ADB Climate Action SOUTH ASIA
Steering Economies Toward Low-Carbon and Climate-Resilient Development
CASA Information Update No. 5 June 2014

Assessing the Costs of Climate Change and Adaptation in South Asia

Climate change will affect South Asia more than most other regions. South Asia's weather is likely to become hotter than the global average, while monsoon rains and heavy storms will increase in most parts of the region. As well, the mountainous countries face increased flooding and landslides, while the coastal countries of the region are likely to be partly inundated by sea-level rise.

In economic terms, the region will lose nearly 2% of its gross domestic product (GDP) by 2050, rising to 9% by 2100—even under optimistic climate projections—if the countries do not take early action. And losses will be higher still when the damage from extreme weather events is included. If appropriate actions for mitigating greenhouse gas emissions and adapting to the climate changes already underway are carried out within a sustainable development plan, a significant part of GDP loss can be avoided.

Background

The six South Asia developing member countries (DMCs)—Bangladesh, Bhutan, India, the Maldives, Nepal, and Sri Lanka—of the Asian Development Bank (ADB) are home to about 1.5 billion people, nearly a third of whom are still living in poverty. The added hazards from global climate change will affect them the most, making their escape from poverty even more difficult. In Bangladesh, Bhutan, northern India, and Nepal, the increasing frequency and strength of extreme weather events will cause flooding, landslides, and damage to crops, infrastructure, and property; while areas of Bangladesh, India, the Maldives, and Sri Lanka are at high risk from sea-level rise that may displace human settlements, cause saltwater intrusion and loss of agricultural land and wetlands, and damage tourism and fisheries.

A recent ADB study examined the economic costs of climate change to the region over the range of climate change conditions expected in the future.[1] It then estimated the cost and benefits of adaptation in the six countries, looking especially at some key sectors: agriculture, terrestrial ecosystems, water, coastal and marine resources, energy, and human health.[2] The Intergovernmental Panel on Climate Change (IPCC) *Fourth Assessment Report's* A1B (median), A2 (pessimistic), and B1 (optimistic) scenarios were used in the sector analyses[3]. Finally, the study considered adaptation options, policies, and strategies.

Impacts on Vulnerable Sectors

The study found that all the key sectors would be increasingly affected by climate change, and that early action to avoid, remedy, or minimize damage is essential.

---

[1] ADB. 2009. *Regional Economics of Climate Change in South Asia Part II: Adaptation and Impact Assessment.* Manila, Philippines. (TA7423-REG)

[2] For the full regional synthesis report, see Ahmed, M. and S. Suphachalasai. 2014. *Assessing the Costs of Climate Change and Adaptation in South Asia.* ADB, Manila, Philippines.

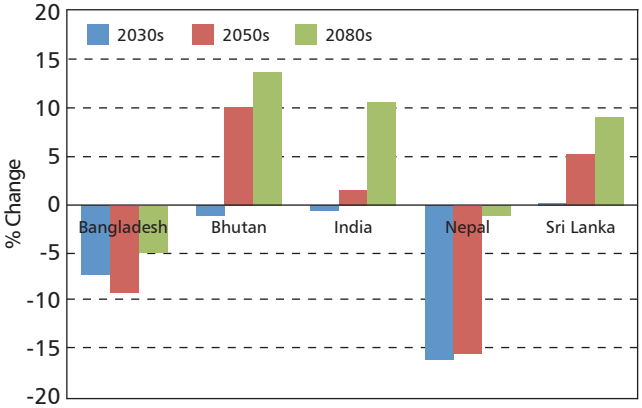
[3] The recently released IPCC *Fifth Assessment Report* features the results of new data and models. While confirming the trends of the fourth report, it considers four basic scenarios, called representative concentration pathways, that have similarities with some of the emissions scenarios of the fourth assessment report used here.

Agriculture. Some crops in parts of the region may benefit from future warmer temperatures, but the overall impact of climate change on agriculture is expected to be negative, posing a serious threat to regional food security. Early yield gains are predicted in rice, for example, in Bhutan and India but yields may begin to decline again by the 2050s. By the 2080s, rice production is forecast to increase by as much as 16% in Nepal's hills and mountains, but decline by as much as 23% in the extensive tropical and subtropical regions of Bangladesh, Bhutan, India, and Sri Lanka.

Coastal and Marine Areas. Global sea level could rise between 0.2 meter and 0.8 meter by 2100. However, the smallest resolution of predictive models at present is 1.0 meter and projections on that basis overestimate the extent of future flooding. Bearing that in mind, a 1-meter rise would cause widespread inundation in coastal areas: about 0.72% (20,932 square kilometers [km^2]) of drylands and 0.75% (3,694 km^2) of the wetlands in South Asia, affecting about 95 million people. This would increase to 3.17% of dryland and 5.50% of wetland areas, and more than 200 million people when extreme storm surge is also considered.

