional institutions; and

- Integrated approach to climate change adaptation across a transboundary basin developed and potentially applied in other regions (e.g., South Asia, Himalayas).

A.3 Asian Mega-Cities Adaptation Initiative

Coastal mega-cities face a number of current and future climate impacts including temperature increases, extreme weather events, sea level rise, flooding, and drought. These add to the existing environmental and socio-economic stresses on large and medium-sized cities from economic growth, population growth, and urban migration. Cities will be challenged to address increased vulnerability to climate change for even larger numbers of people, while they simultaneously pursue economic growth and increased quality of life and services for their residents.

Objective

The objective of this initiative is to support mainstreaming of climate change into city planning, integrate disaster risk management with adaptation strategy development, and focus attention on the nexus of mitigation and adaptation in urban infrastructure and services.

Illustrative Activities

- ***Analyze and propose solutions to urban climate change concerns*** – this activity would look at impacts on people, neighborhoods, linked ecosystems, and infrastructure and public services. Specific components might include:

    - Assessing and proposing options for addressing locational issues for the most vulnerable (poor) residents;
    - Assessing and implementing strategies to restore freshwater and coastal wetlands and integrate ecosystem management into city planning; and
    - Identifying, assessing, and promoting low cost best practices to repair and improve urban drainage;
    - Determining and implementing best practices to improve the climate resilience of health systems;
    - Identifying and putting into place systems and processes to support coordination across different urban sectors to improve climate change resilience; and
    - Developing best practices for each of the components above that can be shared and replicated across the region.

- ***Support integrated urban planning processes and implementation of adaptation options*** – focus will be on linking adaptation and city planning for all key sectors including water supply and sanitation, waste management, land use, communications and transportation infrastructure, health, and disaster risk management. Specific components might include:

[121] The CCAI is envisioned as a 15-year capacity building effort in view of the challenges expected to identify and train an adequate number of practitioners in the region that can support governments and communities in developing adaptation strategies.

- Promoting integrated city planning that accounts for climate change and combines adaptation planning and disaster risk management with general development plans and programs;
- Developing a system of social and economic safety nets for extremely vulnerable urban populations;
- Promoting low-carbon urban development, energy efficiency, and green building through collaborative efforts to promote mitigation measures as, or in combination with, adaptation options;
- Promoting sustainable public service planning to improve service delivery and develop redundant systems and capacity;
- Piloting activities in specific locales with a view to replicating best practices in other areas in the region; and
- Sharing lessons learned through relevant regional forums.

Geographic Focus

Key mega-cities including Bangkok, Dhaka, Ho Chi Minh City, Jakarta, Kolkata, Manila, and Shanghai; initiative might be expanded to include additional large and mid-sized cities.

Potential Program Partners

- Sharing of methodological approaches to urban planning and sharing of lessons learned with The Rockefeller Foundation's ACCCRN;
- Sharing of lessons learned on low-carbon development in cooperation with the Chinese Meteorological Administration, Chinese Academies of Sciences, and WWF's Yangtze Basin vulnerability and adaptation study (includes Shanghai); and
- Sharing of lessons learned and adaptation options in cooperation with the Mangroves for the Future Project.

Key Results

- Reduced disaster-related deaths, injuries, and illness through improved disaster risk management;
- Reduced climate-related economic damages through climate proofing of infrastructure and improved disaster risk management;
- Increased energy efficiency and reliability of urban service delivery, primarily water and sanitation; and
- Mitigated GHGs through energy efficiency and low-carbon urban development that promotes resilience.

A.4 Coastal Communities and Ecosystems Adaptation Initiative

Sea level rise, changing storm paths, warming ocean temperatures, and ocean acidification are regional changes that will impact coastal communities, fisheries, marine ecosystems including coral reefs, and coastal infrastructure on regionally coherent scales. As coastal communities throughout the region (Pacific Islands, South Asia, and other areas with important coastal and marine areas) face common vulnerabilities to climate change, there is an opportunity to build on, extend and replicate activities

undertaken under the Coral Triangle Initiative and link the initiative to the mega-cities initiative (as coastal cities must account for urbanization and industrialization drivers and stressors) and the agriculture and food security initiative (given the importance of coastal agriculture and fisheries to food security).

Objective

The objective of this initiative is to tailor V&A capacity building and research to problems of coastal communities and coastal and marine ecosystems.

Illustrative Activities

- ***Adapt V&A capacity building to coastal communities and ecosystems*** – build on and tailor regional capacity building activities to the needs of coastal communities, small islands, and the ecosystems they depend on for food and livelihoods. Specific components might include:
    - Developing ***regional awareness programs*** on coastal climate change at all levels of government and for fisheries, aquaculture, and forests (ridge-to-reef conservation); synthesizing climate change and non-climate information into forms useable for outreach among different audiences, and disseminating through regional platforms;
    - Developing ***training modules*** on general climate change awareness building that target policy makers, government officials, community-level NGOs, and civil society;
    - Supporting ***regional assessments*** of marine protected area networks for vulnerability, resilience and adaptation to climate change; and
    - Supporting ***development and scaling up of tools and capacity*** to assess coastal vulnerability across the region, e.g., effective models for sea level rise at regional and local resolution; regional inundation mapping; V&A methodologies for mangroves, coral reefs, and other relevant ecosystem types.

- ***Launch a regional climate change science network*** – this regional network would monitor, facilitate, document, and disseminate research on coastal climate change topics such as:
    - Impacts of climate change on species (including corals) and ecosystems;
    - Socio-economic impacts, specifically including small scale fisheries and other livelihoods; and
    - Identification of refugia to impacts of species, e.g., analysis of ocean temperature data to determine possible coral bleaching refugia.

- ***Support improved livelihoods for coastal communities*** – this activity would integrate assessments of climate and non-climate factors into livelihood strategies. Specific components might include:
    - Assessing existing and historical adaptation strategies (e.g., by local communities and their coping strategies) for their practical application in other Pacific Island and Coral Triangle locations;
    - Assessing the impact of current climate, climate change and non-climate factors on fisheries (commercial and near-shore) and identify fish species that could be the focus of future commercial activities;
    - Providing guidance on resilient livelihood strategies that address urgent weaknesses in fisheries management, anticipate changes in the economics of fisheries due to climate factors (ocean temperature and ocean acidification and changes in markets, and include options for diversifying livelihoods, with best practices shared through regional forums and peer-to-peer exchanges particularly between CTI implementers and their partners, and island and coastal nations in South Asia and the Pacific; and

- Developing a long term strategy for funding regional adaptation actions including identifying a portfolio of potential climate change adaptation projects across the region (focused on the Coral Triangle).

Geographic Focus

Coral Triangle countries (Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands, and Vanuatu) with links to Pacific Islands (Federated States of Micronesia, Republic of Marshall Islands, and others), other ASEAN countries (Thailand and Vietnam) and South Asian countries (Bangladesh, India, Maldives, and Sri Lanka) with important coastal and marine resources.

Potential Program Partners

- The Coral Triangle Initiative, which already has an existing climate change adaptation work plan at a regional and national level with identified goals and outputs, and can serve as a ready-made mechanism for delivering climate change adaptation activities with pre-existing commitments and plans from all six countries, which would lead to more immediate and sustainable results and leverage further funding;
- ASEAN, AusAID, and ADB;
- Partnerships in Environmental Management for the Seas of East Asia (PEMSEA) on coastal and ocean governance and climate change; and
- Micronesia Conservation Trust, which implements Micronesia Challenge; SPREP; Secretariat of the Pacific Community; and Pacific Island Forum Secretariat, and the University of the South Pacific.

Key Results

- Capacity and institutions improved to implement regionally coordinated adaptation in coastal and marine areas, and small islands, including effectively using regional data and tools;
- Enabling environment improved for effective implementation of regionally-coordinated climate change adaptation in coastal and marine areas and small islands;
- Specific examples and best practices of ecosystem and community-based adaptation demonstrated and replicated throughout region;
- Increased capacity to assess vulnerability, and plan and implement adaptation, among a variety of institutions across the region (including but not limited to governments);
- Resilience-building strategies integrated into relevant planning processes by national and regional institutions; and
- Integrated approaches to climate change adaptation in marine/coastal ecosystems demonstrated and replicated in other regions.

A.5 Agriculture and Food Security Adaptation Initiative

This initiative would focus on management of agriculture and food security systems to adapt to disasters affecting production and distribution of food, as well as support for data sharing, climate/weather monitoring, and early warning systems. As agriculture is vulnerable to climate change throughout the

region, this initiative or individual components could be combined with other initiatives, particularly the regional capacity building, Mekong, and coastal initiatives above.

Objective

The objective of this initiative is to mainstream climate concerns into the development of agriculture and food security programs and initiatives through regional cooperation, regional demonstration and replication of best practices, and regional institution strengthening. At the regional level, this initiative would contribute guidance on assessment of climate vulnerability and slate of adaptation options and implementation of the latter that might be integrated into regional and bilateral agriculture and food security activities.

Illustrative Activities

- ***Integrated assessments for agriculture and food security*** – pursuing opportunities to combine vulnerability assessments with other diagnostic tools and methodologies such as disaster risk reduction and value chain analysis. Specific components might include:
  - Assessing risks of natural hazards to food production, processing, transportation, and storage systems, including risk mapping; and
  - Integrating climate concerns into value chain analysis of weaknesses in the food security system, including agriculture, aquaculture, and fisheries production, with lessons learned shared regionally.

- ***Integrate adaptation and disaster risk reduction options into agriculture, land use, and food security strategies, plans, policies, and programs*** – improving preparation and response to climate stressors (e.g., drought, shifting precipitation, and water availability) and natural disasters and their implications for food production and food security. Specific components might include:
  - Mitigating risks of natural hazards to food production through disaster risk reduction approaches (including opportunities for cross-linkages with other initiatives, e.g., Mekong Watershed and Delta Initiative);
  - Supporting development of regional best practices and piloting of 'eco-agricultural' approaches that improve sustainability, build resilience (and future adaptation) to climate change impacts, and provide opportunities for climate change mitigation (e.g., through sequestration);
  - Using regional networks and linkages to regional agricultural research organizations to generate best practices and demonstrate on-the-ground benefits of adaptation measures such as drought/climate resilient varieties, improved and diversified cropping patterns and seasonal planting models, strengthened water and soil management, development of catastrophic risk insurance programs, and drought and pest monitoring and early warning systems;
  - Linking integrated water resources management to adaptation in agricultural production and strengthening planning and management capacity in the agricultural and water sectors, with lessons learned and best practices shared regionally; and
  - Regionally collaborating on climate-smart land-use and agricultural planning that includes agricultural suitability analysis to understand how and where crop production could shift in a climate-constrained future with fewer tradeoffs for ecosystems and people.

Geographic Focus

Significant impacts of climate change on agriculture and food security are possible throughout the region. Synergies between food, water, and climate are significant, for instance, in each of the following "hot spot" locations:

- Mekong Basin – rice (irrigated and rainfed), fisheries, and aquaculture;
- Himalayas – livestock, dairy, fruits, and vegetables;
- Coral Triangle – traditional foods, fisheries, and aquaculture;
- Borneo – rice, cassava, fruits and vegetables, and coconut;
- Sundarbans – rice, fisheries, and aquaculture; and
- Pacific Islands – traditional foods, coconut, livestock, vegetables, and fisheries.

Potential Program Partners

- DFID and the Chinese Academy of Agricultural Sciences;
- ASEAN climate and agricultural programs;
- Pacific Islands Forum, SPREP, SOPAC, and University of South Pacific on food security (fisheries and agriculture); and
- International, regional, and local NGOs working on agriculture and food security in Asian river basins, Tibetan Plateau, and coastal communities.

Key results:

- Increased and longer-term food security established across the region;
- More sustainable landscapes, with greater recognition of the role that ecosystem services play in underpinning agricultural production leading to better protection and management; and
- Increased synergies between responses to food security, climate change, and biodiversity challenges in the region.

A.6 Forest Ecosystems Adaptation Initiative

An ecosystem-based approach to adaptation places important emphasis on the inherent resilience of the cohesive biological diversity of intact nature preserves and furthers the related objectives of promoting biodiversity conservation as well as forest-based GHG mitigation. Forest ecosystems provide important environmental services related to carbon storage, habitat for biodiversity, water storage and regulation of water and sediment flows, and support of natural resource-based livelihoods. Many forested ecosystems are likely to be challenged beyond their capacity to adapt over the course of the century by an unprecedented combination of climate change, and associated disturbances such as deforestation and land conversion, forest fires, and forest degradation.

Objective

The objective of this initiative is to promote sustainable landscapes through greater regional engagement to address both climate and non-climate stressors of forested ecosystems, and to advance the potential contributions of well managed forests to GHG mitigation, sequestration, and adaptation through the production of ecosystem services.

Illustrative Activities

- ***Support research on climate impacts*** – promoting further understanding across the region of the environmental and economic dimensions of climate change impacts on forested and natural ecosystems, ranging from high mountain plateau grasslands to temperate and tropical forests. Specific components might include:

    - Analyzing climate impacts on different economic parameters of resource use, watershed services, and livelihoods within forested ecosystems (link to forestry/agriculture sector, forest fires, degradation of forests, loss of biodiversity, livelihoods, hydrological, and soil conservation);
    - Sharing generated data and information through regional forums and platforms; and
    - Developing, piloting, and regionally replicating protocols for monitoring changes in forest and grassland species ranges, health, richness, and abundance.

- ***Integrate climate vulnerability and adaptation assessments into forest ecosystem planning*** – establishing systems to anticipate climate stressors on forest and landscape management, and identify and promote joint benefits of ecosystem services. Specific components might include:

    - Conducting vulnerability assessments on bundled ecosystem services and analyzing implications of climate on the forest ecosystem and implications for other ecosystems and communities that benefit offsite from ecosystem services;
    - Conducting adaptation cost-benefit studies regarding forest ecosystem measures that promote ecosystem services and might be financed by payment for ecosystem services and carbon financing mechanisms;
    - Conducting assessments to assist countries in better landscape planning (e.g., identification of locations of priority sites for conservation, food production, etc.);
    - Promoting the sharing of lessons learned and dissemination of best practices through regional forums and platforms; and
    - Supporting efforts by countries as well as ASEAN and other regional institutions to incorporate forest ecosystem climate change issues (both adaptation and mitigation) into their policies and solve issues related to overlapping policies across sectors and between levels of governance.

- ***Demonstrate and share adaptation best practices*** – to move beyond research and motivate planning, public and private forest managers need locally and regionally tested adaptation examples to integrate into their plans and strategies. Also, there are opportunities to address the chronic problem of sustainable financing for forest management through the promotion of REDD, CDM, and voluntary carbon transactions as well as mechanisms such as payment for ecosystem services (PES). Specific components of this activity might include:

    - Enhancing forest ecosystem resiliency to climate change through adoption of forest best practices, wider application of protected area management, reforestation and rehabilitation of degraded forests and habitats, strengthened threats monitoring and enforcement capacity,

Development of forest fitness and disease and pest monitoring as well as early warning systems, improved forest fire mitigation, preparedness and response programs, and aggressive monitoring and eradication of invasive species;

- Promoting sustainable financing and innovative management approaches, including revenue generation from carbon sales through international mechanisms, local PES schemes focused mainly on water regulation and production services for downstream public and private water users; and community co-management mechanisms (including enhancing community rights and ownership of forest resources) and promotion of non-timber forest products, tourism and other livelihood options; and
- Compiling regional lessons learned and best practices as well as building capacity in regional organizations to assist forest managers in applying them—there is an extensive network of international and local NGOs supporting improved forest management, particularly in Northeastern, South, and Southeast Asia.

