

CLIMATE CHANGE IN BHUTAN : ADAPTATION AND MITIGATION

South Asia Climate Change Focal Points and Experts Consultation Meeting
November 16-17, 2011
Dil Bahadur Rahut, South Asian University

Climate Change is for Real...

IPCC Fourth Assessment Report:

- Mountain glaciers and snow cover have declined on average in both hemispheres. Widespread decreases in glaciers and ice caps have contributed to **sea level rise**
- Global average sea level rose at an average rate of **1.8 mm per year over 1961 to 2003**.
- Long-term trends from 1900 to 2005 have been observed in precipitation amount over many large regions. **Significantly increased precipitation has been observed in eastern parts of North and South America, northern Europe and northern and central Asia.**
- Widespread changes in **extreme temperatures** have been observed over the last 50 years.
- Cold days, cold nights and frost have become less frequent, while **hot days, hot nights, and heat waves have become more frequent**

From An Economic Perspective Climate Change is a Unique “Externality”

- The emission of greenhouse gases imposes costs on others that are not borne by the emitter.
- Reducing GHGs is a global public good
 - If one country reduces, all countries benefit
 - Individual countries have an incentive to “free ride”
- While Bhutan is the net sequesterer of GHG, it is highly vulnerable to the impact of climate change.
(GHG Inventory 2000 provides that, in 1994, the forests and land use system sequestered 3,549.52 gigagram (Gg) of CO₂ annually, while total CO₂ emissions were only 228.46 Gg.

From An Economic Perspective Climate Change is a Unique “Externality”

- The costs will be felt over a long time period and over the entire world.
- But, the exact nature of costs is uncertain: they will be shaped by policies, market mechanisms, & other events.
- Those most affected—future generations— cannot speak up for their interests

Bhutan and Climate Change

- **Bhutan is a responsible nation** and is committed to growth with environmental responsibility. ***GROSS NATIONAL HAPPINESS***
- Bhutan declared to remain Carbon Neutral during the COP at Copenhagen
- Maintenance of forest coverage
- Bhutan signed UNFCCC at Rio de Janeiro in 1992

Bhutan and Climate Change

- Signatory to Kyoto Protocol/ratified Kyoto Protocol in 2002
- Submitted the Initial National Communication at the 6th Conference of Parties on November, 2000
- Completed first National Inventory on Greenhouse Gas Emission 2000.
- National Adaptation Program of Action (NAPA) completed-2006

Impact of Climate Change in Bhutan

- Reduced agricultural productivity (productivity of farms, forests, & fisheries)
- Threaten food security
- Decrease the ability to fight against poverty
- Heightened water insecurity (Water: Supply & Demand)
- Increased exposure to extreme weather events
- Collapse of ecosystems (distribution & abundance of species)
- Increased health risks (geography of disease)
- Economic loss from hydropower (direct/indirect)
- [Damages from storms](#), floods, droughts, wildfires
- Tourism
- Property and human life loss from GLOF

Biodiversity
& Forest

Agriculture

Water

Natural
Disaster

Health

Impacts on Agriculture

- Rural Livelihood: Over 70 percent of Bhutanese population dependent in agriculture.
- Contributes to about 14% of GDP and its is growing at decreasing rate
- High dependency on rainfed irrigation combined with high variability in precipitation and changes in the timing of rainfall
- Could benefit from increased growing season at high latitudes
- Increased minimum temperature (crop growth and pest/pathogen effects)



Impact on Biodiversity

- Bhutan is rich in biodiversity
- Biodiversity resources also contributes significantly to the livelihood of rural poor
- **Millennium Ecosystem Assessment** (Climate change is the second greatest threat to biodiversity)

Climate change is **changing species** through:

- shifting habitat
- changing life cycles
- the development of new physical traits
- Loss of habitat for humans and animals



Health impacts

– Malaria

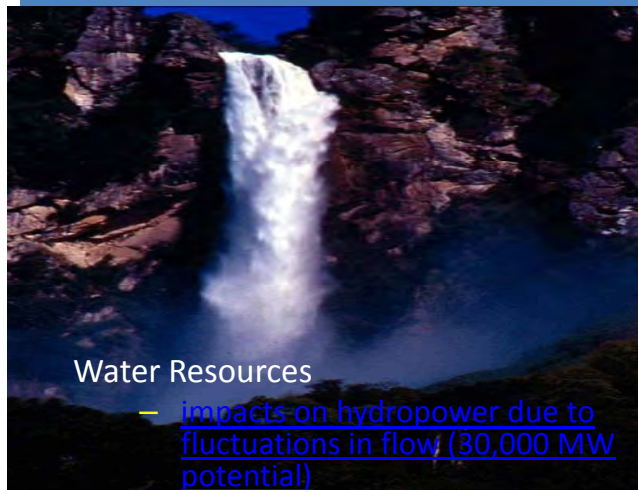


– Malnutrition

– Heat Stroke, floods

Impact on the Hydro-power Sectors

- [Large source of export earning from India](#)
- Substantial contribution to government fiscal budget
- Forest conservation and rural electrification cyclical affects
- Wide variation in the water level changes the hydropower generation
- Affect energy pricing and government revenue



