



IMPACT OF CLIMATE CHANGE ON WATER IN SOUTH ASIA

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FIVE QUESTIONS

- A. Why South Asia is vulnerable to climate change?
- B. How climate change (in the form of glaciers, weather patterns and sea level rise) can impact water?
- C. How the impact of climate change on water can affect people?
- D. What are the main sources of green house gas (GHG) emissions in South Asia?
- E. What are the ways and strategies to ensure economic growth in South Asia in a way to ensure sustainable human development?



INTRODUCTION

- Climate change, an inevitable reality, impacting developing and developed countries. Impacts are seen everywhere in the forms of floods, droughts, and change in weather patterns.
- The impact of climate change, in the form of melting of glaciers, heavy and untimely rainfall, extreme weather events, and sea level rise, threaten people's well-being in SA by affecting water resources and systems.
- According to IPCC, “water and its availability will be the main pressures on, and issues for, societies and the environment under climate change.”
- SA is already facing water shortages due to population growth, rapid urbanization, faster industrialization and poor water management. CC will exacerbate stresses on water resources in South Asia by negatively affecting water quality, quantity, demand, security and transboundary issues.



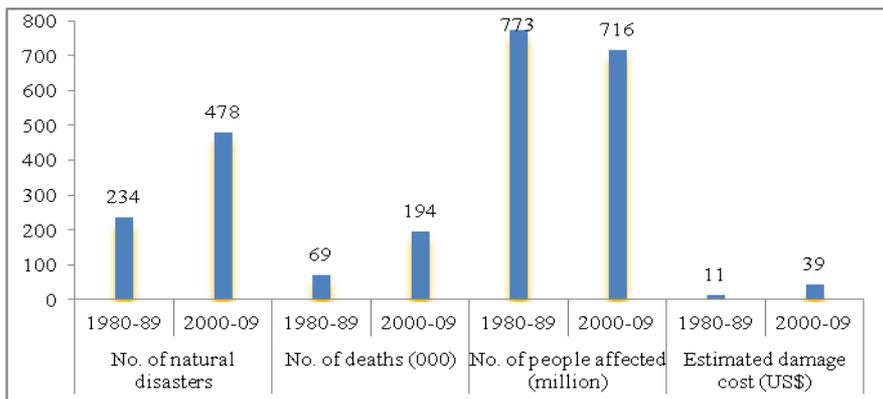
A. VULNERABILITY OF SOUTH ASIA TO CLIMATE CHANGE

SA is one the most vulnerable regions of the world due to more exposure to natural disasters, high incidence of poverty and inequality, high proportion of population living in slum areas, high population density, and more dependence on monsoon rainfall.

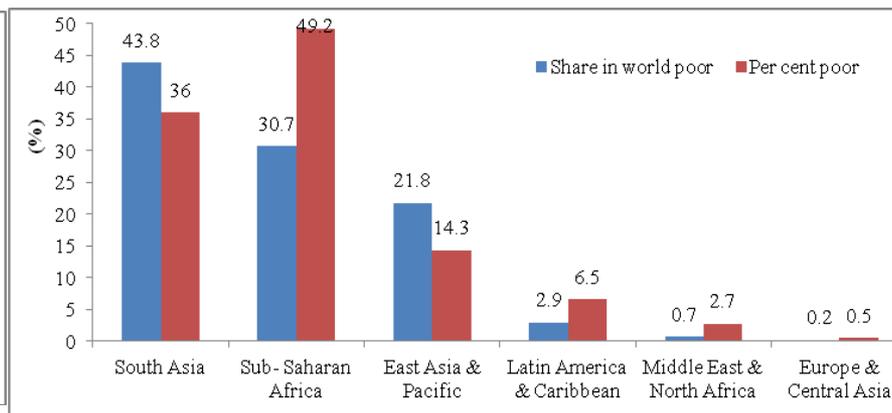
- Monsoon rain accounts for 70 % of the regions' total annual precipitation.



