



WORKSHOP ON CLIMATE CHANGE AND DISASTER RISK MANAGEMENT IN PLANNING AND INVESTMENT PROJECTS

Economic Impacts of Climate Change in South Asia

**By. Dr. Benoit Laplante, Consultant
Climate Change Adaptation Economist
New Delhi, India
June 27, 28 and 29 2016**

The views expressed in this presentation are the views of the author/s and do not necessarily reflect the views or policies of the Asian Development Bank, or its Board of Governors, or the governments they represent. ADB does not guarantee the accuracy of the data included in this presentation and accepts no responsibility for any consequence of their use. The countries listed in this presentation do not imply any view on ADB's part as to sovereignty or independent status or necessarily conform to ADB's terminology.



Outline of Presentation

- 1. Overall approach to estimate economic impacts of climate change**
- 2. Economic impacts of climate change in South Asia**
- 3. Concluding remark**

Outline of Presentation

1. Overall approach to estimate economic impacts of climate change
2. Economic impacts of climate change in South Asia
3. Concluding remark

Overall approach: Steps

Steps:

Step 1:

Project a future path of GHG emissions (assumptions about population growth, GDP, technology development and adoption, etc.)

Step 2:

Translate this path of GHG emissions into alternate scenarios of climate change. Do the same for a projected path of GHG emissions which add 1 ton of carbon in any given year.

Step 3:

Estimate physical impacts of climate change on humans and ecosystems.

Step 4:

Monetize these impacts and discount.



Overall approach: Integrated assessment models

IAMs do all 4 steps.

3 IAMs:

DICE (Dynamic Integrated Climate Change and Economy; W. Nordhaus)

PAGE (Policy Analysis of the Greenhouse Effect; C. Hope)

FUND (Climate Framework for Uncertainty, Negotiation, and Distribution; R. Tol)

These IAMs differ in terms of:

- **The way they transform changes in temperature into changes in consumption and investment. For example, GDP is endogenous in DICE but not PAGE and FUND.**
- **PAGE and DICE includes the possibility of catastrophes, not FUND.**
- **PAGE and FUND allows for some form of adaptation, not DICE.**



Overall approach: Integrated assessment models

Known limitations of IAMs:

- **Incomplete treatment of non-catastrophic impacts**
For example, the impacts (and costs) of ocean acidification are not included in IAMs.
- **Incomplete treatment of potentially catastrophic impacts**
For example, the impacts (and costs) of massive loss of ice sheets and re-organization of ocean circulation are not included in IAMs
- **IAMs are calibrated over a relatively narrow range of observed temperatures (around 2.5C). Very crude extrapolation of damages to higher degrees of warming.**
- **Incomplete treatment of adaptation and technological change.**



Overall approach: Integrated assessment models

Known limitations of IAMs:

- Inadequate treatment of risk aversion.

	Probability	Damages	Expected damages
Event 1	1%	\$1,000	\$10
Event 2	10%	\$100	\$10

If society is risk neutral, then the WTP to reduce the likelihood of Event 1 will be the same as to reduce the likelihood of Event 2.

However, if society is risk averse, then the WTP to reduce the likelihood of Event 1 will be higher than the WTP to reduce the likelihood of Event 2.

Weitzman (2009, 2013): The combination of fat tails and strong risk aversion yields extremely large SCC.

Tol (2009): “The assumed rate of risk aversion is at least as important as the assumed rate of time preference in estimating the SCC.”

Outline of Presentation

1. Overall approach to estimate economic impacts of climate change
2. Economic impacts of climate change in South Asia
3. Concluding remark

Economic impacts of climate change in South Asia

ADB Study (2014):

Assessing the Costs of Climate Change and Adaptation in South Asia

Available at: www.adb.org

Objective of study:

The study aimed to (i) assess the biophysical impacts of climate change in the region, and (ii) estimate the total economic loss to the countries in the region by 2100, and (iii) to estimate the magnitude of funding for adaptation measures required to avert such potential losses.

Countries included:

Bangladesh, Bhutan, India, Maldives, Nepal, Sri Lanka.



Economic impacts of climate change in South Asia

Sectors included:

Sector	Impact
Agriculture	Changes in crop yield; optimal crop growing temperature; shifts in cropping calendar.
Coastal and marine	Loss of dryland and wetland areas due to sea level rise; extent of coastal areas temporarily inundated by high tides and storm surges.
Energy	Impact on hydropower generation capacity; changes in energy demand.
Forest	Change in total carbon storage; change in net primary productivity; change in vegetation types.
Human health	Mortality and morbidity due to water-borne and vector-borne diseases; mortality and morbidity due to extreme cold and heat.
Water resources	Dependable water resource; length of projected water deficits; average annual water deficit volumes.



Economic impacts of climate change in South Asia

Methodology:

A regional climate model was used over the South Asia domain at a 30-kilometer (km) grid resolution.

The A2, A1B, and B1 scenarios from the 2001 Special Report on Emission Scenarios (SRES) of the IPCC, representing high, medium, and low emission futures respectively.

PAGE09 IAM was used.

Three time periods—2030s, 2050s, and 2080s.