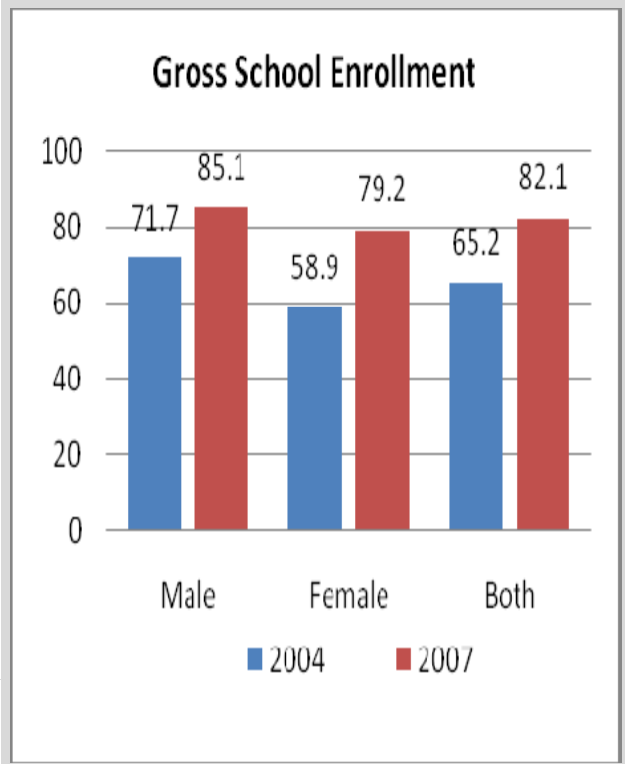
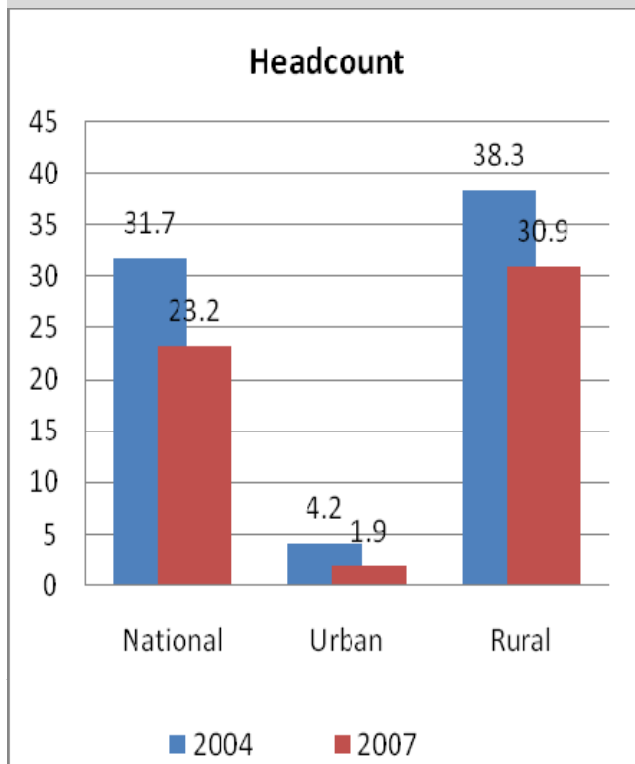
Water Resources

— [impacts on hydropower due to fluctuations in flow \(30,000 MW potential\)](#)