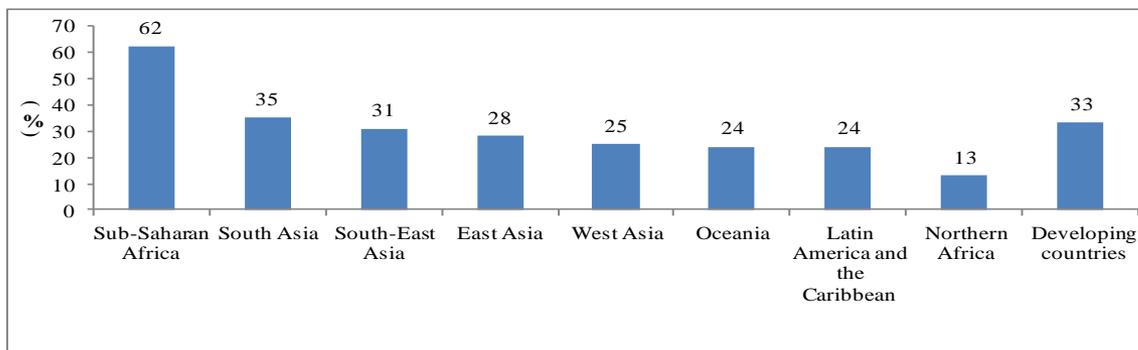
Natural disasters in South Asia



Poverty: Population living on less than PPP \$1.25 a day, 2008



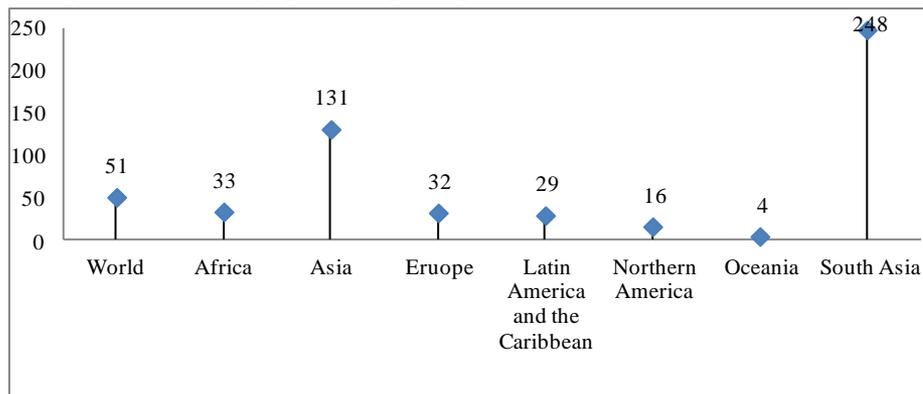
Proportion of urban population living in slum areas, 2012



Population living in coastal zones in South Asia, 2000

	Population in coastal zones, 2000	
	Total	% of total population
India	63,188,208	6.27
Pakistan	4,157,046	2.94
Bangladesh	62,524,048	45.56
Afghanistan	0	0
Nepal	0	0
Sri Lanka	2,231,097	11.79
Bhutan	0	0
Maldives	290,923	100

Population density (persons per square km), 2010



B. IMPACT OF CLIMATE CHANGE ON WATER IN THE FORM OF GLACIERS, WEATHER PATTERNS AND SEA LEVEL RISE?

1. Melting of glaciers
2. Temperature and precipitation
3. Extreme weather events (floods, droughts, heat waves and cyclones)
4. Sea level rise



1) *MELTING OF GLACIERS*

- Glacial melt is an important source of freshwater in SA. Snow and glacial melt contribute to the 10 largest rivers in Asia, ranging from 2 per cent of the average flow in the Yellow River to about 50 per cent in the Indus River, benefiting 1.3 people.
- The Himalayan glaciers are melting faster than the global average with serious implications for water availability. In SR, increase risk of floods due to more run-offs in rivers. In LR, water shortage along with a decline in river run-offs.
- In the region river flows are expected to increase during the first 50 years and decrease by 30 to 40 % during the next 50 years. In the Hindu Kush Himalayan range, about 204 glacial-melt water lakes have been identified as potentially dangerous which can burst any time.



2) *TEMPERATURE AND PRECIPITATION*

- About two-thirds of the cultivated area is rain-fed.
- Climate change will change the temperature and increase the variability in the magnitude and timing of rainfall especially during the monsoon season, resulting in lesser water storage and increased water stress.
- In SA, both increasing and decreasing trends in rainfall have been observed over the last century. In the future, annual mean temperature is projected to increase in all South Asian countries. This will be accompanied by a decrease in number of annual cool days and cold nights, and an increase in annual hot days and warm nights.