Geographic Focus

This initiative could be combined with other initiatives, designed to complement ongoing forest ecosystem projects and programs in the region, or targeted to forest "hotspots" such as forested areas subject to desertification and/or vulnerable to droughts and forest fires. The **Greater Himalayan region** and **Tibetan Plateau** include some of the most fragile and unique forest and grassland ecosystems in Asia and could be targeted for this initiative or linked to the **Mekong Climate Initiative** in terms of, for instance, providing better understanding of the relationships between forest ecosystem services, livelihoods and food security, and climate change adaptation, and the need for planning and policy to reflect these relationships.

Another specific idea is to support regional adaptation efforts in the **Heart of Borneo** (ecologically connecting the landscapes of Indonesia, Malaysia, and Brunei Darussalam). The three governments jointly declared in February 2007 their commitment to preserve and sustainably develop this 240,000 km^2 area of continuous forests. They have developed a strategic action plan which highlights the need for a sustainable economic model for the Heart of Borneo through a joint conservation and development approach. This includes valuing services which forested ecosystems provide through income generating (ecosystem services-based) schemes and sustainable natural resource management within the area. It is crucial that the economic impacts of climate change be taken into consideration when developing such strategies for the Heart of Borneo. Due to its elevational gradients and habitat diversity, the Heart of Borneo is expected to be a climate refuge and the centerpiece of forest and freshwater ecosystem connectivity across the island. Adaptation approaches will therefore bring biodiversity, natural resource (freshwater and carbon), and food security benefits, and be an important component of green and low carbon development planning. There are also significant opportunities to link with mitigation approaches like REDD, and parallel food security initiatives.

Potential Program Partners

- ASEAN – focusing on improved management to avoid forest fires;
- International NGOs working on the design and implementation of REDD readiness and demonstration activities;
- International and local NGOs working on impacts of glacial retreat on mountain ecosystems and communities such as ICIMOD and The Mountain Institute; and
- International NGOs working on disaster risk management, and forest and grassland management in the Himalayas.

Key results

- Increased ability of country planners to address climate risks, optimize investment decisions, and avoid costly maladaptation;
- Increased adaptive capacity of technical experts and decision-makers for coping with impacts of climate variability and change; and
- Long term economic benefit through avoiding damages to forested ecosystems and securing climate refugia.

ANNEX B – ASIA AND PACIFIC REGIONAL MEETINGS AND CONSULTATIONS

Assessment Team and USAID Participants:

a – Glen Anderson, IRG; b – Yoon Kim, IRG; c – Maria Haws, UH-Hilo; d: Murray Ford, UHSGCP and College of Marshall Islands; e – Seema Bhatt, ISET; f – Geoffrey Blate, WWF; g – Ken MacClune, ISET; h – Orestes Anastasia, USAID/RDMA

Asia Region – Philippines, Thailand, Indonesia, Vietnam, Bangladesh, Laos

Meeting/ Consultation	Location	Date (2009/2010)	Participants	Staff
Asian Development Bank (ADB)	Manila, Philippines	October 23	*David McCauley*, Climate Change Coordination Unit (CCCU), Regional and Sustainable Development Department (RSDD); *Jay Roop*, Climate Change Implementation Program (Adaptation), RSDD; *Daniele Pozi*, Adaptation Policy, RSDD; *Lauren Sorkin*, CCCU, RSDD; *Lisa LeClerc,* Climate Change Finance and Operations Specialist, Environment and Social Safeguards Division	a
USAID/Philippines	Manila, Philippines	November 3	*Rolf Anderson*, Chief, Office on Energy and Environment, USAID/Philippines; *Aurelia Micko*, Deputy Chief, Office on Energy and Environment, USAID/Philippines; *Oliver Angoncilla*, Natural Resources Policy Advisor, USAID/Philippines; *Ruppa Karia*, Governance Officer, Office of Energy and Environment, USAID/Philippines	a
Manila Observatory	Manila, Philippines	November 3	*Deanna Marie Olaguer*, Project Development Officer and Head, Klima Climate Change Center, Manila Observatory; *May Celine Vincente,* Program Manager, Geomatics for Environment and Development, Manila Observatory; *Gemma Teresa Narisma*, Head, Regional Climate Systems, Manila Observatory; *Aurelia Micko*, Deputy Chief, Office on Energy and Environment, USAID/Philippines	a
Department of Environment and Natural Resources	Manila, Philippines	November 3	*Joyceline Goco,* Chief, Institutional Coordination and Documentation Center, DENR; *Aurelia Micko*, Deputy Chief, Office on Energy and Environment, USAID/Philippines	a
WWF-Philippines	Manila, Philippines	November 4	*Luz Baskina,* Vice President for Project Development, WWF-Philippines; *Jose (Joel) Palma,* Vice President for Programs, WWF-Philippines; *Chrisma Salao,* Grants Officer/Project Coordinator, WWF-Philippines	a

Meeting/ Consultation	Location	Date (2009/2010)	Participants	Staff
USAID/RDMA – Regional Environment Office	Bangkok, Thailand	October 26	*Barry Flaming,* Regional Program Development Specialist, Regional Environment Office; *Rene Acosta,* Regional Environment Program Specialist, Regional Environment Office; *Winston Bowman,* Director, Regional Environment Office	a, b, e, f, h
USAID/RDMA – Governance and Vulnerable Populations Office	Bangkok, Thailand	October 26	*Piyachatr Pradubraj,* Regional Program Development Specialist, Governance and Vulnerable Populations Office; *Pui Man Wong,* Crisis Stabilisation and Governance Officer, Governance and Vulnerable Populations Office	a, b, e, f, h
USAID/RDMA – Office of Public Health	Bangkok, Thailand	October 26	*Aye Aye Thwin,* Director, Office of Public Health; *John MacArthur,* Infectious Diseases Team Leader, Office of Public Health*; Mareitou Satin,* Population, Health and Nutrition Office Deputy Director, Office of Public Health	a, b, e, f, h
Southeast Asia START Regional Centre	Bangkok, Thailand	October 27	*Anond Snidvongs,* Director*; Suppakorn Chinvanno,* Advisor to Research Group	a, b, e, f
GtZ	Jakarta, Indonesia	October 29	*Andreas Obser*, Principal Advisor, ASEAN – German Regional Forest Programme; *Timothy Buehrer*, Chief of Party, ASEAN-US Technical Assistance and Training Facility (ADVANCE); *Suzanne Young*, Climate Change Specialist, ADVANCE; *Beth Spelsberg*, ASEAN and Regional Economic Coordinator, US Embassy; *Jennifer Wilson*, General Development Officer, RDMA	a, b, e, h
ASEAN	Jakarta, Indonesia	October 29	*Somsak Pipoppinyo*, Assistant Director, Agriculture Industries and Natural Resources Division, ASEAN Economic Community Department; *Timothy Buehrer*, Chief of Party, ASEAN-US Technical Assistance and Training Facility (ADVANCE); *Suzanne Young*, Climate Change Specialist, ADVANCE; *Beth Spelsberg*, ASEAN and Regional Economic Coordinator, US Embassy; *Jennifer Wilson*, General Development Officer, RDMA	a, b, e, h
World Bank	Jakarta, Indonesia	October 30	*Tim Brown*, Senior Natural Resources Specialist, World Bank; *Virza Sasmitewidjaya*, Senior Environmental Policy and Safeguards, World Bank; *Iwan Gunawan*, Senior Disaster Management Advisor, World Bank	a, b
USAID/Indonesia	Jakarta, Indonesia	October 30	*Alfred Nakatsuma*, Director, Office of Environment; *Mary Melnyck*, USAID Asia Bureau; *Ben Stoner*	a, b, h
US Embassy Indonesia	Jakarta, Indonesia	October 30	*Cameron Hume*, Ambassador; *Hugo Yon*, Chief and First Secretary, Environment, Science, Technology and Health Unit, US Embassy Indonesia; *Walter North*, USAID Mission Director; *Alfred Nakatsuma*, Director, Office of Environment, USAID Indonesia	a, b, h
Coral Triangle Support Partnership (CTSP)	Jakarta, Indonesia	October 30	*Maurice Knight*, Chief of Party, CTSP; *Suzanne Young*, Climate Change Specialist, ADVANCE	a, b, h
USAID/OFDA	Bangkok, Thailand	November 2	*Al Dwyer*, Principle Regional Advisor for East Asia and the Pacific, Office of Foreign Disaster Assistance	a, b
UNEP ROAP	Bangkok,	November 2	*Dechen Tsering*, Deputy Regional Director, UNEP ROAP; *Mozaharul Alam*,	b

Meeting/ Consultation	Location	Date (2009/2010)	Participants	Staff
	Thailand		Regional Climate Change Coordinator, UNEP ROAP; *Serena Fortunam*, Associate Program Officer, UNEP ROAP; *Seon-Mi Choi*, Associate Program Officer, UNEP ROAP; *Mahesh Pradhan*, Director, a.i., AIT/UNEP Regional Resource Centre for Asia and the Pacific (RRC.AP)	
AIT/UNEP RRC.AP	Bangkok, Thailand	November 3	*Mahesh Pradhan*, Director, a.i., AIT/UNEP RRC.AP; *Satya Priya,* AIT/UNEP RRC.AP; *Roopa Rakshit*, Knowledge Management Officer, Knowledge Support, AIT/UNEP RRC.AP; *Lekha Ratnayake*, Conference Services Officer, Knowledge Support, AIT/UNEP RRC.AP; *Hiromi Inagaki*, Consultant, Regional Support, AIT/UNEP RRC.AP	b
Rockefeller Foundation ACCCRN	Bangkok, Thailand	November 4	Sam Kernaghan, Senior Consultant, International Development, ARUP; Anna Brown, Senior Research Associate, Rockefeller Foundation	b, h
ANE-Asia/Oregon State University	Bangkok, Thailand	November 4	*Alan Cooper*, Affiliate Faculty, Oregon State University; *Dr. David Hannaway*, Extension, Research & Teaching Forages, Oregon State University	b, h
Greater Mekong Subregion (GMS) – Core Environment Program (CEP), ADB	Bangkok, Thailand	November 4	*Hasan Moinuddin*, Biodiversity Corridors Initiative Task Leader and Climate Change Coordinator, GMS-CEP; *Sumit Pokhrel*, Program Associate, GMS-CEP	b
Swedish Environment Secretariat in Asia (SENSA) and Stockholm Environment Institute (SEI)	Bangkok, Thailand	November 5	*Anders Granlund*, Director, SENSA; *Kai Kim Chiang*, Research Coordinator, SEI	b
European Union (EU)	Bangkok, Thailand	November 5	*Sutthiya Chantawarangul*, Programme Officer, EU; *Delphine Brissonneau*, Attaché, EU	b
CARE	Bangkok, Thailand (call)	November 5	*Charles Ehrhart*, Climate Change Coordinator, CARE	b
Ho Chi Minh City Roundtable	Ho Chi Minh City, Vietnam	November 5	*Mr. Châu*, Climate Change Specialist, Solid Waste Management, HCMC Department of Natural Resources and the Environment; *Ms. Phan Thu Nga*, Scientific Research Management, HCMC Department of Science and Technology; *Trịnh Thị Long*, Director - Southern Institute of Water Resources Research - Environmental Research & Engineering Center; *Nguyễn Xuân Hiền*, Deputy Director, Southern Institute for Water Resources Planning ; *Dr. Nguyễn Hữu Dũng*, Center for Environmental Economics and Policy, HCMC University of Economics; *Dr. Võ Lê Phú*, Department of Environmental Management Faculty of Environment, HCMC University of Technology, Deputy Director, Sub-Institute of Hydrometeorology & Environment ; *Dr. Phạm Gia Trân*, HCMC University of Social Sciences & Humanities; *Angela Dickey ,* Deputy Consul General, Consulate General of the United States of America, Ho Chi Minh City, Vietnam; *Jennifer Ludders,* Economic Officer, Consulate General of the United States of America, Ho Chi Minh City; *Patricia Norland,* Press and Cultural Attache, Education	a, g, h

Meeting/ Consultation	Location	Date (2009/2010)	Participants	Staff
			Programs, Consulate General of the United States of America, Ho Chi Minh City; *Tran Ha Nguyen,* Economic/Political Specialist, Consulate General of the United States of America, Ho Chi Minh City	
UNDP	Bangkok, Thailand	November 6	*Gernot Laganda*, Regional Technical Advisor, Climate Change Adaptation (LDCs), UNDP; *Angus Mackay*, Regional Technical Advisor, Climate Change Adaptation (Mid-income), UNDP	b, h
SEI	Bangkok, Thailand	November 6	*Kai Kim Chiang*, Research Coordinator, SEI	b
DRAGON Institute, Can Tho University	Can Tho, Vietnam	November 6	*Dr. Nguyen Hieu Trung*, Deputy Director, DRAGON Institute; *Dr. Nguyen Van Be*, Head, Department of Environmental and Natural Resources Management, Can Tho University; *Dr. Pham Xuan Binh*, Deputy Director, Department of International Relations, Can Tho University; *Tran Ha Nguyen,* Economic/Political Specialist, Consulate General of the United States of America, Ho Chi Minh City	a, g, h
Department of Natural Resources and Environment, Can Tho City	Can Tho, Vietnam	November 6	*Ky Quang Vinh*, Director, Center for Natural Resources and Environmental Monitoring, DONRE; *Nguyen Minh The*, Vice Director, DONRE; *Angela Dickey,* Deputy Consul General, Consulate General of the United States of America, Ho Chi Minh City; *Tran Ha Nguyen,* Economic/Political Specialist, Consulate General of the United States of America, Ho Chi Minh City	a, g, h
Mekong Delta Rice Research Institute	Can Tho, Vietnam	November 6	*Le Can Banh,* Director, Mekong Delta Rice Research Institute; *Lưu Hồng Mẫn*, Chief of Science and International Cooperation, Mekong Delta Rice Research Institute; *Angela Dickey,* Deputy Consul General, Consulate General of the United States of America, Ho Chi Minh City; *Tran Ha Nguyen,* Economic/Political Specialist, Consulate General of the United States of America, Ho Chi Minh City	a, g, h
USAID/Bangladesh	Dhaka, Bangladesh	November 9	*Naren Chanmugam*, Director, Office of Economic Growth, USAID/Dhaka; *Azharul Mazumder*, Environment Team Leader, OEG, USAID/Dhaka	b
USAID/Bangladesh	Dhaka, Bangladesh	November 9	*Denise Rollins*, Mission Director, USAID/Dhaka; Carey Gordon, Deputy Mission Director, USAID/Dhaka; *Azharul Mazumder*, Environment Team Leader, OEG, USAID/Dhaka	b
Bangladesh Centre for Advanced Studies (BCAS)	Dhaka, Bangladesh	November 9	*Atiq Rahman*, Executive Director, BCAS	b
EU	Dhaka, Bangladesh	November 9	*Koen Duchateau*, First Secretary, Bangladesh Delegation, EU	b
AusAID	Vientiane, Laos	November 9	*Simon Buckley,* First Secretary and Manager, Mekong Water and Infrastructure Unit; *, Franc Shelton,* Economics/Commercial Officer, US Embassy	a
Centre for Natural Resource Studies (CNRS)	Dhaka, Bangladesh	November 10	*Anisul Islam*, Director, CNRS	b