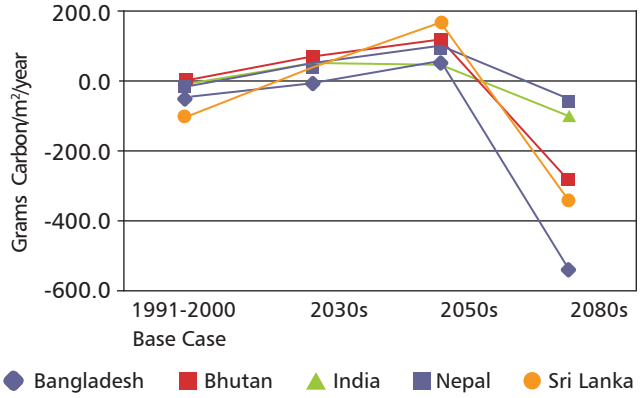
Forest Ecosystems. Overall, South Asia's forest carbon pool appears to increase by the 2080s, implying absorption of more carbon dioxide (CO_2), the most prevalent greenhouse gas **(Figure 1)**. Meanwhile, net biome productivity—the difference between the amount of CO_2 taken up from the atmosphere by photosynthesis and that released by decomposition and forest fires—appears positive and increasing by the 2030s and 2050s, but will be negative and declining by the 2080s **(Figure 2)**. This declining trend implies that forest ecosystems will be unable to compensate for the rising metabolic losses due to increasing temperature.

Figure 1: Projected Change (%) in Forest Carbon Pool in South Asia under A1B Scenario



The projected percent changes are as compared to the 1991–2000 baseline forest ecosystem carbon level. The Maldives is not included because it is too small for the model resolution. A1B = projected scenario from Intergovernmental Panel on Climate Change (IPCC). 2001. *Special Report on Emissions Scenarios*. A special report of Intergovernmental Panel on Climate Change (IPCC) Working Group III. Cambridge, UK: Cambridge University Press.
Source: RECCSA II ADB study team.

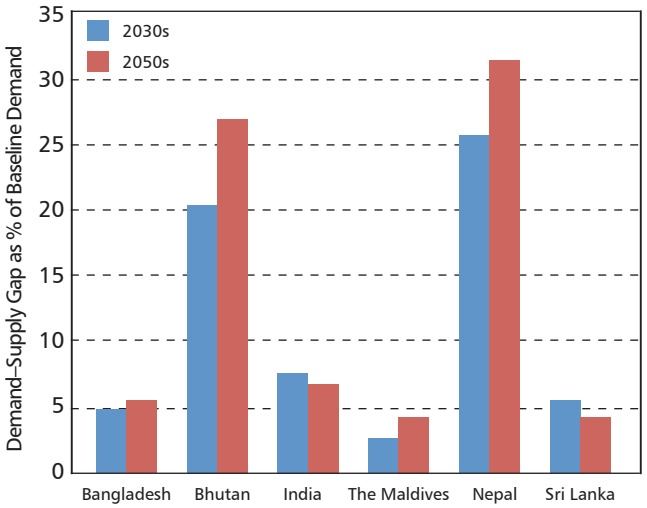
Figure 2: Projected Net Biome Productivity in South Asia under A1B Scenario



m^2=square meter.
The Maldives is not included because it is too small for the model resolution. Positive values indicate the removal (absorption or capture) of carbon dioxide from the atmosphere, while negative values show its release back to the atmosphere. A1B = projected scenario from Intergovernmental Panel on Climate Change (IPCC). 2001. *Special Report on Emissions Scenarios.* A special report of Intergovernmental Panel on Climate Change (IPCC) Working Group III. Cambridge, UK: Cambridge University Press.
Source: RECCSA II ADB study team.

Energy. Climate change will affect both energy generation and demand in South Asia. Changes in temperature and precipitation can reduce the capacity of power plants (e.g., hydropower plants) and efficiency of distribution systems, hence reduce energy supply. Meanwhile, aside from normal determinants such as population and economic development, climate change will place a higher demand for energy, due to higher requirements for heating and cooling. By 2050s, the highest gap between energy demand and energy supply due to climate change is estimated to range from 4.2% in Sri Lanka to 31.8% in Nepal. Only India and Sri Lanka may experience slightly improved energy supply coverage between 2030s and 2050s **(Figure 3)**.

FIGURE 3: Projected Highest Demand–Supply Gap Based on Baseline Power Demand in South Asia, 2030s and 2050s



Source: RECCSA II ADB study team.