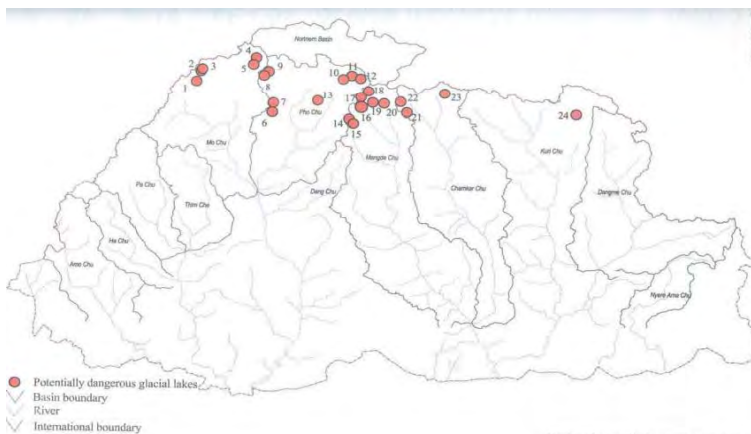
Impact on Business

- Vulnerability of inputs such as energy and agricultural products
 - Agro based industries
 - Power intensive industries
 - Decrease on Indian rupee earning could hamper the imports from India for business
- This will also have impact on employment
- Challenges to the Sustainable Development of the Tourism Industry

IMPACT ON MGDs



Bhutan: Impacts of Climate Change (GLOF)



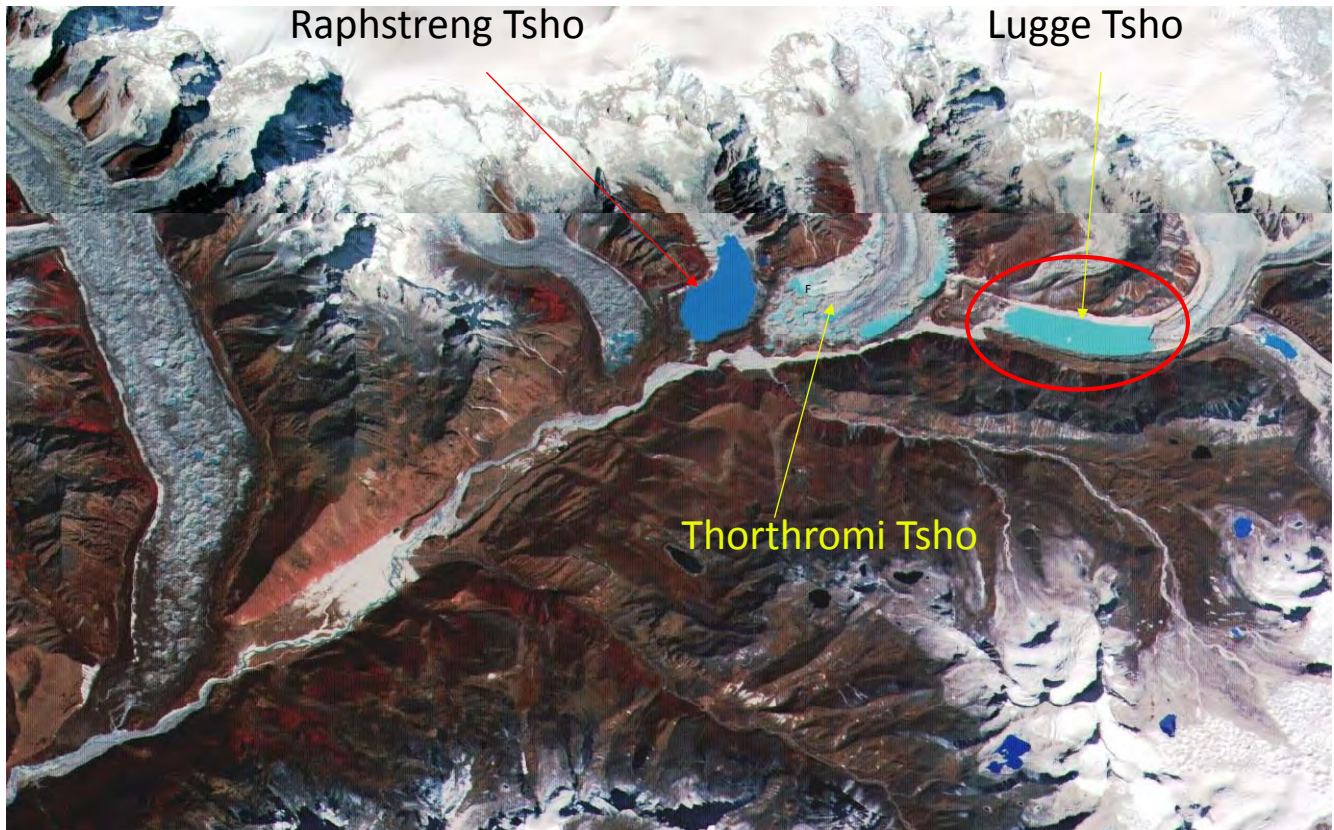
Glacier Retreat

- Total of 2,794 glacial lakes
- 25 potentially dangerous

Phochhu Sub basin	9
Mochhu Sub basin	5
Chamkhar chhu Sub basin	3
Kurichhu Sub basin	1
Mangde Chhu Sub basin	7