Meeting/ Consultation	Location	Date (2009/2010)	Participants	Staff
Centre for Global Change (CGC)	Dhaka, Bangladesh	November 10	*Ahsan Uddin Ahmed*, Executive Director, CGC	b
IUCN	Dhaka, Bangladesh	November 10	Niaz Khan, Country Representative, IUCN	b
Mekong River Commission (MRC)	Vientiane, Laos	November 10	*Hanne Bach,* Chief Technical Advisor, Environment Division, MRC; *, Franc Shelton,* Economics/Commercial Officer, US Embassy	a
US Embassy Vientiane	Vientiane, Laos	November 10	*Peter Haymond,* Deputy Chief of Mission, US Embassy*, Franc Shelton,* Economics/Commercial Officer, US Embassy	a
UNEP	Beijing, China	January 12	*Jiang Nanqing,* Project Manager, UNEP China; *Dr. Hu Tao,* Programme Coordinator, China Climate Change Partnership Framework; *Catherine Wong,* International Consultant, UNIDO; *Sherry Hong*, Deputy Chief, ESTH Office, US Embassy, Beijing	a, h
Department for International Development (DFID)	Beijing, China	January 12	*Ellen Kelly,* First Secretary, Climate Change Adaptation Adviser, and Project Coordinator, DFID; *John Warburton,* First Secretary and Senior Environment Adviser, DFID; *Wang Guoquian,* Climate Change Adviser, DFID; *Sherry Hong*, Deputy Chief, ESTH Office, US Embassy, Beijing	a, h
The Nature Conservancy (TNC)	Beijing, China	January 12	*Robert Tansey,* External Affairs Director, North Asia Region, TNC; *Ma Jian,* Conservation and Climate Change Project Manager, TNC; *Peng Zhao,* External Affairs Manager, TNC; *Sherry Hong*, Deputy Chief, ESTH Office, US Embassy, Beijing	a, h
World Resources Institute (WRI)	Beijing, China	January 12	*Zou Ji,* China Country Director, WRI; *Deborah Seligsohn,* Principal Advisor, Climate Change, Energy and Pollution Program, WRI; *Sherry Hong*, Deputy Chief, ESTH Office, US Embassy, Beijing	a, h
China Foundation for Desertification Control (CFDC)	Beijing, China	January 13	*AN Chengxin,* Chairman, CFDC; *Elton Qing CHEN,* Chief, International Affairs, CFDC; *Wu Daoxin,* President Assistant, CFDC; *Xiong Dingguo,* President Assistant, CFDC; *Tahra Vose,*, US Embassy, Beijing; *Loren Braunohler,* Office of China and Mongolia Affairs, US Department of State	a, h
National Climate Center, China Meteorological Administration	Beijing, China	January 13	*Lu Xuedu,* Deputy Director-General, NCC, CMA; *Xiao Fengjin,* Deputy Director, Climate Service Division, NCC, CMA; *Su Buda,* Senior Researcher, Climate Impact Assessment Division, NCC, CMA; *Sun Yuan,* Foreign Affairs Officer, Scientific Development Division, NCC, CMA; *Wang Shili,* Senior Researcher, Chinese Academy of Meteorological Sciences; *Tahra Vose,*, US Embassy, Beijing; *Loren Braunohler,* Office of China and Mongolia Affairs, US Department of State	a, h
State Oceanic Administration	Beijing, China	January 13	*Wang Bin,* Deputy Director-General, Department of Marine Environmental Protection, SOA; *Wang Antao,* Program Officer, Department of International Cooperation, SOA; *Zheng Rui,* Program Officer, Department of Foreign	a, h

Meeting/ Consultation	Location	Date (2009/2010)	Participants	Staff
			Cooperation, SOA; *Sherry Hong*, Deputy Chief, ESTH Office, US Embassy, Beijing	
Desert Control Volunteers Network (DCVN)	Beijing, China	January 13	*Jin Meng,* Director, DCVN; *Zhao Kun,* Program Officer, DCVN; *Sherry Hong*, Deputy Chief, ESTH Office, US Embassy, Beijing	a, h
State Forestry Administration (SFA)	Beijing, China	January 14	*Wang Chunfeng,* Deputy Director-General,Asia-Pacific Network for Sustainable Forest Management and Rehabilitation; *Zhang Zhongtian,* Deputy Director, Division of Multilateral Affairs, SFA; *Xia Jun,* Deputy Division Director, Department of International Cooperation, SFA; *Wang Jianbo,* Division of Forest Disease and Pest Control, SFA; *Sherry Hong*, Deputy Chief, ESTH Office, US Embassy, Beijing	a, h
Institute of Environment and Sustainable Development in Agriculture IEDA), Chinese Academy of Agricultural Sciences (CAAS)	Beijing, China	January 14	*Yinlong Xu,* Professor, IEDA, CAAS; *Ma Shiming,* Professor, IEDA, CAAS; *Lin Erda,* Professor, IEDA, CAAS; *Sherry Hong*, Deputy Chief, ESTH Office, US Embassy, Beijing	a
United Nations Development Programme (UNDP)	Beijing, China	January 14	*Goerild Heggelund,* Senior Climate Change Advisor, UNDP; *Angela De Angelis,* Senior Climate Change Advisor, UNDP; *Zhang Weidong,* Programme Manager, Energy & Environment Team, UNDP; *Sherry Hong*, Deputy Chief, ESTH Office, US Embassy, Beijing	a
Environment, Science, Technology and Health (ESTH) Section	Beijing, China	January 14	*W. Brent Christensen,* Counselor, ESTH Office, US Embassy, Beijing	a
World Wildlife Fund – China (WWF)	Beijing, China	January 15	*Wang Tao,* Senior Officer, Global Climate Initiative China Programme, WWF; *Shen Xingxing,* Freshwater Programme Officer, WWF	a
USAID/Delhi	Delhi, India	January 11	*Dan Miller,* Agriculture Officer, USAID/Delhi	b
ISET	Delhi, India	January 11	*Dilip Singh,* Research Associate, ISET	b, e
The Energy and Resources Institute (TERI)	Delhi, India	January 11	*Dr. Sanjay Tomar,* Fellow, Centre for Global Environmental Research, TERI	b, e
National Institute of Disaster Management	Delhi, India	January 11	*Dr. Anil Gupta,* Associate Professor	b, e
Dr. Praveen Singh	Delhi, India	January 12	*Dr. Praveen Singh (formerly with ISET),* Assistant Professor, School of Human Ecology, Ambedkar University	b, e
Gorakhpur Environmental Action Group	Delhi, India	January 12	*Dr. Shiraz Wajih,* President, Gorakhpur Environmental Action Group	b, e
WWF India	Delhi, India	January 13	*Shirish Sinha,* Head, Climate Change and Energy Programme, WWF India	b, e
GtZ	Delhi, India	January 13	*Vera Sholz,* Natural Resource Management Programme Director, GtZ	b, e

Meeting/ Consultation	Location	Date (2009/2010)	Participants	Staff
US Consulate Kolkata	Kolkata, India	January 14	*Matthew Asada,* Consul for Political and Economic Affairs, US Consulate; *Sangita Dey Chanda*, Economic Advisor, US Consulate	b
Government of West Bengal	Kolkata, India	January 14	*Debal Ray*, Chief Environment Officer, Government of West Bengal	b
Jadavpur University	Kolkata, India	January 14	*Dr. Indrila Guha*, Visiting Researcher, Global Climate Change Programme, Jadavpur University; *Rajarshi Banerji*, Visiting Researcher, Global Climate Change Programme, Jadavpur University; *Dr. R.N. Bhattacharya*, former head of Economics Department, Jadavpur University	b
Kolkata Metropolitan Development Authority	Kolkata, India	January 14	*Tapas Kumar Ghatak,* Environment Cell, Kolkata Metropolitan Development Authority, Dept. of UD, Govt. of West Bengal	b
Central Soil Salinity Research Institute	Kolkata, India	January 14	*Dr. B.K. Bandyopadhyay,* Central Soil Salinity Research Institute	b
WWF India – Sundarbans Programme	Kolkata, India	January 14	*Subhro Sen,* Assistant Coordinator, Sundarbans Programme, WWF India; *Dr. Ajoy Kumar Ghosh*, Former Director, CIFRI, Indian Council of Agricultural Research, Department of Agricultural Research and Education, Ministry of Agriculture, Govt. of India	b
South Asian Forum for Environment (SAFE)	Kolkata, India	January 14	*Dr. Dipayan Dey*, Chair, SAFE	

Pacific Region – Republic of the Marshall Islands, Federated States of Micronesia, Solomon Islands

Meeting/ Consultation	Location	Date (2009/2010)	Participants	Staff
RMI Roundtable	Majuro, RMI	October 14	*Don Hess*, College of the Marshall Islands; *Deborah Barker-Manase*, Director, RMI Environmental Protection Authority (EPA); *Albon Ishoda*, Executive Director, Marshall Islands Conservation Society; *Ingrid Algren*, RMI Historical Preservation Society; *Darren Nakata*, Marshall Islands Marine Resources Authority (MIMRA); *Florence Edwards*, MIMRA; *Teri Keju*, RMI EPA; *Regina Woodrum RudRud*, UH-Manoa; *Candice Guavis*, MIMRA; *Hespy Note*, Youth-to-Youth-in-Health	a, c, d
USAID/OFDA	Majuro, RMI	October 15	*Bart Deemer*, USAID Office of Foreign Disaster Assistance; *Ashley Carl,* Project Coordinator, International Organization for Migration	a, c, d
US Embassy	Majuro, RMI	October 15	*Martha Campbell,* US Ambassador to the Marshall Islands; *Eric Watnik,* Deputy Chief of Mission, US Embassy; *Larry Kimmel,* Political and Economic Officer, US Embassy; *Bart Deemer*, USAID Office of Foreign Disaster Assistance; *Ashley Carl,* Project Coordinator, International Organization for Migration	a, c, d

Meeting/ Consultation	Location	Date (2009/2010)	Participants	Staff
Pacific Climate Change Roundtable (SPREP)	Majuro, RMI	October 19-21	71 participants from 13 Pacific Islands nations and 8 multilateral and bilateral donors and international NGOs (Participant List is available at www.sprep.org)	a, c, d
Solomon Islands participants in the Pacific Climate Change Roundtable	Majuro, RMI	October 19	*Chanel Iroi,* Undersecretary, Ministry of Environment, Conservation and Meteorology, Solomon Islands; *Gillian Cook,* Media Awareness Officer, Climate Change Division, Ministry of Environment, Conservation and Meteorology	a, c
FSM participants in the Pacific Climate Change Roundtable	Majuro, RMI	October 20	*Jackson Soram,* Deputy Assistant Secretary for Multilateral Affairs, FSM; *Ricky Carl,* Deputy Director, Micronesia Program, The Nature Conservancy, Pohnpei, FSM	a, c
Island Food Community NGO	Pohnpei, FSM	October 23	*Dr. Lois Engleberger,* Nutritionist, Island Food Community NGO, Pohnpei, FSM	c
Marine and Environmental Research Institute of Pohnpei (MERIP)	Pohnpei, FSM	October 23	*Simon Ellis,* Director, MERIP; *Shaun Cronin,* Assistant Director, MERIP; *Fran Hezel,* Micronesia Seminary, Pohnpei, FSM	c
Micronesia Conservation Trust (MCT)	Pohnpei, FSM	October 25	*Willy Kostka,* Director, MCT, Pohnpei, FSM; *Lisa Andon,* MCT; *Lilha Noori,* Program Coordinator, MCT	c

ANNEX C – LIST OF DOCUMENTATION

C.1 Global and Regional Documentation

Author	Title, Date	Geographic Scope
Arias, D.	Agricultural Insurance: Scope and Limitations for Weather Risk Management, June 2009	Global
de Sherbinin, A., et al.	How vulnerable are global coastal cities to climate change hazards? 2008	Global (Mumbai, Shanghai)
Dudley, N., et al.	Natural Solutions: Protected areas helping people cope with climate change, 2010	Global
Dyurgerov, M. and Meier, M.	Glaciers and the Changing Earth System: A 2004 Snapshot, 2005	Global
European Commission	Communication From the Commission to the Council and the European Parliament–Building a Global Climate Change Alliance between the European Union and poor developing countries most vulnerable to climate change	Global
Food and Agriculture Organization of the United Nations	International Trade in Rice, Recent Developments and Prospects. World Rice Research Conference 2004.	Global
Gender and Water Alliance and UNDP	Resource Guide: Mainstreaming Gender in Water Management, 2006	Global
GTZ	Climate Change Information for Effective Adaptation: A Practitioner's Manual, May 2009	Global
Handisyde, N.D., et al.	The Effects of Climate Change on World Aquaculture: A Global Perspective, 1990	Global
Hellmuth, M.E, Osgood, D.E., Hes, U., Moorhead, A. and Bhojwani, H. (eds).	Index insurance and climate risk: Prospects for development and disaster management. Climate and Society No. 2. International Research, Institute for Climate and Society (IRI), Columbia University, New York, USA, 2009	Global
IIED	Assessing the Costs of Adaptation to Climate Change – A Review of the UNFCCC and other recent estimates, August 2009	Global
IFPRI	Climate Change – Impact on Agriculture and Costs of Adaptation, September 2009	Global
IPCC	Third Assessment Report, Working Group II: Impacts, Adaptation and Vulnerability, 2001	Global
IPCC (WG II)	Technical Paper VI: Climate change and water, June 2008	Global, regional

Author	Title, Date	Geographic Scope
Kahn, M.	The death toll from Natural Disasters: The role of income, geography and institutions, 2003	Global, regional
Kramer, A.M.	Adaptation to Climate Change in Poverty Reduction Strategies, Human Development Report 2006/2007, UNDP	Global, regional
Leahy, Stephen	Oceans Passing Critical CO2 Threshold, November 25, 2008 by Inter Press Service	Global
Lenton, T. et al.	Major Tipping Points in the Earth's Climate System and Consequences for the Insurance Sector, 2009 (for WWF and Allianz)	Global
Nicholls, R.J. et al.	Ranking Port Cities with High Exposure and Vulnerability to Climate Extremes: Exposure Estimates, January 2008	Global (China, India, Vietnam)
OECD	Adaptation to Climate Change: What Role for Microfinance? International Workshop on "The Social Dimension of Adaptation to Climate Change" , FEEM, Venice , 18-19 February 2010	Global
OECD	Key Adaptation Concepts and Terms, 2006	Global
OECD	Integrating Climate Change Adaptation into Development Co-operation – Policy Guidance, 2009	Global
OECD	Stocktaking of Progress on Integrating Adaptation to Climate Change into Development Co-operation Activities, 2007	Global
Osman-Elasha and T. Downing	Lessons Learned in Preparing National Adaptation Programmes of Action in Eastern and Southern Africa, European Capacity Building Initiative, 2007	Global (East and South Africa)
Oxfam	Adapting to climate change–What's needed in poor countries, and who should pay, May 2007	Global
Padgham, J.	Agricultural Development under a Changing Climate: Opportunities and Challenges for Adaptation, World Bank, August 2009	Global
Population Action International	Projecting Population, Projecting Climate Change Population in IPCC Scenarios, June 2009	Global
Scheraga, J. and A. Grambsch	Risks, Opportunities, and Adaptation to Climate Change, Climate Research, 1998	Global
Stern, Todd	Keynote Remarks at U.S. Climate Action Symposium, March 2009	Global
Thompson, Lonnie	Understanding Global Climate Change: A Paleoclimate Perspective from the World's Highest Mountains, July 2009	Global
Thow, A. and de Blois, M.	Climate Change and Human Vulnerability: Mapping emerging trends and risk hotspots for humanitarian actors, ed. 2, March 2008	Global
Tyndall Centre for Climate Change Research	Surviving Climate Change in Small Islands: A Guidebook, October 2005	Global
University of Copenhagen	Synthesis Report: Climate Change – Global Risks, Challenges& Decisions, March 2009	Global
UNDP	A Toolkit for Designing Climate Change Adaptation Initiatives	Global
UNDP	UNDP/Spain Millennium Development Goals Achievement Fund–Framework Document, August 2007	Global