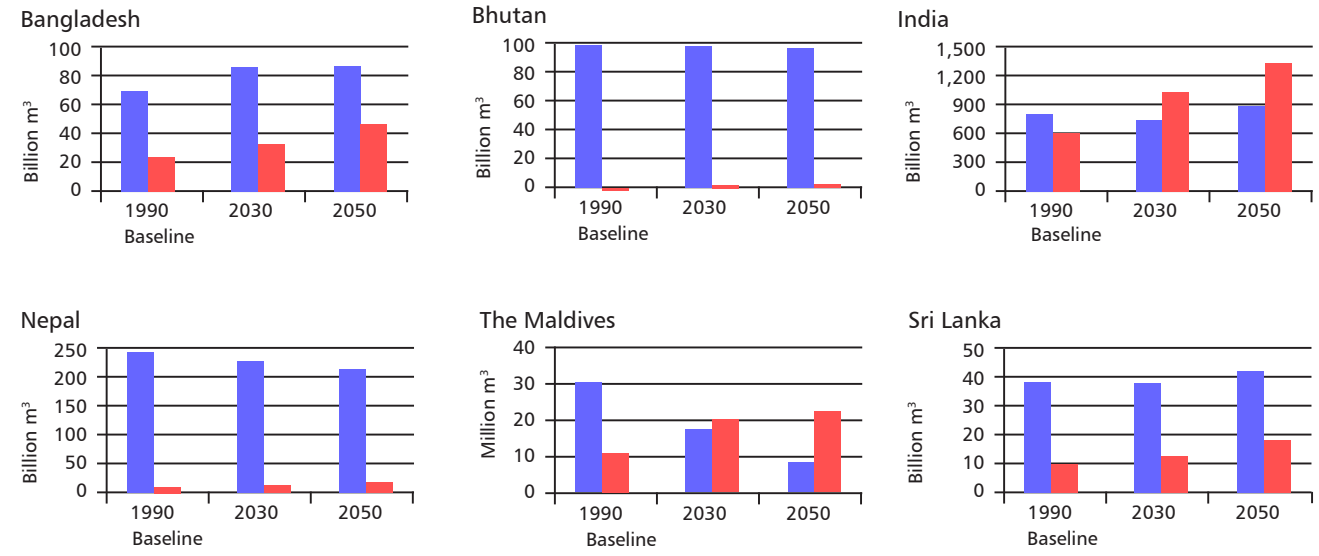
Water Resources. Water supply in Bangladesh, Bhutan, Nepal, and Sri Lanka are likely to be higher due partly to the positive effects of increased rainfall. On the other hand, due to variations in intensity and distribution of rainfall, the region as a whole will experience water deficit, particularly in India where water deficit will be roughly 300 billion cubic meters (m^3) and 400 billion m^3 by 2030s and 2050s respectively **(Figure 4)**.

Human Health. Climate and anomalous weather events will likely result in a rise of vector- and water-borne diseases in South Asia. Deaths from dengue, malaria, and diarrhea are projected to increase with climate change. However, from the 2030s to the 2080s, the number of malaria cases will likely fall, while those of dengue and diarrhea will probably rise.

Economic Implications

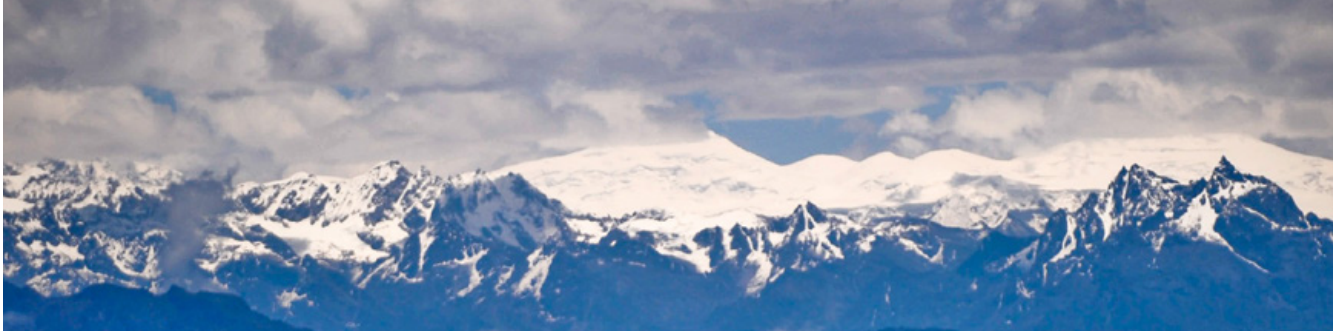
The total climate change cost in South Asia will increase and become prohibitively high in the long term unless the world turns away from its fossil fuel-intensive development path. South Asia could lose an equivalent of 1.8% of its annual GDP by 2050, which will increase to 8.8% by 2100 on average. The Maldives and Nepal will be the hardest hit, with projected GDP losses of 12.6% and 9.9%, respectively by 2100.