1994 Glacier Lake Outburst Flood

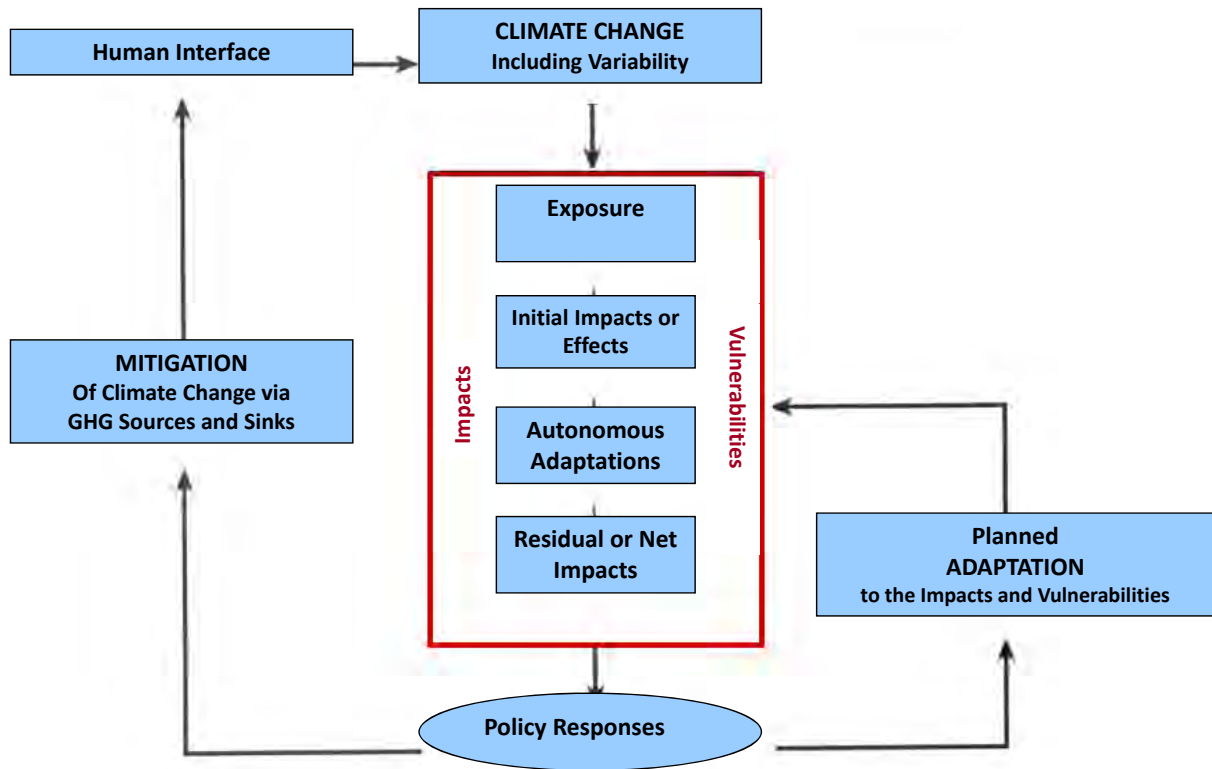


What Should We Do?

- Face the challenge in two ways:
 - Mitigation = reduce GHG emissions & concentration in atmosphere
 - Adaptation = prepare for impact of climate change
- We need to prepare now for the inevitable effects of climate change, such as heat waves and wildfires

“Neither adaptation nor mitigation alone can avoid all climate change impacts; however, they can complement each other and together can significantly reduce the risks of climate change” (**Key findings of the IPCC Fourth Assessment Report**)

Mitigation and Adaptation Diagram from SRES



Places of adaptation in the climate change issue.

Adopted from David D. Houghton

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Adaptation

- As per Bhutan's National Adaptation Programme of Action (NAPA) 2006, 45 adaptation activities were identified.
- These adaptation activities were further fine tuned into addressing climate hazards impacting vulnerable and vital components of the Bhutanese society.
- The framework of climate induced hazards and adaptation activities then constituted the basis for projects.