Author	Title, Date	Geographic Scope
UNEP	Review of the Literature on the Links Between Biodiversity and Climate Change – Impacts, Adaptation, and Mitigation, Secretariat of the Convention on Biological Diversity, CBD Technical Series, No. 42, 2009	Global
UNFCCC	Compendium on methods and tools to evaluate impacts of, vulnerability and adaptation to, climate change, 2008	Global
UNFPA	State of World Population: Facing a Changing World, Women, Population and Climate, 2009	Global
UN/ISDR	Gender Perspectives: Integrating Disaster Risk Reduction into Climate Change Adaptation. Good Practices and Lessons Learned, 2008	Global
UN/ISDR	Living with Risk – A global review of disaster reduction initiatives, 2004	Global
USAID	Biodiversity Conservation and Forestry Programs, Annual Report, 2009	Global
USAID	A Report to Congress on the $75 million FY09 Food Security Strategy: Targeted Agriculture Funds	Global
Warner, K.,et al.	In Search of Shelter: Mapping the Effects of Climate Change on Human Migration and Displacement, May 2009	Global (4 Asia regions)
World Bank	The Costs to Developing Countries of Adapting to Climate Change–New Methods and Estimates: The Global Report of the Economics of Adaptation to Climate Change Study Consultation Draft	Global
World Bank	The Economics of Adaptation to Climate Change, Final Methodology Report, February 2009	Global
World Bank	The Impact of Sea Level Rise on Developing Countries: A Comparative Analysis, World Bank Policy Research Paper, February 2007	Global
WWF Global Freshwater Programme	World's Top 10 Rivers at Risk, 2007	Global
World Resources Institute	The National Adaptive Capacity Framework - Key Institutional Functions for a Changing Climate, 2009	Global
ADB	Climate Proofing – A Risk-based Approach to Adaptation, 2005	Asia-Pacific
ADB	Climate Change and Migration in Asia and the Pacific, Executive Summary, 2009	Asia-Pacific
ADB	Disaster and Emergency Assistance Policy, May 2004	Asia-Pacific
ADB	Mainstreaming Adaptation Concerns in Development Assistance Operations – a regional development bank case study, PowerPoint presentation by Putu Katayama	Asia-Pacific
ADB	Promoting Climate Change Adaptation in Asia and the Pacific, October 2007	Asia-Pacific
ADB	Regional Partnerships for Climate Change Adaptation and Disaster Preparedness, October 2008	Asia-Pacific
ADB	Under the Weather and Rising Tide – Adapting to a Changing Climate in Asia and the Pacific, 2009	Asia-Pacific
ADB	Building Climate Resilience in the Agriculture Sector of Asia and the Pacific, 2009	Asia-Pacific

Author	Title, Date	Geographic Scope
Ahmed, Sara	Gender, Water Security and Climate Change in Asia-Pacific, 2009	Asia-Pacific
Institute for Global Environmental Strategies	Climate Change Policies in the Asia-Pacific: Re-uniting Climate Change and Sustainable Development, 2008	Asia-Pacific
Taylor, M. and Figgis, P. (eds)	Protected Areas: Buffering nature against climate change. Proceedings of a WWF and IUCN World Commission on Protected Areas Symposium, 18-19 June 2007.	Asia-Pacific
USAID/RDMA	Global Climate Change in the Asia-Pacific Region: An Analysis and Road Map for the USAID Regional Development Mission for Asia, 2008	Asia-Pacific
ACCCRN	Responding to the Urban Climate Challenge	Asia
Adaptation Team	From Research to Policy, Capacity and Action–Enabling Adaptation to Climate Change for Poor Populations in Asia through Research, Capacity Building and Innovation	Asia
ADB	Understanding and Responding to Climate Change in Developing Asia, 2009	Asia
Alam, Mozaharul, et al.	Impacts, vulnerability and adaptation to climate change in Asia, Background Paper for the UNFCCC, April 2007	Asia
Cruz, R.V., et al.	IPCC Fourth Assessment Report. Climate Change 2007: Impacts, Adaptation and Vulnerability. Chapter 10: Asia, 2007.	Asia
International Institute for Sustainable Development	Land and Water Resources Management in Asia: Challenges for Climate Adaptation, 2009	Asia
Mangroves for the Future (MFF)	MFF Newsletter , August-September 2009	Asia
Richardson, Michael	Rice Production: Climate change and Asia's paddy fields New research vital to combat threat to continent's staple food from rising sea levels and temperatures, August 2007	Asia
Rockefeller Foundation	Asian Coastal Cities Climate Change Resilience Network (brochure)	Asia
Srinivasan, A., (Ed.)	The Climate Regime Beyond 2012: Reconciling Asian Developmental Priorities and Global Climate Interests, February 2008	Asia
Tyler, S. and Liz Fajber	Land and Water Resource Management in Asia Challenges for climate adaptation, January 2009	Asia
USAID/OFDA	Asia Flood Network – A Flood Mitigation and Preparedness Program in Asia	Asia
World Vision	Planet Prepare: Preparing Coastal Communities in Asia for Future Catastrophes, 2008	Asia
World Wildlife Fund	Mega-Stress for Mega-Cities–A Climate Vulnerability Ranking of Major Coastal Cities in Asia, 2009	Asia
Yohe, G., et al.	Reducing Poverty and Hunger in Asia: Climate Change in the Context of Asia: Pro-Poor Adaptation, Risk Management, and Mitigation Strategies, March 2008	Asia
ADB	ADB Climate Change Program with special reference to the Pacific	Pacific

Author	Title, Date	Geographic Scope
ADB	Mainstreaming Climate Change in ADB's Operations, Pacific Regional Department, Climate Change Implementation Plan for the Pacific (2009-2015) – 3 documents	Pacific
ADB	Regional Technical Assistance Report, Project Number: 42073, July 2008	Pacific
Australia, Commonwealth of	Engaging our Pacific Neighbours on Climate Change: Australia's Approach, 2009	Pacific
AusAid and UNDP	The gendered dimensions of disaster risk management and adaptation to climate change – Stories from the Pacific	Pacific
Barnett, Jonathan	Climate Change and Small Island States: Power, Knowledge and the South Pacific, An overview of projects and programmes, forthcoming 2010	Pacific
Bettencourt , S., et al.	Not If But When: Adapting to Natural Hazards in the Pacific Islands Region: A Policy Note, 2006	Pacific
FAO	Climate Change and Food Security in Pacific Island Countries, 2008	Pacific
Morrell, W.	United Nations Climate Change Scoping Study: Opportunities to Scale up Climate Change Support to Pacific Island Countries, 2009	Pacific
Nunn, P.	Responding to the challenges of climate change in the Pacific Islands: management and technological imperatives, Climate Research, 2009	Pacific
SPREP	Pacific Islands Adaptation to Climate Change Highlights 1: July 2008	Pacific
SPREP	Pacific Islands Framework for Action on Climate Change 2006 – 2015	Pacific
SPREP	Working Papers from the 2009 Pacific Climate Change Roundtable (http://www.sprep.org/climate_change/PYCC/roundtable.htm)	Pacific
UNDP	Opportunities to scale up climate change support to Pacific Island Countries, 2009	Pacific
UNDP Pacific Center	The gendered dimensions of disaster risk management and adaptation to climate change: Stories from the Pacific, 2009	Pacific
World Bank	Adapting to Climate Change. Vol IV in Cities, Seas and Storms, Managing Change in Pacific Island Economies, 2000	Pacific
ADB	East Asia Regional Department, Climate Change Implementation Plan for East Asia Pacific (2009-2015) – 14 documents	East Asia
World Bank	Climate Resilient Cities – 2008 Primer: Reducing Vulnerabilities to Climate Change Impacts and Strengthening Disaster Risk Management in East Asian Cities, June 2008 (Hard Copy)	East Asia
ADB	Mainstreaming Climate Change in ADB's Operations, South Asia Regional Department, Climate Change Implementation Plan for South Asia (2009-2011)	South Asia
Eriksson, Mats	Impacts of Climate change on water and hazards in the Hindu Kush – Himalaya Adapting to too much and too little water, July 2009	South Asia
ISET	Climate Adaptation in Asia: Knowledge Gaps and Research Issues in South Asia, September 2008	South Asia

Author	Title, Date	Geographic Scope
Mitchell, T., et al.	We know what we need: South Asian women speak out on climate change adaptation, 2007	South Asia
Mool, Pradeep	Glaciers, Glacial Lakes and Glacial Lake Outburst Flood in the Himalaya, July 2009	South Asia
Ulka Kelkar and Suruchi Bhadwal	South Asian Regional Study on Climate Change Impacts and Adaptation: Implications for Human Development, 2007	South Asia
USAID	Integrating Environmental Security Across Sectors: A Blueprint for Addressing Glacial Melt in Asia, 2009	South Asia
World Bank	South Asia Climate Change Strategy, 2009	South Asia
World Bank	South Asia: Shared View on Development and Climate Change, 2009	South Asia
ADB	Mainstreaming Climate Change in ADB's Operations, Southeast Regional Department, Climate Change Implementation Plan for South Asia (2009-2015)	Southeast Asia
ADB	Climate Change and Food Security in Southeast Asia–PowerPoint presentation by Dr. Ursula Schaefer Preuss, Vice President, ADB January 2009	Southeast Asia
ADB	The Economics of Climate Change in Southeast Asia: A Regional Review, April 2009	Southeast Asia
ADB	A Regional Review of the Economics of Climate Change in Southeast Asia, December 2008	Southeast Asia
ASEAN	ASEAN Integrated Food Security (AIFS) Framework and Strategic Plan of Action on Food Security in the ASEAN Region, 2009-2013	Southeast Asia
ASEAN	ASEAN Multi-Sectoral Framework on Climate Change: Agriculture, Fisheries and Forestry towards Food Security, September 2009	Southeast Asia
ASEAN	ASEAN Climate Change Initiative, PowerPoint presentation by Liana Bratasida	Southeast Asia
ASEAN	Fourth ASEAN State of the Environment Report 2009, October 2009	Southeast Asia
ISET	Climate Adaptation in Asia: Knowledge Gaps and Research Issues in South East Asia, June 2008	Southeast Asia
International Water Management Institute (IWMI)	Scoping Study on Natural Resources and Climate Change in Southeast Asia with a Focus on Agriculture. Draft Report. May 2009.	Southeast Asia
Lasco, R.	An Integrated Assessment of Climate Change Impacts, Adaptation, and Vulnerability in Watershed Areas and Communities in Southeast Asia. AIACC, 2006	Southeast Asia
Yusuf, A.A. and Francisco, H.	Climate Change Vulnerability Mapping for Southeast Asia, Economic and Environmental Program for Southeast Asia (EEPSEA) 2009	Southeast Asia

C.2 Sub-regional and National Documentation

Author	Title, Date	Country
ADB	People's Republic of Bangladesh: Strengthening the Resilience of the Water Sector in Khulna to Climate Change, December 2008	Bangladesh
Ahmed, Ahsan Uddin	Effective Strategies for Adapting to Climate Change: Lessons from RVCC Project, CARE-Bangladesh, 2008	Bangladesh
Ahmed, Ahsan Uddin and Neelormi, Sharmind	Climate Change, Loss of Livelihoods and Forced Displacements in Bangladesh: Whither Facilitated International Migration?	Bangladesh
Ahmed, Ahsan Uddin; Neelormi, Sharmind; and Adri, Neelopal	Climate Change in Bangladesh: Concerns Regarding Women and Special Vulnerable Groups, 2007	Bangladesh
Ahmed, Ahsan Uddin; Neelormi, Sharmind; and Adri, Neelopal	Entrapped in a Water World: Impacts of and Adaptation to Climate Change Induced Water Logging for Women in Bangladesh, 2007	Bangladesh
Government of Bangladesh	Bangladesh Climate Change Strategy and Action Plan (BCCSAP), 2008	Bangladesh
Government of Bangladesh	Bangladesh Climate Change Strategy and Action Plan (BCCSAP), 2009	Bangladesh
Karim, Zahurul	Climate Change Impacts on Bangladesh–Agriculture and Food Security Policy, Strategy and Management interventions, October 2009	Bangladesh
Agrawala, S., et al.	Development and Climate Change in Bangladesh: Focus on Coastal Flooding and the Sundarbans, 2003.	Bangladesh
ADB	Financial Arrangement for a Proposed Global Environment Facility Grant and Asian Development Bank Technical Assistance Grant to the People's Republic of China for the Capacity Building to Combat Land Degradation Project, June 2004	China
AEA	The Impacts of Climate Change on Chinese Agriculture – Phase II–National Level Study: The Impacts of Climate Change on Cereal Production in China, 2008	China
AEA	The Impacts of Climate Change on Chinese Agriculture – Phase II–National Level Study: Future Cereal Production in China: Modeling the interaction of climate change, water availability and socioeconomic scenarios, 2008	China
Barnett; T.P. et al.	China and India face prospect of permanent water shortage, 2005	China, India
Chen, Elton	Introduction to the China Foundation for Desertification Control (PowerPoint), January 2010	China
Chen, Shaohua and Ravallion, Martin	China is Poorer than we Thought, but No Less Successful in the Fight against Poverty. World Bank Policy Research Working Paper, 2008	China
Chinese Academy of Sciences	Climate Adaptation in Asia: Knowledge Gaps and Research Issues in China, 2008	China

Author	Title, Date	Country
Government of China	China's National Climate Change Programme (CNCCP), 2007	China
Farrington, J.	Impacts of climate change on the Yangtze Source Region and adjacent areas, Qinghai-Tibet Plateau, China, 2009	China
Shen, Y.	2004. An overview of glaciers, retreating glaciers and their impact in the Tibetan Plateau. WWF China, 2004	China
Tanner, T. et al.	Screening for Climate Change: Adaptation in China, 2008	China
Wen, S.	Climate Witness Assessment in Rural communities in Minshan landscape in the Upper Yangtze. WWF China, 2007	China
World Resources Institute	China, the United States and the Climate Change Challenge, October 2009	China
WWF China	Climate Change Vulnerability Study for the Yangtze Estuary City, 2008	China
WWF China	Report of Yangtze Vulnerability Assessment	China
Xu, J.	The highlands: a shared water tower in a changing climate and changing Asia, Working Paper no. 64. Beijing: World Agroforestry Centre-ICRAF China, 2007	China
Xu, Ming and Ma, Chaode	Yangtze River Basin Climate Change Vulnerability and Adaptation Report, WWF China, 2009	China
Xu, Yinlong	Introduction to the Project: Adapting to Climate change in China (PowerPoint), January 2010	China
Xu, Balqing, et al.	Black Soot and the Survival of Tibetan Glaciers, Proceedings of the National Academy of Sciences, 2009	Himalayas
Byers, Alton	50 Years of Climate, Culture and Landscape Change Around Mt. Everest, 2009	Himalayas
Yakubowski, D and Meindersma, C.	Water on the Tibetan Plateau: Ecological and strategic implications for the Region, 2009	Himalayas
Yongjian, D., et al.	Yellow River at Risk: An Assessment of the Impacts of Climate Change on the Yellow River Source Region. Greenpeace, 2005	China
Zeyin, J.	An Assessment on Climate Change Impact to Panda Habitat in Minshan Landscape. WWF China, 2007	China
GoFSM	Views on the Possible Security Implications of Climate Change to be included in the report of the Secretary-General to the 64th Session of the United Nations General Assembly	FSM
Jaynes, Bill	Competition Amongst Coral Dredgers Impedes Progress on Pohnpei Airport Expansion Project, October 2009	FSM
SPREP	Pacific Adaptation to Climate Change–Federated States of Micronesia (FSM) Kosrae State Report of In-Country Consultations	FSM
SPREP	Appendix 1 Federated States of Micronesia – Climate Risk Profile	FSM
ADB	India: Preparing the Sustainable Coastal Protection and Management Project, September 2007	India
Government of India	India's National Action Plan for Climate Change (NAPCC), 2008	India
SDMRI and WWF India	Effect of Climate Change On The Loss Of Lactarius Lactarius Fishery And Dependent Fishermen In The Southeast Coast Of India, 2009	India
World Bank	Climate change impacts in drought and flood affected areas : case studies in India, 2008	India