FIGURE 4: Water Supply and Demand in South Asia Under A1B Scenario



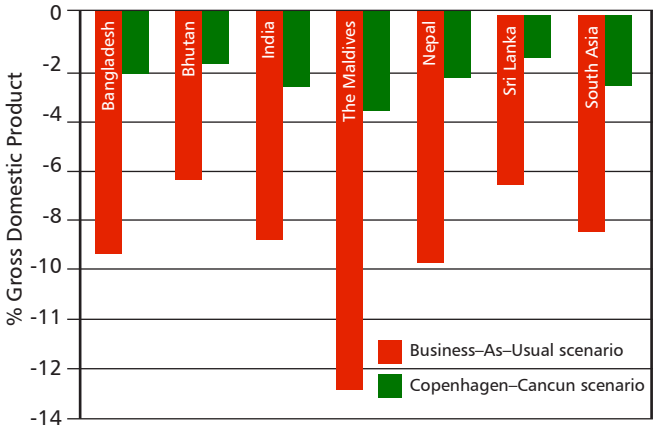
Dependable water supply (includes precipitation amount available 80% of the time)
Water demand (covers irrigation, drinking, industry, and energy)

Sources:
1990 Baseline data is from United Nations. 2006. Water: *A Shared Responsbility. The United Nations World Water Development Report 2.*United Nations Educational, Scientific and Cultural Organization (UNESCO) and Berghahn Books.
Water demand data for India is from Planning Commission. 2004. *Report of the Inter Ministry Task Group on Efficient Utilisation of Water Resources.* http://planningcommission.nic.in/aboutus/taskforce/inter/inter_uwr.pdf
Water demand data for Bangladesh, Bhutan, the Maldives, and Nepal are from Reddy, M., V. Char, N. Afzal, S. Qutub, D. Basnyat, J. Karmacharya, M. Miah, S. Mukherjee, J. Nickum, K. Rahman, and K. Rasheed, K. 2004. *Water Demand–Supply Gaps in South Asia: Approaches to Closing Gaps.* Project on Water and Security in South Asia, implemented by the South Asia Program, School of Advanced International Studies, Johns Hopkins University, Washington, DC.



If the global community takes action in line with the agreements made in recent years by world political leaders (the so-called "Copenhagen–Cancun agreements") to keep the temperature rise below 2°C, the total economic cost of climate change across South Asia will be manageable—only about 1.3% of GDP by 2050 and roughly 2.5% by 2100. **Figure 5** shows the marked differences in losses over time under the business-as-usual and the Copenhagen–Cancun conditions.

FIGURE 5: Mean Economic Cost of Climate Change (as % GDP) under Business-as-Usual and Copenhagen–Cancun Conditions in 2100, South Asia



GDP = gross domestic product.
The business-as-usual (BAU) condition assumes no adaptation effort or investment beyond the current level. Although a "no action" assumption may be unrealistic, the scenario creates a benchmark against which scenarios with action are evaluated. The BAU scenario is consistent with a high-emission scenario (between A2 and A1F1).
The Copenhagen–Cancun condition assumes decoupling of greenhouse gas emissions from BAU economic growth, and imposes the implementation of Copenhagen Accord pledges (toward 2020) with a long-term vision in line with Cancun Agreements, aimed at keeping the global mean temperature below 2°C.
Source: RECCSA II ADB study team.

The six South Asian countries would need to invest 0.86% of their GDP on average (about $72.6 billion) between now and 2050 to avoid increasing damage from climate change impacts with a business-as-usual development path. Under the Copenhagen–Cancun agreements, this figure could be as low as 0.48% of GDP (or about $40.6 billion), a saving of nearly 50%.

Adaptation Options, Policies, and Strategies

The South Asian countries have already developed a wide range of climate change adaptation options for specific economic sectors, such as agriculture, water, forestry, and energy, and have begun integrating them into their development plans and actions at all levels. These options include (i) improved management of resource use and supply; (ii) more research and development activities; (iii) information, education, and communication campaigns; (iv) capacity building; and (v) policy development or reform.

Such climate change response policies (both adaptation and mitigation) need to be integrated into overall national development strategies to be fully effective. And not all issues can be resolved by individual countries but must be addressed regionally or subregionally. Thus, integration requires not only governance and institutional capacity development and sustained climate financing, but also strong intergovernmental policy coordination and effective regional cooperation. In conclusion, it is through an early action that South Asia countries can be fully prepared against significant adverse climate change impacts.

The Regional Economics of Climate Change in South Asia: Adaptation and Impact Assessment study was funded under a regional technical assistance financed by the Government of the United Kingdom through the Department for International Development.

For further information, contact:
Mahfuz Ahmed
Principal Climate Change Specialist
Portfolio, Results and Quality Control Unit
Office of the Director General, South Asia Department, ADB
casa@adb.org

See also: www.adb.org/sard

 Publication Stock No. ARM146579-2