Adaptation Options/Strategies

[Based on Hazard]

GLOF (Due to temperature rise)

- Early warning systems
- Artificial lowering of Glacier Lake
- Assessment of GLOF threats for hydropower projects
- Awareness to the population in high risk zone

Decreases/Fluctuation in river water

- Diversification in to other sources of renewable energy like:
 - Wind
 - Solar
- Forecasting the climate changes and its impact on river water

Adaptation Options/Strategies

Landslide (due to weather pattern)

- Soil Conservation and Land Management
- National database
- Relocation the population from high risk zone
- River bank protection
- Small stream catchment protection
- Slope stabilization- terraces/canals/afforestation



Adaptation Options/Strategies

Flash flood (due to GLOF/weather pattern)

- Early warning systems
- Relocation the population from high risk zone
- Watershed Catchment Management integrated with Land Management/Soil
- Conservation
- Weather and climate forecasting
- Promote forest management and afforestation projects
- Protect water treatment plants to ensure safe drinking water
- Control the spread of impervious ground cover that impedes the recharging of ground water resources

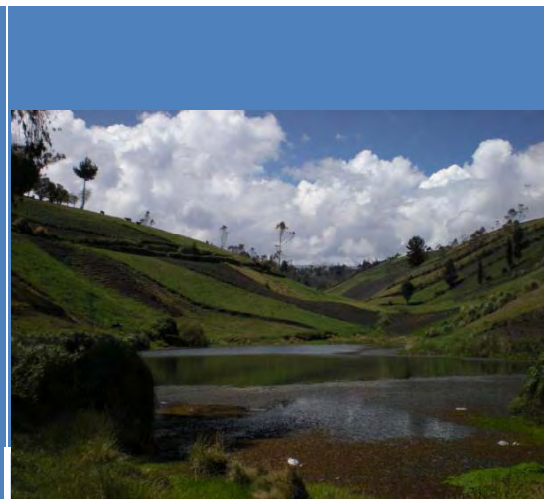


Drought (due to temperature rise/weather pattern)

- Promote forest management and afforestation projects
- Protecting water sources
- Irrigation water supply, etc
- Weather and climate forecasting
- Water use efficiency,
- Resistant crop varieties,
- Water harvesting

Rural Livelihood

- Diversification of livelihood activities,
- Adjustments in farming operations;
- Income-generation projects;
- Move towards off- or non-farm livelihood incomes.



Policies/Institutions

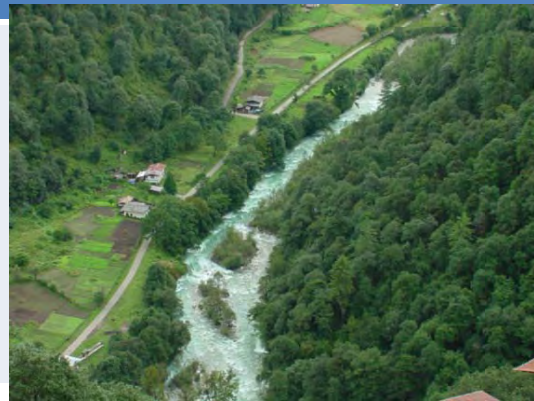
- Support to institutional building and implementing agencies
- Coordination
- Mainstreaming adaptation process in the five year plans: Adaptation to be integrated into the development projects in general.
- Stakeholder involvement
- Awareness and outreach programs
- Capacity building
- [Climate Change Data base](#)

Mitigation

The UN defines mitigation in the context of climate change, as a human intervention to reduce the sources or enhance the sinks of greenhouse gases.

Mitigation Strategy

- Carbon sequestration through forest management
 - Conservation
 - Afforestation
- Ban on exports of timber
- Rural electrification
- Renewable energy: Solar



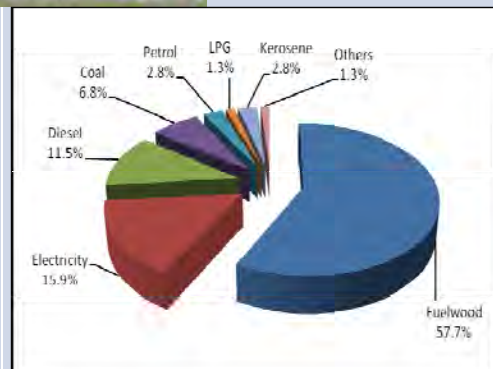
Mitigation Strategy

Transportation: Emission testing
Fuel efficiency
Hybrids
Road to rail
Public transport
Land-use planning



Buildings

Day-lighting
Energy efficiency
Promoting alternatives to timber for housing
Green building
Improved cook stoves (to reduce fuelwood)
Solar heating & cooling
Fuel Switching (replacement by LPG)



Mitigation Strategy

Agriculture

Crop & land
management

Livestock & manure
management

Improved N fertilizer
use



Industry

Energy efficiency

Heat & power recovery



Mitigation Strategy

Awareness



THANK YOU
AND
TASHI DELEK