Author	Title, Date	Country
WWF India	Climate change and fisheries: Case study on the livelihood issues along Tamil Nadu coast, 2009	India
WWF India and Jadavpur University	Studies in selected sectors of Mousuni Gram Panchayat of Namkhana Development Block for Climate Change Adaptation and awareness, 2009	India
Ardiansyah, F.	Cross-border resource management in Southeast Asia in a changing climate: the cases of Greater Mekong region, the Heart of Borneo and Coral Triangle, WWF Indonesia, August 2009	Indonesia
BAPPENAS	Climate Change in Indonesia National Development Planning: Experience and Hints from Developing Country, September 2005	Indonesia
BAPPENAS	Indonesia's National Action Plan Addressing Climate Change (RAN-PI), 2007	Indonesia
GTZ	Adapting to Climate Change in Indonesia (water sector) 2008	Indonesia
PT Pelangi Energi Abadi Citra Enviro (PEACE)	Indonesia and Climate Change: Current Status and Policies, 2007	Indonesia
Saidy, A.R. and Azis, Y.	Sea Level Rise in South Kalimantan, Indonesia - An Economic Analysis of Adaptation Strategies in Agriculture, EEPSEA, 2009	Indonesia
Soesastro, Hadi	Indonesia and An APEC Agenda on Climate Change	Indonesia
Studdert, Lisa; Frongillo, Jr., Edward; and Valois, Pascale	Household Food Insecurity Was Prevalent in Java During Indonesia's Economic Crisis. *The Journal of Nutrition*, 2001 (131), 2685-91.	Indonesia
UNDP-Indonesia	The Other Half of Climate Change: Why Indonesia must adapt to protect its poorest people (2007)	Indonesia
WWF Indonesia	Vulnerability assessment on orangutan habitat and community livelihood in West Kalimantan. Ongoing.	Indonesia
Asian Disaster Preparedness Centre (ADPC) and IUCN	Vulnerability Assessment of Climate Risks in Attapeu Province, Lao PDR. Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme, 2005	Laos
Government of Maldives	National Adaptation Plan of Action, November 2006	Maldives
Government of Maldives	National Strategy for Sustainable Development, 2009	Maldives
Anonymous	Japan–Tokyo Declaration of the First Meeting between the Heads of the Governments of Japan and the Mekong region countries, November 2009	Mekong Basin
Eastham, Judy, et al.	Mekong River Basin Water Resources Assessment: Impacts of Climate Change. CSIRO Water for a Healthy Country Flagship Report series, 2008	Mekong Basin
International Centre for Environmental Management	Climate Change Adaptation in the Lower Mekong Basin Countries – Regional Synthesis Report, March 2009	Mekong Basin
Government of Mongolia	National Action Program on Climate Change, 2000	Mongolia
ADB	Nepal: Strengthening Capacity for Managing Climate Change and the Environment Stakeholder Project Design Workshop, 28 – 30 July 2008, Country Villa Hotel, Nagarkot, Nepal	Nepal

Author	Title, Date	Country
ADB	Federal Democratic Republic of Nepal: Strengthening Capacity for Managing Climate Change and the Environment, November 2008	Nepal
Lamont, James	Melting Himalayan ice prompts conflict fear, October 2009	Nepal
ADB	Climate Change and Adaptation Road Map: PALAU: Country Partnership Strategy (2009–2013), May 2009	Palau
Government of Papua New Guinea	Initial National Communications under the United Nations Framework Convention on Climate Change, 2000	Papua New Guinea
SPREP	Pacific Adaptation to Climate Change – Papua New Guinea Report of In-Country Consultations	Papua New Guinea
Anonymous	Taking Science Down to the Community (Re: Manila Observatory)	Philippines
Anonymous	Biodiversity, Coastal and Marine and Forestry Sectors, 2009	Philippines
ADB	Emergency Preparedness in the Philippines: A Country Perspective, July 2007	Philippines
Binoya, C.	Camarines Sur: Adaptation to Climate Change of Agricultural and Coastal Communities, 2009	Philippines
Coastal CORE, Inc.	DRR and Climate Change Adaptation in Coastal Communities Exposed to Climate Risks	Philippines
Navida, C.	Adaptation Strategies – Infrastructure Sector, 2009	Philippines
Oliveros, Y.	Climate Change and Health–Sectoral Responses and Adaptation Strategies to Protect the Health of Filipinos, 2009	Philippines
PAGASA/DOST	Observed Trends and Climate Change Scenarios for the Philippines, 2009	Philippines
Penaranda, I.	Proposed Adaptation Strategies: Water Sector, 2009	Philippines
PCIS	Crop Insurance in the Philippines: Security For Farmers and Agricultural Stakeholders	Philippines
Tejada, S.	Agriculture Sector Climate Change Adaptation Strategy within the Context of the Devolution, 2009	Philippines
Tionko, A.	Adapting to a Changing Climate: Agricultural Community, 2009	Philippines
UNDP	MDG Achievement Fund Country reports for Philippines and China – see projects table.	Philippines and China
WWF Philippines	Apo Reef and Sablayan Climate Adaptation Program, 2009	Philippines
Reti, J.	An Assessment of the Impact of Climate Change on Agriculture and Food Security in the Pacific. A Case Study in the Republic of the Marshall Islands, 2008	RMI
RMI Government	Initial Communication Under the United Nations Framework Convention on Climate Change, September 2000	RMI

Author	Title, Date	Country
RMI Government	National Action Plan for Disaster Risk Management 2008-2018, National Task Force for Disaster Risk Management, 2007	RMI
SPREP	Pacific Adaptation to Climate Change – Republic of Marshall Islands Project Proposal	RMI
USAID	Adaptation to Climate Change: Case Study – Freshwater Resources in Majuro, RMI, August 2009	RMI
GEF	National Adaptation Programmes of Action – Solomon Islands, November 2008	Solomon Islands
Kauhiona, Hudson	Pacific Adaptation to Climate Change Inception Meeting, PowerPoint presentation on Solomon Islands, July 2009	Solomon Islands
SPREP	Pacific Adaptation to Climate Change – Solomon Islands Report of In-Country Consultations	Solomon Islands
Boonprakrob, K. and Hattirat, S.	Crisis or Opportunity: Climate Change and Thailand. Greenpeace Southeast Asia, 2006	Thailand
Chirapol, S., et al.	Bangkok Assessment Report on CC. Green Leaf Foundation, Bangkok Metropolitan Administration, UNEP, 2009	Thailand
Thailand Environment Institute	Thailand's Country Study on Climate Change, 1990. A Report submitted to the Ministry of Science, Technology and Environment	Thailand
WWF Greater Mekong Programme and START Southeast Asia Regional Center	Assessing the Implications of Climate Change at the Provincial Level: Krabi, Thailand	Thailand
GEF	Tuvalu's National Adaptation Programme of Action, May 2007	Tuvalu
GEF	Republic of Vanuatu–National Adaptation Programme of Action	Vanuatu
Phillips, Brian	Pacific Adaptation to Climate Change Inception Meeting, PowerPoint presentation on Vanuatu, July 2009	Vanuatu
Reti, J.	An Assessment of the Impact of Climate Change on Agriculture and Food Security in the Pacific. A Case Study in Vanuatu, 2007	Vanuatu
SPREP	Pacific Adaptation to Climate Change – Vanuatu Report of In-Country Consultations	Vanuatu
ADB	Ho Chi Minh City Adaptation to Climate Change: Volume 2 Main Report, September 2009	Vietnam
Carew-Reid, Jeremy	Rapid Assessment of the Extent and Impact of Sea Level Rise in Viet Nam, Climate Change Discussion Paper 1. ICEM – International Centre for Environmental Management, 2007	Vietnam
DRAGON Institute	A Brief Introduction to the Institute, PowerPoint Presentation, November 2009	Vietnam
DRAGON Institute	Key Climate Change and Future Flood Risk in the Mekong River Delta, Vietnam, November 2009	Vietnam
East Meets West Foundation	Climate Change Adaptation Survey, 2009	Vietnam

Author	Title, Date	Country
Institute of Meteorology and Hydrology, Ministry of Natural Resources and Environment	Benefits on Climate Change adaptation from Small and medium scale hydropower plants: Synergies and trade offs with rural development, 2009	Vietnam
International Symposium on Biodiversity and Climate Change	International Symposium on Biodiversity and Climate Change – Links with Poverty and Sustainable Development Hanoi, 22-23 May 2007 (http://www.biodiversity-day.info/uploads/media/Complete_Papers_E.pdf)	Vietnam
Ministry of Agriculture and Rural Development	Action Plan Framework for Adaptation and Mitigation of Climate Change of the Agriculture and Rural Development Sector, Period 2008-2010, 2009	Vietnam
MONRE	Climate Change, Sea Level Rise Scenarios for Vietnam, 2009	Vietnam
MONRE	National Target Program to Respond to Climate Change, 2007	Vietnam
Oxfam	Viet Nam, Climate Change, Adaptation, and Poor People, 2008	Vietnam
Socialist Republic of Vietnam	National Target Program to Respond to Climate Change. Decision No 158/QD-TT, December 2, 2008.	Vietnam
Storch, Harry	Adapting Ho Chi Minh City for Climate Change. Urban Compactness: a Problem or Solution? 2008	Vietnam
UNDP	Human Development Report 2007/2008, Climate Change and Human Development in Vietnam, 2007	Vietnam
Various	Selected PowerPoint presentations from the Mekong Delta Climate Change Forum, November 12-13, 2009	Vietnam
World Bank	An Initial Local Resilience Plan for Can Tho City, 2009	Vietnam
World Bank	Vietnam: Economics of Adaptation to Climate Change Study. Unpublished.	Vietnam
WWF Greater Mekong Programme and Southern Institute of Water Resources Planning	Assessing the Implications of Climate Change at the Provincial Level: Ca Mau, Vietnam	Vietnam

C.3 Documentation on Other Geographic Areas

Author	Title	Geographic Coverage
ADB	Strengthening Coastal and Marine Resources Management in the Coral Triangle of the Pacific Phase 1, July 2008	Coral Triangle
USAID	Coral Triangle Support Program – US Support to the Coral Triangle Initiative	Coral Triangle
USAID	CTSP Climate Change Regional Priority Setting Workshop Bali, Indonesia 15-17 July 2009	Coral Triangle
World Wildlife Fund	The Coral Triangle and Climate Change: Ecosystems, People and Societies at Risk – A Comprehensive Study Involving Over 20 Experts and Based on 300 Peer-Reviewed Scientific Articles, May 2009	Coral Triangle
Eriksson, M., et al.,	The Changing Himalayas: Impact of climate change on water resources and livelihoods in the greater Himalayas, 2009.	Himalayas
Rai, S., WWF	An overview of glaciers, glacier retreat, and subsequent impacts in Nepal, India and China, 2005	Himalayas
Tsering, D. and Farrington, J.	High Altitude Wetlands of the Tibetan Plateau: Climate Change and Other Threats. WWF-China, 2009	Himalayas
Wilkes, Andreas	Towards Mainstreaming Climate Change in Grasslands Management Policies and Practices on the Tibetan Plateau	Himalayas
WWF	An overview of glaciers, glacier retreat, and subsequent impacts in Nepal, India and China, 2005	Himalayas
WWF	Witnessing Change: Glaciers in the Indian Himalayas, 2009	Himalayas
Xu, J., et al	The Melting Himalayas: Regional Challenges and Local Impacts of Climate Change on Mountain Ecosystems and Livelihoods, 2007	Himalayas
Yakubowski, D and Meindersma, C.	Water on the Tibetan Plateau: Ecological and strategic implications for the Region, 2009	Himalayas
Anonymous	Japan–Tokyo Declaration of the First Meeting between the Heads of the Governments of Japan and the Mekong region countries, November 2009	Mekong Region
International Centre for Environmental Management	Climate Change Adaptation in the Lower Mekong Basin Countries – Regional Synthesis Report, March 2009	Mekong River
Johnston, Leslie	Lower Mekong River Basin Hydropower Report, 2008 Prepared by: Leslie Johnston, USAID/Washington, EGAT/ESP	Mekong River
Mekong River Commission	Adaptation to climate change in the countries of the Lower Mekong Basin: regional synthesis report MRC Technical Paper No. 24, September 2009	Mekong River
Mekong River Commission	Climate Change and Adaptation Initiative: Framework Document for Implementation and Management, June 200	Mekong River
Mekong River Commission	Climate Change Adaptation in the Lower Mekong Basin Summary of Findings and Outlook, October 2008	Mekong River

Author	Title	Geographic Coverage
Mekong River Commission	Sharing Perspectives, PowerPoint presentation by Dr. Pornsook Chongprasith, July 2009	Mekong River
SEA START (Snidvong, A., Choowaew, S. and Chinvanno, S.)	"Impact of climate change on water and wetland resources in Mekong River Basin: Directions for preparedness and action" Background paper. Report No. 12, July 2003	Mekong River
Shaw, R., et al.	Drought-management considerations for climate change adaptation: focus on the Mekong region, 2007	Mekong River
WWF Greater Mekong Programme	The Greater Mekong and Climate Change, 2009	Mekong River

ANNEX D – VULNERABILITY TO CLIMATE CHANGE IN THE ASIA-PACIFIC REGION

D.1 Key Vulnerabilities in North Asia

People and livelihoods

- Northward shift of agricultural zones likely: 500 km northward shift of tri-planting zone in northern China from Changjiang Valley to Yellow River basin, shift of double planting regions towards single planting regions, with latter shrinking by 23% (Batima 2006, Cruz, et al., 2007).
- Lower rice yields: in China, warming of 2 °C is projected to lower rain-fed rice yields by 5-12% (Cruz, et al., 2007)
- Warming and lower precipitation may reduce pasture productivity in the Mongolian steppe by 10-30%, except in high mountains and in Gobi where a marginal decrease in pasture productivity is projected by 2100 (Cruz, et al., 2007)
- Potential expansion of steppe and desert steppe in Mongolia and northward shift of cool temperate grassland in the region, with decrease in net primary productivity, further limiting expansion of livestock numbers. Livestock productivity and health may decline due to heat and water stress and changes in disease distributions (Cruz et al., 2007).
- Possible diminishment of suitable grazing lands in Mongolia by 30% by 2050, and by 40% by 2080. (Batima 2006)
- Approximately 70% of pastures expected to facie degradation, with dramatic declines in fodder yield over recent decades in some parts of Mongolia (Alam, et al. 2007)
- Pasture biomass projected to decrease in the forest-steppe and steppe and increase in the high mountains and desert. HadMC3 projects a pasture biomass decrease from 0.6 to 37.2 per cent in the forest-steppe and steppe by 2020-2080, more than 20 per cent increase in the high mountains and a much greater increase in the desert. (Batima 2006)
- Population at risk of dengue fever projected to increase in China (Cruz, et al., 2007)
- Projections of high excess mortality due to heat stress projected to go up in China (Cruz, et al., 2007)

Natural Resources and Ecosystems

- Future changes in surface runoff likely to be highly spatially variable. An increase in surface runoff seems likely in Mongolia and northern China. Studies suggest that, on average, a 3°C increase in temperature coupled with a 10% increase in precipitation would increase river flows by approximately 15% in water abundant areas. (Alam, et al. 2007)
- Changes in snow and glacial melt, snowpack, and phase shifts may affect huge numbers of people, as 500 million people in the Himalayan region overall, and 250 million in China, depend on glacial melt for their water supply (Stern 2007)
- In North China, as a result of climate change and increasing demand, only 70% of water requirements for agricultural production to be met by irrigation from surface- and groundwater sources (Cruz, et al., 2007).