Economic impacts of climate change in South Asia

Results: Business as usual scenario

Economic cost of climate change (as % of projected GDP)

	Country	Mean	Range
By 2050	Bangladesh	-2.1	-0.9 to -4.2
	Bhutan	-1.4	-0.5 to -3.1
	India	-1.8	-0.8 to -3.8
	Maldives	-2.3	-0.9 to -5.1
	Nepal	-2.3	-1.0 to -4.5
	Sri Lanka	-1.3	-0.5 to -2.6

Economic impacts of climate change in South Asia

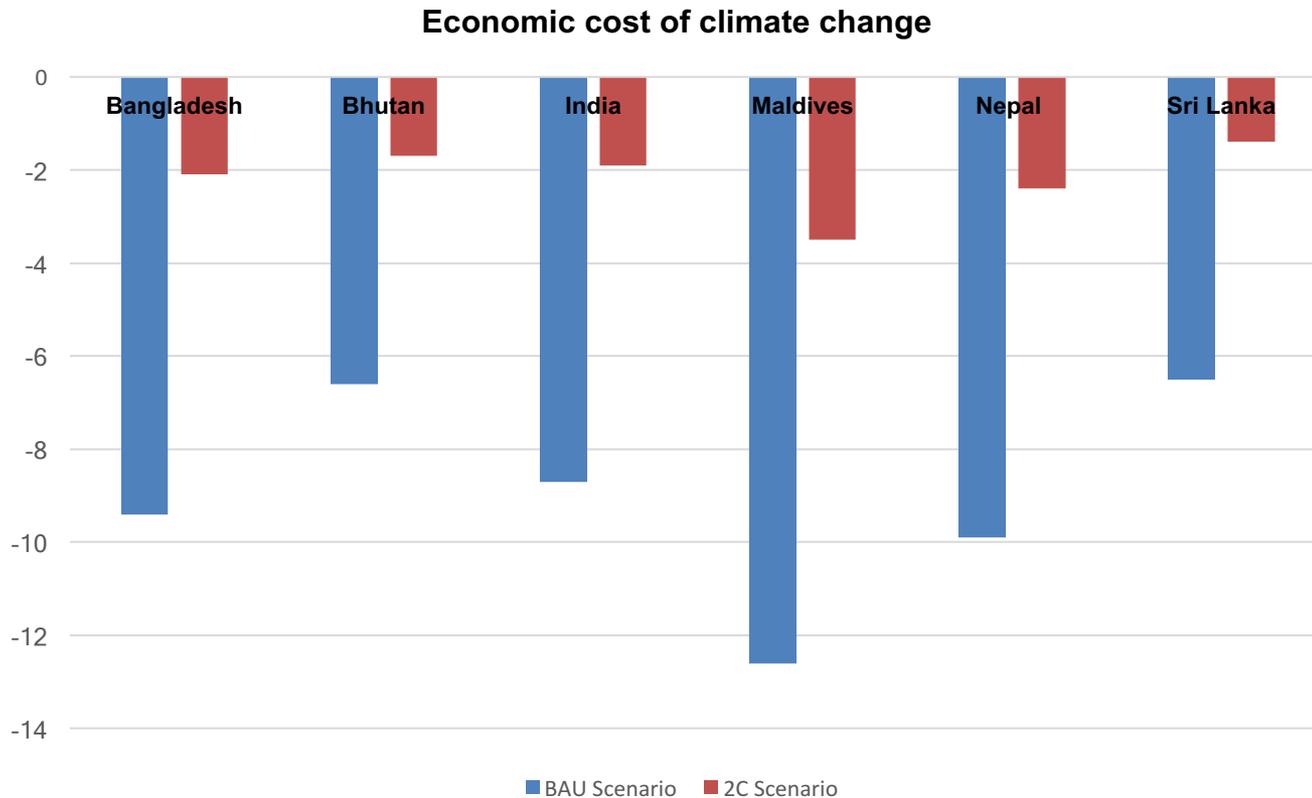
Results: Business as usual scenario

Economic cost of climate change (as % of projected GDP)

	Country	Mean	Range
By 2050	Bangladesh	-2.1	-0.9 to -4.2
	Bhutan	-1.4	-0.5 to -3.1
	India	-1.8	-0.8 to -3.8
	Maldives	-2.3	-0.9 to -5.1
	Nepal	-2.3	-1.0 to -4.5
	Sri Lanka	-1.3	-0.5 to -2.6
By 2100	Bangladesh	-9.4	-3 to -24
	Bhutan	-6.6	-2 to -18
	India	-8.7	-3 to -19
	Maldives	-12.6	-3 to -36
	Nepal	-9.9	-3 to -25
	Sri Lanka	-6.5	-2 to -20

Economic impacts of climate change in South Asia

Results: BAU and 2C warming



Strong global mitigation reduces economic cost, but not to 0.

Economic impacts of climate change in South Asia

Adaptation needs

Estimated annual average adaptation cost to avoid climate change impacts under different climate change scenarios
(\$ billion)

	Scenario	Average	Range
BAU1	2100; 6.9C; 1.1 m SLR	110.9	51 - 198
BAU2	2100; 4.5C; 0.7 m SLR	72.6	33 - 128
BAU3	2050; 2.5C; 0.3 m SLR	40.2	18 - 72
CC1	2100; 2.5C; 0.5 m SLR	40.6	19 - 71
CC2	2050; 1.9C; 0.3 m SLR	31.0	14 - 54



Outline of Presentation

1. Overall approach to estimate economic impacts of climate change
2. Economic impacts of climate change in South Asia
3. Concluding remark

Concluding remark

It is certainly true that there is much uncertainty behind these estimates.

However:

“Everything that we know about climate change tells us that it is bad. Everything that we don’t know tells us that it is probably much worse.”

M. Weitzman et al. Climate Shock: The Economic Consequences of a Hotter Planet. 2015.





WORKSHOP ON CLIMATE CHANGE AND DISASTER RISK MANAGEMENT IN PLANNING AND INVESTMENT PROJECTS

Economic Impacts of Climate Change in South Asia

**By. Dr. Benoit Laplante, Consultant
Climate Change Adaptation Economist
New Delhi, India
June 27, 28 and 29 2016**