- Projections based on assumption of doubled CO2 concentrations (likely before the middle of the 21st century) suggest extinction of 105-1522 plant species and 5-77 vertebrate species in China, and 133-2835 plants and 10-213 vertebrates in Indo-Burma could become extinct. (Cruz, et al., 2007)
- For a global mean temperature increase of 2-3°C, Tibetan plateau experiences loss of permafrost and desertification. Substantial changes in locations and areas of natural vegetation on Tibetan plateau. (Cruz, et al., 2007)
- Widespread retreat of permafrost in northern Asia and at high altitudes. (Cruz, et al., 2007)
- Shifts in mountain ecosystems to higher altitudes. (Cruz, et al., 2007)

Material Assets

- For 30cm sea-level rise, 81,348 km2 projected to be inundated in China. (Cruz, et al., 2007)
- Relative sea-level rise will be greater than the global mean in many deltaic regions, e.g., for 50 cm change in global mean sea-level, relative sea level is projected to increase by 40-70, 50-70 and 70-90 cm in the Zhujiang, Changjiang and Huanghe Deltas respectively by 2050 (Cruz, et al., 2007)
- Thirty centimeter rise in sea level will increase areas affected by coastal flooding by five to six times present extent in Changjiang and Zhujiang Deltas. Existing protections are inadequate to make a significant difference in the event of flooding (compared with no-protection scenarios) (Cruz, et al., 2007)
- Saltwater intrusion has already been observed in coastal groundwater reservoirs in China, and is likely to accelerate (Cruz, et al., 2007)

D.2 Key Vulnerabilities in South Asia

People and livelihoods

- Increased river bank erosion and saline water intrusion in coastal areas may cause 6 to 8 million people to be displaced by 2050, if SLR is higher than expected and coastal polders are not strengthened/new ones built (Government of Bangladesh 2009)
- Risk of crop losses projected to increase due to higher flood frequency under climate change (IPCC 2008). In Bangladesh about 1.32 m ha of cropland is highly flood-prone and about 5.05 m ha moderately flood-prone. (Bangladesh NAPA).
- Significant decrease in yields of non-irrigated wheat projected in South Asia for temperature increase above 2.5° C, with projected loss in farm-level net revenue of 9-25% (Lal, 2007, cited in Cruz, et al., 2007).
- Projected decreases of 2-5% in yield potential of wheat and maize in India for temperature increase of 0.5°-1.5° (Cruz, et al., 2007)
- Climate changes, especially in temperature, humidity and radiation, may have effects on the incidence of insect pests, diseases and microorganisms. A change of 1°C changes the virulence of some races of rust infecting wheat. (Bangladesh NAPA)
- Too much water for crops during the wet season and too little during the dry season projected in Bangladesh. 60% moisture stress on top of other effects might cause as high as 32% decline in boro yield, instead of having an overall 20% net increase. The effect of low-flow on agricultural vulnerability potentially less significant than other climate change effects. The ultimate impacts of loss of food grain production would threaten food security and increase food imports. (Bangladesh NAPA)
- CO2 fertilization may facilitate food-grain production. Doubling of atmospheric concentration of CO2 in combination with a similar rise in temperature potentially to result in 20% rise in rice production and 31% decline in wheat production. *Boro* rice would enjoy good harvest under

severe climate change scenario with doubling of atmospheric concentration of CO2 (Bangladesh NAPA)

- Climate change projected to increase intensity and frequency of natural disasters, which may lead to 17% decline in overall rice production in Bangladesh, and a decline as high as 60% in wheat production, compared to a baseline of 1994/1995. Crop modeling results also suggest that the duration of the growing season could decrease by 2 to 12 days, which may delay the *aman* transplantation in December and January (World Bank 2009 *South Asia Climate Change Strategy*)
- Increased salinization may have serious impacts on agriculture - .5 m ton reduction in rice production predicted w/.3 m SLR (Handisyde 1990), or of foodgrain production by as much as 40% in coastal districts (World Bank 2009 *South Asia Climate Change Strategy*)
- In Sri Lanka, anincrease in the frequency of droughts and extreme rainfall events could result in a decline in tea yield, a major source of foreign exchange and a significant source of income for laborers (Kelkar and Bhadwal 2007)
- Population at risk of dengue fever projected to increase in India (Cruz, et al., 2007)
- Projections of high excess mortality due to heat stress projected to go up in India (Cruz, et al., 2007)

Natural Resources and Ecosystems

- Without climate change, India's per capita renewable freshwater supply projected to fall by 40% based on projections of population growth, water demand and run-off within the major river basins. Climate change could significantly worsen this picture, decreasing rainfall supplies to major river basins, particularly in the winter when rainfall is projected to decline (Cruz, et al., 2007).
- Greater shortage of drinking water in Bangladesh, especially in coastal belt and in drought-prone areas in north-west, which will be particularly taxing for women and children. Increasingly saline drinking water will pose health hazard, especially for pregnant women. (Government of Bangladesh 2009)
- With predicted sea level rise and during periods of ocean-induced flooding, saltwater intrusion of freshwater lenses in the Maldives may be affected and will likely affect the quality of life for the people in the islands.
- Loss of grassland coverage and productivity anticipated due to higher temperatures and evaporation; savannas and grasslands in South Asia projected to be significantly negatively impacted. (Cruz, et al., 2007)
- Loss of wetlands, with potential loss of > 50% of Sundabans (Bangladesh) for global mean temperature increase > 2°C (Cruz, et al., 2007). Growth of freshwater species to be affected by increased soil salinity due to high evapotranspiration and low winter flows. Eventually species offering dense canopy cover may be replaced by non-woody shrubs and bushes, while the overall forest productivity may decline significantly. Degradation of forest quality likely to affect biodiversity of the Sundarbans ecosystem (Bangladesh NAPA)
- Animal diversity critically threatened by both anthropogenic and climate change causes in South Asia (forthcoming RDMA biodiversity report)
- In Maldives, damage to coral reef and associated habitat loss may cause reef fish species which are specialists requiring specific types of habitats within a reef or specific type of food from a reef to be adversely affected (Adam 2006)

Material Assets

- Projected sea level rise of about 40 cm by the end of 21st century may increase annual number of people flooded in coastal populations from 13 million to 94 million. Almost 60% of this

increase will occur in South Asia, along coasts from Pakistan, through India, Sri Lanka and Bangladesh to Burma, and the coastal megacities likely to be highly vulnerable (Cruz, et al., 2007)

- Cyclones and storm urges expected to become more intense with climate change, which will have important social and economic consequences, including the deterring of private sector investment in the coastal zone unless appropriate measures are taken.
- In coastal cities, higher and more intense rainfall may place added stress on drainage and sewer systems, which already frequently back-up in the monsoon season. The slums will be most adversely affected. Flooding by contaminated wastewater could cause serious health risks.
- Sea level rise may delay discharge from the drainage system in low-lying areas. In coastal zones, salinity intrusion may affect availability of fresh surface and ground water (ADB 2008 *Strengthening the Resilience of the Water Sector in Khulna to Climate Change*)

D.3 Key Vulnerabilities in Southeast Asia

People and livelihoods

- Climate change will narrow down area of agricultural land. A significant fraction of agricultural land in the coastal plain in Cambodia, the Red River Delta and the Mekong River Delta will be exposed to salt water intrusion as a result of rising sea level if no response is applied.
- By 2100, higher sea levels in the Mekong Delta may inundate approximately half of the delta's agricultural lands (WWF *The Greater Mekong and Climate Change* 2009)
- Under elevated CO2, yields of wet season rice in Cambodia might increase above that of dry season rice. However, there is a chance that under changing climate, rice yield in some provinces would be more variable than under current conditions due to the increase in flood frequency and intensity, in particular in rice growing areas surrounding the Tonle Sap Lake and the Mekong River. (ICEM 2009)
- Climate change has significant impacts on growth and productivity of plants, affects cropping seasons, and may induce pestilent insect outbreaks?. Climate change would also affect growth and reproduction of livestock, increase risk of pathogenesis and spread of dangerous diseases.
- Health of populations in cities may be threatened by increased frequency, duration and intensity of conditions conducive to air pollution formation and oppressive heat. Natural disasters such as surges, storms, floods, heavy rainfall and landslides, and more that take place in a more frequent and more intense manner may also result in higher number of deaths and negatively affect human health by causing environmental pollution, malnutrition, diseases. The most vulnerable people are poor farmers, ethnic minority groups, elderly people, children and women.

Natural Resources and Ecosystems

- Maximum monthly flow of the Mekong estimated to go up by 35-41% in the basin, and 16-19% in the delta, with lower estimates for years 2010-38 and higher for 2070-99, compared with 1961-90 levels. Decline in minimum monthly flows estimated to be 17-24% in the basin and 26-29% in the delta, with potential for a rise in flooding risks during wet season and of water shortage in dry season. (Cruz, et al., 2007)
- Projected decrease in annual flow of the Red River by 13-19% and of Mekong River by 16-24% by end of 21st century, which may exacerbate water stress (Cruz, et al., 2007)
- Increased temperatures likely to result in northward and upward movement of tropical plants, whereas the area of sub-tropical plants may shrink. It is estimated that in the 2070s upland sub-tropical plants would be observed to grow normally at the height of more than 100-500 m and 100-500 km further to the North, as compared with their present-day location.

- Under projected climate conditions, Cambodia's area of wet and dry forests likely to decrease while that of moist forest likely to increase, with implications for some forest ecosystems and their unique biodiversity (ICEM 2009)
- Loss of forest and associated biodiversity in Indonesia associated with increased incidence of drought and forest fires (Cruz, et al., 2007)
- In Vietnam, sea level rise may shrink existing mangroves, with consequences for some marine species, and some plants and animals are at higher risk of extinction, particularly a number of valuable species.
- Rising temperatures may cause some marine species to move to northwards or into deeper water, causing a shift in depth-wise pattern of marine creatures. Coral reefs would be degraded and destructed, and physiological and biochemistry processes under the interactive relation between coral reefs and seaweeds would be alternated.

Material Assets

- In urban areas of the Philippines, SLR of 30 cm would inundate 2,000 hectares and affect 500,000 people, while SLR of 1 meter would inundate 129,114 hectares and affect 2 million people.
- Climate change may cause difficulties in water and material supply for industries and construction such as textile, manufacturing, exploitation and processing of mineral resources, agricultural products, forest product and aquaculture products, industrial and domestic construction, nuclear technologies, and communication. More frequent extreme climatic phenomena and natural disasters would reduce life span of materials, equipment, machines, and buildings, whereas maintenance costs would be higher.
- Number of people at risk from flood events in Bangkok to rise from approximately 900,000 to more than 5 million by 2070. Economic costs of impacts to infrastructure due to such floods estimated to increase from $39 billion to $1.1 trillion by 2070 (OECD, 2007)
- Almost 55% of Bangkok may be affected by floods if mean sea level were to rise by 50 cm; if mean sea level were to rise to twice that level (by 100 cm), 72% of the city may be affected (GLF, BMA, UNEP 2009)

D.4 Key Vulnerabilities in the Pacific

People and livelihoods

- Increased intensity/frequency of cyclones may have both immediate effects such as damage to crops and infrastructure, and delayed effects due to pests and diseases
- Saltwater intrusion associated with SLR, storms and high tides affects agriculture on atolls
- Correlation between rising temperatures and decreased yields of taro observed in coastal
- Changes in rainfall distribution may have severe impacts on agricultural production. Intense and prolonged rainfall in planting seasons may damage seedlings, reduce growth and provide conditions that promote plant pests and diseases. Moreover this may lead to greater frequency and intensity of flash floods leading to soil erosion and flooding of agricultural land. Drought combined with higher temperatures would lead to greater evaporation, reduced availability of water for agriculture and added thermal stress on plant.
- With FSM's increased exposure to drought and storms, water sanitation is expected to decrease and disease outbreaks to rise.
- In Solomon Islands, climate change are likely to adversely affect water and sanitation, food shortages leading to poor nutrition, reduced immunity and enhanced distribution of bacteria and parasites. Increased rainfall and increased humidity may to more breeding sites for malaria mosquito's survival and transmission.

- The health sector in Vanuatu is likely to be severely impacted due to the projected climate changes. Malaria is already endemic to certain areas of Vanuatu and there is some evidence to suggest that these areas are extending southwards. Other tropical and vector borne disease such as dengue, and water related diseases such as dysentery and diarrhea are also likely to increase. Other problems associated with the increased temperature, such as contamination of food and heat stress are likely to be exacerbated.

Natural Resources and Ecosystems

- In the Solomon Islands, sea level rise and coastal erosion are likely to damage water supply infrastructure, while saltwater intrusion may contaminate potable water from groundwater aquifers or freshwater lenses.
- Coastal mangroves in FSM are at risk from climate change, which may exacerbate the impacts of climate change by resulting in storm surge, tidal excursions, and coastal erosion.
- In Vanuatu, climate change is likely to impact directly on marine resources through its effect on marine ecosystems such as mangroves and reefs. Furthermore, enhanced sedimentation due to soil erosion from agricultural and forestry practices will have a profound effect on the availability of marine resources. Ciguatera poisoning may increase due to the increased temperatures of the oceans, marine pollution from land-based activities and sedimentation of coastal areas and water run-off.

Material Assets

- In an increasingly urbanized Pacific, with many people residing in informal settlements, under very crowded conditions, poor housing and limited access to basic amenities, climate change is expected to place major burden on already stressed urban management.

ANNEX E – ADAPTATION PROJECTS AND FUNDS

UNFCCC and Kyoto Protocol

Project/Fund	Funding Amount	Funding Source	Description
Adaptation Fund	Through September 2009, 1.13 million certified emission credits sold, generating $18.7 million for the Adaptation Fund	2% set-aside of certified emission reduction credits issued for CDM projects	The Adaptation Fund was established to finance concrete adaptation projects and programs in developing country Parties to the Kyoto Protocol that are particularly vulnerable to the adverse effects of climate change.
Least Developed Country Fund (LDCF)	$172 million (as of March 2009)	GEF	The LDCF was established to support a work program to assist Least Developed Country Parties (LDCs) carry out, inter alia, the preparation and implementation of National Adaptation Programmes of Action (NAPAs).
Community Based Adaptation to Climate Change through Coastal Afforestation Link	$3.3 million	GEF (LDCF)	The project objective is to reduce vulnerability of coastal communities to the impacts of climate change-induced risks in four upazilas in the coastal districts of Barguna and Patuakhali (Western Region), Bhola (Central Region), Noakhali (Central Region), and Chittagong (Eastern Region). The project will implement community-based climate risk reduction measures in targeted communities that are especially vulnerable to climate change. In particular: • Ensure that buffer zone rules are followed • Facilitate diversification of livelihoods and alternative employment opportunities • Develop secure sources of potable water for communities vulnerable to saline intrusion • Develop capacities at the national and community levels to better integrate climate change risk into development planning processes. • Train and policymakers at the national level to integrate climate risks into coastal zone planning • Integrate climate change risks into legislation related to coastal zoning regulations • Ensure that information flows are improved between climate monitoring, forecasting and early warning services to communities in coastal areas. Initiative of Forest Department, Institution & Policy Support Unit (MOEF), UNDP

Reducing Climate Change-induced Risks and Vulnerabilities from Glacial Lake Outburst Floods in the Punakha-Wangdi and Chamkhar Valleys Link	$3.4 million	GEF (LDCF)	The project addresses urgent priorities from the recently concluded NAPA process in Bhutan. The project will integrate climate risk projections into existing DRM practices and implement corresponding capacity development measures at the national, district, and community levels. The project will demonstrate a practical approach to reduce GLOF risks from Thorthormi Glacier Lake, which is one of Bhutan's most dangerous glacier lakes with a worst-case-scenario outburst projection as early as 2010. The lessons learned in this project will facilitate replication of GLOF risk reduction in other high risk areas, both within and outside Bhutan. The project will also ensure that the existing EWS in the PW Valley, which is not currently equipped to handle the full extent of GLOF risks, is expanded to take sufficient account of this growing risk. Lessons learned from this initiative will enable up-scaling of EWS in other areas vulnerable to GLOFs. **Expected Outputs:** The project's goal is to enhance adaptive capacity to prevent climate change-induced GLOF disasters in Bhutan and its objective is to reduce GLOF risks in the Punakha-Wangdi (PW) and Chamkhar Valleys. Initiative of Dzongkhag (district level) administrations, Government of Bhutan • Department of Geology and Mines (DGM) • Disaster Management Division (DMD) • Department of Energy (DoE) • National Environment Commission (NEC) • Planning Commission • National Committee on Disaster Management.
Special Climate Change Fund (SCCF)	$90 million (as of March 2009)	GEF	The SCCF under the Convention was established in 2001 to finance projects relating to adaptation; technology transfer and capacity building; energy, transport, industry, agriculture, forestry and waste management; and economic diversification.
Strategic Priority on Adaptation	$50 million (fully committed)	GEF	Supports pilot and demonstration projects that address local adaptation needs and generate global benefits.
Pacific Adaptation to Climate Change (PACC)	US$13.125 million dollars into 13 Pacific Island countries	GEF	PACC will facilitate the implementation of long-term adaptation measures to increase the resilience of a number of key development sectors in the Pacific island countries to the adverse impacts of climate change. Funding is for start-up of adaptation projects in three major climate change concerns; food security, water and coastal management. Fiji, Palau, Papua New Guinea and the Solomon Islands will focus on agriculture and food security. The Cook Islands, Federated States of Micronesia, Samoa and Vanuatu are developing Coastal Management capacity and Nauru, Niue, Republic of Marshall Islands, Tonga and Tuvalu are looking to strengthen their water resource management.
Mainstreaming Adaptation to Climate Change Into Water Resources Management and Rural Development	$5 million	GEF(SCCF)	The proposed project is to strengthen the resilience of agricultural development in China to climate change by implementing selected adaptation measures at demonstration sites in the 3 H Basin and mainstreaming climate change adaptation into irrigation, water resource management and the wider context of rural development. Partners include World Bank and the Ministry of Finance.

Climate-resilient Infrastructure Planning and Coastal Zone Development	$3.4 million	GEF (SCCF)	The project seeks to increase the resilience of communal and critical economic infrastructure in the coastal areas of Vietnam to the adverse impacts of climate change and create a policy framework conducive to promoting resilient coastal zone development. The project aims to mainstream climate risk reduction into policy formulation and coastal zone management as well as associated infrastructure development planning; develop capacity to increase understanding of current and emerging climate risks and promote resilient decisions at central and local planning levels; and demonstrate ways to effectively 'climate-proof' coastal area infrastructure with a view to systematically develop and apply climate resilient building codes and standards. A central element of the project is to examine climate change related risks with local communities and officials, and to make the experiences gained from the climate-proofing of critical coastal area infrastructure work for vulnerability reduction at all levels, using entry points of policy and regulatory revisions as well as climate-resilient development planning. It does this in the context of substantial baseline efforts in policy development, coastal infrastructure development, and capacity building efforts of UNDP and ADB in Vietnam, which jointly make up a coherent program to address climate change. Initiative of Ministry of Agriculture and Rural Development (MARD); Provincial People's Committees; Ministry of Construction (MOC), Asian Development Bank, UNDP.

Bilateral, Multilateral and Other Donors and Banks

Project/Fund	Funding Amount	Funding Source	Description
Climate Investment Fund	$6 billion pledged	Various bilateral donors (including Australia, Canada, Denmark, France, Germany, Japan, Netherlands, Norway, Spain, Switzerland, UK, and USA), with the ADB, World Bank and other multilateral development banks managing the fund	The Climate Investment Fund has two trust funds, the Clean Technology Fund and the Strategic Climate Fund. The latter includes the Pilot Program on Climate Resilience, which seeks to pilot and demonstrate how climate risk and resilience considerations can be mainstreamed into development programming and implementation. It has country programs in Bangladesh, Cambodia, and Nepal, and a Pacific regional program that includes Papua New Guinea.
Climate Change Fund	Initially $40 million	ADB	Will fund mitigation and adaptation support.
Promoting Climate Change Adaptation in Asia and the Pacific	$3.45 million	ADB, UK, and Japan Special Fund	Seeks to build the capacity of subregional organizations to address adaptation issues pertaining to vulnerable ecosystems, sectors, or peoples in developing member countries. Activities under development include the Ho Chi Minh City Coastal Cities Project (mainstreaming), and proposed activities include dissemination of results of the Southeast Asia Stern Review Workshop; Strategic Adaptation Partnerships; Climate Change Impact Depiction; Climate Refugee Fund; and Climate Resilient Research in the Agriculture Sector; Climate Change & Water; and Climate Change & Health.
Climate Change Adaptation Initiative (CCAI)	A$4 million	AusAID	CCAI is a Mekong River Basin focused, 15-year project in recognition of the time it will take to build capacity in the region to assess climate change issues and develop capacity to design and implement adaptation measures. Initial focus will be on the scoping of pilot and demonstration activities, with different types of activities planned for different countries. In Laos, focus will be on village-level activities and Thailand will focus on integrated water resources management in sub-basins. Priorities for capacity building and assistance are Laos and Cambodia
Mekong Delta Climate Change Impact and Adaptation Study	$1.3 million plus in-kind and budgetary contributions from Ministry of Natural Resources and Environment	AusAID and Asian Development Bank	The study will identify threats, assess impacts and vulnerability, explore adaptation options, integrate adaptation into a regional plan and mainstream adaptation into sector and provincial planning. 18-month study commencing January 2010

Project/Fund	Funding Amount	Funding Source	Description
International Climate Change Adaptation Initiative (ICCAI)	A$150 million including A$25 million for bilateral adaptation activities	AusAID	Three year program with five objectives: 1) establish policy, science and analytical basis for climate adaptation, 2) increase understanding of climate change impacts, 3) enhance capacity to assess vulnerability and risk, 4) formulate adaptation strategies and mainstream climate concerns into sector plans, and 5) help finance adaptation priorities. A$120 million targeted at Pacific Island countries and Timor Leste. Initiatives include: Pacific Climate Change Science Program (A$20 million, 2009-2011), the Asia-Pacific Community-based Adaptation Small Grants Program (A$6 million, 2009-2013, including approximately A$4 million for Pacific Island countries and East Timor), the Pacific Future Climate Leaders Program (A$3 million, 2010-2011), and the Mekong Delta Vulnerability and Adaptation Initiative (Australia's contribution A$1.14, 2009-2010).
Foundation of the Peoples of the South Pacific International Community and Coasts Program - Linking Community Based Marine Resource Management	N/A	Coral Reef Initiatives for the Pacific (CRISP) (sponsored by France and developed by the French Development Agency); Macarthur Foundation; and Packard Foundation	This initiative aims to better resource management through activities such as the establishment of marine protected areas, strengthening community awareness, and impact assessments as a means to build community resilience.
Adapting to Climate Change in China (ACCC)	$6.75 million	DFID, UK Department for Energy and Climate Change, and Swiss Agency for Development	Follow-up to previous project, Impacts of Climate Change on Chinese Agriculture, 3-year project has five objectives: 1) improved development to climate science in China; 2) comprehensive risk assessments in selected sectors; 3) climate risks integrated into planning and management within the three provinces covered by the project (Ningxia, Inner Mongolia, and Guangdong); 4) increased awareness and capacity among Chinese policymakers; and 5) knowledge sharing between China, UK and other countries in Asia and Africa
Comprehensive Disaster Management Programme: Establishing an Integrated Approach to Climate Change Risk Management at National and Local Levels	$26 million	DFID, UNDP	The Comprehensive Disaster Management Program (CDMP) aims to achieve a paradigm shift from a conventional response-and-recovery approach to a more comprehensive risk-assessment-and-reduction approach. Climate change risks are being included in the risk assessment process and in disaster preparedness and management activities. Integration of CC into the Comprehensive Disaster Management Program is being achieved through (a) capacity-building of government institutions; (b) climate change modeling; (c) strengthening the knowledge and information basis on CC; (d) strategies for awareness-raising, advocacy and coordination; and (e) pilot projects to support livelihoods adaptation to CC in the agricultural sector.Bangladesh Ministry of Food and Disaster Management is a partner.
Global Climate Change Alliance Initiative (GCCAI)	50 million €	European Union	The aim of the GCCAI is to help the most vulnerable developing countries increase their capacity to adapt to the effects of climate change, in support of the achievement of the millennium development goals (MDGs). The program will focus on five priority areas: measures for adaptation to climate change including national adaptation programmes of action (NAPAs reducing emissions from deforestation and forest degradation in developing countries (REDD), the clean development mechanism (CDM), disaster risk reduction (DRR) and poverty reduction strategies and programmes.

Project/Fund	Funding Amount	Funding Source	Description
Adaptation to Climate Change and Conservation of the Biodiversity in the Philippines (ACCBio)	182 million PP ($3.85 million)	GTZ	Provides support for six working groups under the National Strategic Framework on Climate Change Adaptation, tasked to develop inputs for the Philippine Climate Change Adaptation Strategy. Also provides small grants for initiatives at the local level to protect biodiversity
Pilot Project on Climate Change Adaptation for Sustainable Rural Development	N/A	GTZ	The overall goal of the project is to improve the livelihoods and adaptive capacities of vulnerable rural communities in India to the adverse impacts of climate variability and change. The project is conceived of as a pilot project designed to test a two-pronged approach to adaption. The first prong is development and testing of technical adaptation solutions for possible integration into the public watershed and forestry management programs. The second prong of this project's test approach is development and implementation of financial instruments, i.e., micro insurance and weather derivatives for climate risk management. Min. of Env & Forests is a partner.
Cool Earth Partnership	$10 billion, including $2 billion for adaptation and clean energy	Japan International Cooperation Agency (JICA)	5-year program (2008-2012). Adaptation support includes grants through the Grant Aid for Environment and Climate Change and technical assistance directly to countries or through international organizations. Grants are targeted for policy reform and project implementation.
Climate Adaptation Centre	N/A	Netherlands	Inaugurated March 2009 in Mousuni Island, in the Sundarban region. WWF-India has adopted a two-pronged approach to adaptation on Mousuni. While focusing on the immediate needs of disaster management and relief, they are also providing long-term adaptation measures to the next generation of residents. This has been attempted through the Climate Adaptation Centre which houses an electronic Early Warning System to warn villagers of oncoming disasters. The centre also runs a book bank which loans students educational materials to help enhance their future prospects. The Early Warning System has been linked to Jadavpur University in Kolkata and will receive messages whenever there is an oncoming disaster. The Centre also houses relief material like stretchers, torches and medical aid. An organized Disaster Management Team, comprising village youth has been put together to mobilize the village community towards safety in the event of a disaster. Other adaptation strategies introduced include re-introduction of indigenous salt-tolerant paddy to farmers on the island. The market value of this variety (tal mugur) is not far behind other high-yielding varieties. The Climate Adaptation Centre provides paddy seeds to the farmers and also holds information about the various varieties of paddy, their market values and government schemes available to benefit them.

Project/Fund	Funding Amount	Funding Source	Description
Coping With Climate Change	€ 20,000	Netherlands National Lottery (NPL)	This project targets poor communities vulnerable to climate change, by (1) encouraging them to grow fast-growing or water-resistant crop varieties and to store harvest for times of crisis; (2) encouraging women to participate in community groups dedicated to climate change preparedness and adaptation; (3) training community members in disaster coping; (4) making sure vulnerable households have adequate water and sanitation facilities; (5) making sure vulnerable households have enough emergency medicine, food and fodder assistance to survive crises; (6) helping families whose houses have been destroyed to rebuild; and (7) raising awareness of water-borne diseases such as diarrhea and dysentery. Partners include Oxfam Netherlands; Gana Unnayan Kendra; Red Cross Netherlands; Unicef; PLAN and WWF.
Millennium Development Goals (MDG) Achievement Fund	528 million EUROs (globally)	Government of Spain through the UN	Global program initiated in December 2006. Climate and environment programs implemented in China (China Climate Change Partnership Framework) and Philippines (Joint Programme on Strengthening the Philippines' Institutional Capacity to Adapt to Climate Change). Both programs focus on capacity building
Asian Cities Climate Change Resilience Network	$50 million	Rockefeller Foundation	Improve the ability of the cities to withstand, prepare for, and recover from the impacts of CC. (health, infrastructure, water, disaster, urban planning/ development issues). Partners include (ISET) * Arup International Development, ProVention, ICLEI, TARU Leading Edge, Gorakhpur Environmental Action Group (GEAG), Thailand Environment Institute (TEI), Asian Disaster Preparedness Center (ADPC) (Thailand), Mercy Corps (Indonesia), Urban and Regional Development Institute (URDI) (Indonesia), Challenge to Change (Vietnam), and National Institute for Science and Technology Policy and Strategy Studies (NISTPASS) (Vietnam)
Pilot Program on Climate Resilience	Total funds deposited as of September 2009 - $128.6 million; commitments received from donors - $614 million	World Bank with contributions from Australia, Canada, Germany, Japan, and the UK	PPCR is part of the Strategic Climate Fund (SCF), a multi-donor Trust Fund within the World Bank's Climate Investment Funds. The overall objective of the program is to provide incentives for scaled-up action and transformational change in integrating consideration of climate resilience in national development planning consistent with poverty reduction and sustainable development goals.
Application of Community Based Adaptation Measures to Weather Related Disasters Initiative Details	N/A	N/A	This project has the twin goals of initiating a collective disaster insurance scheme in Western Nepal and establishing communication between the National Meteorological Service of Nepal and the Community Based Disaster Preparedness (CBDP) Units. CBDP units exist in many communities throughout Nepal and are organized by the Nepalese Red Cross Society, the leading Nepalese disaster management organization. This organizational structure is based on the philosophy that initial emergency assistance will always come from within the community. Implementing a community disaster insurance scheme will be an important measure to reduce disaster impacts by increasing the economic resilience of the community, while enhanced communication between national weather forecast systems and local community CBDP units will reduce the overall vulnerability to and ultimate loss from disasters. These adaptive measures will assist in achieving some of the development goals of the Nepalese government, including establishing early warning systems throughout the country by 2017, significantly reducing social and economic losses from disasters by 2027 and alleviating poverty. Partners include Himalayan Climate Centre, ACCCA.

Project/Fund	Funding Amount	Funding Source	Description
Bridging Knowledge Gap Between Local and Expert into a Participatory Decisionmaking Process to Address Climate Threats to Coastal Communities Initiative Details	N/A	N/A	This project will (a) develop methodologies to facilitate effective communication between local communities and experts in the fields of climate, marine sciences, and agriculture, and (b) generate information regarding climate change vulnerabilities in the coastal area of Pilang. This information will be used to develop adaptation strategies for the target population. The project aims to: (a) obtain comprehensive information on the current vulnerability of local community livelihoods to climate risk; (b) develop future climate vulnerability scenarios; (c) communicate the links between climate risk, natural resources and community livelihoods to the local community and local government; (d) identify and analyse adaptation options to preserve coral ecosystems and community livelihoods, then prioritize them according to the community's needs; and (e) advocate integration of climate change adaptation strategies (based on participatory community vulnerability assessments) into local, regional and national development policies. Partners include SouthSouthNorth.
Enhancement of Adaptive Capacity of Drought Vulnerable Community in North West Region of Bangladesh	N/A	N/A	This project has five objectives. 1: build community partnerships and engage stakeholders in preparing for climate change. To complete this objective, the project will conduct surveys and hold workshops. 2: identify vulnerable groups and specific vulnerabilities, as well as existing coping strategies and local knowledge. 3: build awareness of climate change and adaptation, includes activities dedicated to collecting and sharing information on climate change and potential adaptation actions. 4: enhance the adaptive capacity of the communities in several target areas -- agriculture, water conservation, drinking water, and livelihood promotion. In the area of agriculture, the project will explore improving cropping patterns and promoting integrated farming. Potential water conservation actions include excavation of ponds, demonstration of good practice for safe drinking water. Drinking water actions may include alternative water collection techniques. Promotion of livelihoods may focus on fisheries, livestock, and poultry as sources of additional income. The final objective is technical support, supervision, and monitoring. Partners include SouthSouthNorth, CARITAS.
Enhancing Adaptive Capacity to Prolonged Flood and Water-Logging in a South Central Floodplain	N/A	N/A	South-Central Bangladesh is prone to extended monsoon flooding and water-logging from the ocean and the Ganges and Jamuna Rivers. Various climate change studies have revealed that this region will be more prone to flooding and water logging due to heavy rainfall and other predicted effects of climate change. Erratic rainfall and temperature fluctuation are hampering crop production and livelihood activities in the area. The project will undertake a variety of strategies in partnership with the Society for Wetland Eco-Research (SWER), including: (a) diversification of agriculture through introducion of new cropping systems such as cultivation of vegetable and spices on Baira (hydroponics) during flood; (b) promotion of deep water Aman rice varieties and other more suitable crops; (c) increasing water drainage to avoid water logging; (d) homestead-based forestry, horticulture and integrated farming; (e) promotion of livelihoods and small entrepreneurship for the poor, women, and marginal groups through natural resources based activities; (f) promotion of market opportunities in relation to existing and emerging livelihood options and products; (g) promotion of safe drinking water facilities to reduce health risk; and (h) disaster preparedness in relation to prolonged flooding, heavy rainfall, and water logging. Partners include SouthSouthNorth.

Project/Fund	Funding Amount	Funding Source	Description
Friends of the Reef Initiative Details	N/A	N/A	The impact of climate change and El Niño is increasingly causing coral reefs to bleach. WWF's Friends of the Reef project is an effort to protect Asia Pacific's coral reef ecosystems, which are the source of new coral recruits for reefs throughout the region and a source of livelihood for coastal people, especially in the fishery and tourism sectors. Friends of the Reef engages local stakeholders and decision makers in developing, testing, and implementing plans to increase coral reef resilience to major threats in the region, including climate change. This project also aims to increase awareness and advocacy activities by highlighting stories and show-cases from previous, current, and future coral bleaching in major reef countries throughout the Asia-Pacific region then using this information to call for emission reduction in regional countries. Friends of the Reef also provides collaborative management mechanisms, enabling the governments of major reef countries to enhance the management and network of Marine Protected Areas (MPAs). The project activities include coral monitoring, marine protection area management, and collaborative multi-stakeholder involvement aimed to improve livelihood of the local communities.
Integrated Community Based Risk Reduction (ICBRR) Initiative Details	N/A	N/A	The stated objectives of this project are to develop and strengthen the capacities in two districts of the Jakarta Province, East Jakarta and West Jakarta, to undertake integrated community-based risk reduction activities (including climate change adaptation) and to learn about integrating risk reduction, climate change adaptation, and micro finance in one holistic project. Specific actions at the community level will include community organization and mobilization through Village Committees; the formation and training of volunteer groups, self-help groups, and Community-Based Action Teams dedicated to improving disaster preparedness; community-specific risk mapping; the reactivation of early warning systems; the development of Community Risk Reduction Plans; mass community awareness-raising; teacher education in risk reduction; and establishment of a fund for risk reduction. Microcredit may be available to households in these districts to compliment these activities. Partners include Red Cross/Red Crescent, Rabobank Foundation.
Integration of Adaptation Strategies into Developmental Policies by Effectively Communicating Climate Risks and Adaptation Measures in the Bundelkhand Region Initiative Details	N/A	N/A	The Bundelkhand region faces a number of natural constraints that adversely affect agricultural production and livelihoods in the region, and which projected water stresses due to climate change are likely to worsen. In light of these circumstances, this project aims to develop and validate risk communication products to improve the understanding of all concerned stakeholders on scientific, social and policy issues governing the climate change adaptation process at a district level in India. This project will assess the vulnerability of the agricultural and water sectors to current and potential climate change, and test and validate risk communication materials through a multidisciplinary stakeholder engagement process. Once the target audiences are made aware of the climate risks to agriculture and water sectors, consultative methods will be used to identify, prioritize and implement pragmatic adaptation strategies. A pilot adaptation project in one district, an extensive media campaign, policy recommendations, and regional workshops will be used for communicating risks and potential adaptation strategies to stakeholders in order to demonstrate the need to integrate adaptation processes into policies and programs at the state level. Partners include Society for Devel. Alternatives; Indian Inst. of Tropical Meteorology, ACCCA.

Project/Fund	Funding Amount	Funding Source	Description
Livelihood Adaptation to Climate Change (LACC)	N/A	N/A	The project promotes climate change adaptation and disaster risk reduction processes and capacities for sustainable livelihoods and food security in the rural sectors including crops, livestock, fisheries and forestry and other key factors of rural livelihoods in the drought prone and coastal regions of Bangladesh. Executed by Department of Agricultural Extension (DAE) under the Ministry of Agriculture (MoA), Subcomponent of Comprehensive Disaster Management Programme (CDMP) of the Ministry of Food and Disaster Management of Bangladesh (MoFDM) funded by UNDP, DFID and EC. Technical guidance by FAO.
Mainstreaming Climate Change Adaptation in Watershed Management and Upland Farming Initiative Details	N/A	N/A	This project's overall goal is to promote climate change adaptation by upland farmers in watersheds at the national level in the Philippines. The project will generate a significant amount of information on climate change adaptation for watershed resources and upland farms that will be useful for decision-making by national policy-makers and local stakeholders. Previous studies from the Assessment of Impacts and Adaptation to Climate Change (AIACC) programme have shown that upland farmers have developed various adaptation strategies to cope with the impacts of climate variability. These adaptation strategies could form a strong foundation for exploring viable options for adaptation to climate change. The project will utilize a variety of methods to ensure the delivery of outputs including multi-stakeholder forums and consultations, workshops, focus group discussions, computer modeling, and a review of relevant literature. Based on the assessment of vulnerability and adaptation policies/ strategies, climate risks adaptation communication materials will be developed for policy makers, local farmers, and other local stakeholders. It is also expected that the project will contribute to the preparation of the Philippines' Second National Communication to the UNFCCC. Initiative of ACCCA.
Mitigating the Risk of Glacier Lake Outburst Floods Initiative Details	N/A	N/A	One of the most dangerous glacial lakes in Nepal is the Tsho Rolpa Lake. At an altitude of about 5000m, the size of this lake increased from 0.23 sq.km in 1957 to 1.65 sq km by 1997. Tsho Rolpa was estimated to store approximately 90-100 million cu m in 1997, a situation that called for urgent attention due to the potential for the lake to overflow its banks. Besides the downstream communities, the 60MW Khimti hydropower plant was under threat. To reduce the risk of a glacier lake outburst flood (GLOF), the water level in the lake was lowered by three meters by cutting open channel in the moraine. In addition, a gate was constructed to allow water to be released as necessary. An early warning system was established in 19 villages downstream of the Rolwaling Khola on the Bhote/Tama Koshi River, to give warning in the event of a Tsho Rolpa GLOF. Local villagers have been actively involved in the design of this system and drills are carried out periodically. The risk of GLOF now has been reduced by 20%. The complete prevention of a GLOF at Tsho Rolpa necessitates further reducing the lake water by as much as 17 m. Initiative of Gov. of Nepal.

Project/Fund	Funding Amount	Funding Source	Description
Participatory Climate Risk Assessment and Development of Local Adaptation Action Plan	N/A	N/A	This project aims to develop a community-driven adaptation plan of action, as well as to facilitate the mainstreaming of climate change adaptation into the sustainable development planning process. Primary beneficiaries will include poor and marginalized farmers, agricultural laborers, landless women, indigenous people, small traders, and students. Through the identification of livelihood vulnerabilities to climate change, climate variability, and other natural hazards, this project will develop strategies to reduce such vulnerabilities identified in the risk assessment process. The project will adhere to the standard community risk assessment procedures of the Ministry of Food and Disaster Management of Bangladesh and its ongoing Comprehensive Disaster Management Programme. Risk communication strategies, materials, and means will be developed to facilitate involvement of government and development agencies and the mainstreaming of climate change adaptation into development planning. A selection of potential adaptation options will be tested at the local level and lessons learned will be shared with local, national, and international stakeholders. As the project aims to implement the activities with the active participation and ownership of the local governments (Union parishad), this process will contribute to the overall development plan of these governments, which, in turn, will contribute to the sustainable development process within those communities. Partners include North South University, ACCCA.
Policy Framework for Adaptation Strategies for the Mongolian Rangelands to Climate Change at Multiple Scales Initiative Details	N/A	N/A	The purpose of this project is to develop local adaptation strategies of the coupled social-environmental system to climate change in the Mongolian rangelands. Spatially large landscape is critical in arid lands to offset climate variability. A fragmentation of the cultural landscapes in the arid and semi-arid lands of Mongolia has increased vulnerability. Therefore, this project will try to reinstate traditional land use practices, while supplementing these with knowledge of adaptive land management. Specifically, the project will: (1) add to communities' and resource managers' knowledge of adaptive rangeland and water management practices currently in use on lands vulnerable to drying; (2) help communities and local government develop plans to revise the allocation of pastures for seasonal use, hay-making lands, reserve pasture, and sacred lands so as to be compatible with current and expected future climate stresses and with traditional cultural values, (3) help herders and other stakeholders come up with local solutions to improve water security, (4) help stakeholders reach an agreement on a new administrative-territorial unit which incorporates cultural landscape as an adaptation mechanism to climate change. Partners include National Univ. of Mongolia; Min. of Construction & Urban Devel.; National Devel. Inst.

Project/Fund	Funding Amount	Funding Source	Description
Promotion of Adaptation to Climate Change and Variability	N/A	N/A	The principal objective is to create enabling conditions in Bangladesh for promoting adaptation to climate change and climate variability in national policies and plans and also at the local community level. This includes preparing a set of recommendations to integrate climate change adaptation into various national actions, with a special focus on issues related to coastal zone management. These recommendations will complement the National Adaptation Plan of Action (NAPA). A network of key stakeholders at the national level will be established. Through this network, issues identified at the local level will be communicated to appropriate national bodies to generate a policy-decision cycle. The network will also contribute to generating discussions and raising awareness at the local level. The project will document local coping mechanisms, analyze the capacity of local institutions, raise awareness through dissemination of information regarding effects of climate change and adaptation possibilities, establish a countrywide Climate Change Adaptation Network, analyze coastal zone management policy, identify recommendation options for adaptation to climate change and climate variability, and organize a final workshop at the national level. The Committee in charge of the project will be drawn from assorted Ministries, including all members of the Bangladesh NAPA Committee. Partners include IUCN, NCAP.
Reducing Vulnerability to Climate Change (RVCC) http://www.cdpbd.org/rvcc_home.html	N/A	N/A	This project aims to increase the capacity of Bangladeshi communities in the southwest to adapt to the adverse effects of climate change by improving climate-change related information collection and dissemination from and to all the stakeholders in the region. The climate change information management system will be improved, climate change information will be disseminated to stakeholders regularly, and collection, preservation, and dissemination between local organizations will be fostered. Partners include CARE Bangladesh.
Strengthening Vulnerable Peoples Capacity to Address the Risk and Impacts of Climate Change and Extreme Weather Events	N/A	N/A	The objective of this project is to incorporate climate change concerns into disaster management strategies, plans and measures within the government of Thailand. The achievement of this goal will contribute to strengthened resilience of vulnerable communities in Thailand to climate change impacts. The project aims to provide benefits to vulnerable communities, as well as contribute to local and national capacity to manage climate-related disasters. The project proposes small-scale, locally-based climate risk reduction activities, embedded in the national disaster management mandate shared by the Thai government and the Thai Red Cross. The project will be achieved through the following outcomes: 1) Implementation of adaptation and disaster risk reduction measures, 2) Enhanced institutional cooperation and coordination for integrating climate change concerns into disaster management, 3) Improved knowledge on climate risk reduction through integration in disaster management programs of the DDPM, TRCS and local chapters of TRCS, disaster relief workers and volunteers, 4) Improved awareness of the Government, TRCS and its local branches and network of partners on the relationship between climate change and disasters, among others. Initiative of International Committee of the Red Cross.

Project/Fund	Funding Amount	Funding Source	Description
Vietnam - Preparing for the Effects of Climate Change Initiative Details	N/A	N/A	Capitalizing on its vast network of trainers throughout Vietnam, the Red Cross integrated a climate change and adaptation unit into its disaster preparedness training modules. One component of this project was awareness-raising about the impacts of climate change on livelihoods and the need to be prepared to adapt. This was accomplished by encouraging NGOs to make climate change impacts part of their focus, and by producing two documentaries that were broadcast on national television. The Red Cross also integrated the theme of climate change impacts into its participatory community assessments, which resulted in the identification of community-specific vulnerabilities and solutions to them. In some cases, these solutions (e.g., loud speaker systems for early warning, construction of dams and tree barriers as defense for agricultural land against winds and salt water intrusion) were implemented. Based on this pilot project, the Red Cross has decided to focus efforts on mangrove restoration and afforestation as a strategy to both ameliorate climate change impact and simultaneously generate funds through the UNFCCC Clean Development Mechanism to finance disaster preparedness.
Vietnam - Preparing for the Impacts of Climate Change in Huong River Basin and the Coastal Phu Vang District Initiative Details	N/A	N/A	The project combines a participatory approach and water modeling. The main objective is to strengthen the capacity of the sectors, institutions, and Vietnamese people to adapt and respond to climate change impacts. It aims to reduce their vulnerability to climate change and disasters by raising their understanding and preparedness to foresee impacts and minimize losses. This objective will be accomplished by undertaking specific objectives: (1) combine water flow modeling for an entire river basin with participatory management tools for a coastal communities; (2) study existing and future climate change impacts on water resources in the river basin and understand how poor people's livelihoods depend on climate and water resource changes; (3) improve awareness, build a pro-active attitude, and foster preparedness, especially the most vulnerable communities and individuals; (4) assess, prioritize and improve the existing adaptation measures with stakeholders' participation; and (5) prepare and develop, with stakeholder participation, an adaptation plan and policy at the district level with a view to replicate it at provincial and national levels. Outputs include data and models, a vulnerability assessment, and a stakeholder action plan for Phu Vang district with information about all possible stakeholders, their interrelationships, and potential obstacles and solutions. Initiative of Institute of Meteorology & Hydrology, NCAP.