Climate variability in South Asia, 2045-65

	Change in annual temperature degrees (celsius)	Change in annual cool days/cold nights	Change in annual hot days/warm nights
India	1.9 to 2.6	-2.0 / -2.2	4.6 / 13.3
Pakistan	2.4 to 3.4	-1.8 / -1.9	3.4 / 8.1
Bangladesh	1.7 to 2.4	-1.7 / -2.1	3.4 / 11.8
Afghanistan	2.3 to 3.6	-1.4 / -1.5	3.1 / 7.0
Nepal	2.2 to 3.4	-2.1 / -2.1	2.5 / 8.0
Sri Lanka	1.5 to 1.8	-2.8 / -2.9	7.9 / 23.9



3) *EXTREME WEATHER EVENTS (FLOODS, DROUGHTS, HEAT WAVES AND CYCLONES)*

- CC can increase the incidence and frequency of extreme weather events, negatively affecting water resources and water security. The average number of natural disasters in the region more than doubled from 234 in 1980-89 to 478 in 2000-09. Between 1970 and 2009, SA experienced 1,107 natural disasters, direct economic loss of \$80 bn.
- There is evidence of the increasing trend in the intensity and frequency of extreme weather events and the possible impact on water resources and water security in SA. During the 2004 floods in Dhaka more than two mn city residents faced an acute shortage of drinking water as supplies became contaminated. During 1998, 2004 and 2007 floods in slum areas of Dhaka, about four-fifths of the residents suffered in gaining access to basic sanitation as most of the latrines were inundated by the floodwaters.
- In the future, the intensity of floods, droughts and cyclones is expected to increase in SA, with negative impact on water resources. *Flood* area in Bangladesh is projected to increase by 23 to 29 % with a 2°C increase in global temperature. A 2 to 4°C rise in sea surface temperature is projected to increase tropical cyclone intensity by 10 to 20 % in SA.



4) *SEA LEVEL RISE*

- The global sea level is rising at an increasing rate with similar trend in SA. SA is more vulnerable due to its long and densely populated coastlines, many low lying islands such as the Maldives, and the threat of saltwater intrusion for its agricultural plains and freshwater resources.
- Sea level can have direct inundation impacts. For instance, it will submerge the Maldives completely in a worst case scenario. Similarly, a one metre rise in sea level will inundate one-fifth of Bangladesh's land and impact one-tenth of its population. In India one metre rise in sea level will inundate 5,763 square kilometres of land.
- It can also increase areas of salinization of groundwater. In two islands in India, the thickness of freshwater lenses decreased from 25 metres to 10 metres and from 36 metres to 28 metres respectively, for a sea level rise of 0.1 metre only.



C. HOW THE IMPACT OF CLIMATE CHANGE ON WATER CAN AFFECT PEOPLE?

1. Impact on livelihoods
2. Impact on people's health
3. Climate change induced displacement
4. Impact on women



1. *IMPACT ON LIVELIHOODS*

- CC will affect through changes in the available water resources by intensifying droughts and floods, with potential implications for livelihoods, RD and FS.
- *Agriculture*: one-fifth of GDP and more than half of employment. will be affected by both shortage and excess of water.
- Too little water (due to decrease in precipitation). In SA, increases in temperature and resulting water stress are expected to decrease crop yields by 30 % by the mid 21st century. (49 % decline in crop yields in India, 18 % in Pakistan, 14 % in Bangladesh, 10 % in Sri Lanka and Afghanistan and 1 % in Nepal.)
- Too much water (due to increase in the extent and frequency of floods) can also have adverse effects on crop yields. For instance, in Bangladesh between 1962 and 1988, about 0.5 mn tons of rice were lost annually due to floods. This loss accounted for around 30 % of the country's average annual food grain imports.



- *Forestry*: Employs about 1.9 mn. Potential CC impacts for forestry in SA include: impacts of variation in rainfall and temperature on species distribution and biodiversity; increase in incidence and severity of forest fires; increase in incidence of diseases, insect and pest damage; and increased forest clearance for agriculture due to a decrease in agricultural crop yields.
- For instance, in *Pakistan*, the impact of CC on forestry includes changes in forest area, productivity and species composition. In India, over half of the area under forests is vulnerable to the projected CC. In *Sri Lanka*, rising temperatures and variability in rainfall will result in a decrease in tropical wet forests by 11 %, and an increase in both tropical very dry forests by 5 per cent and tropical dry forests by 7 per cent. About 40 per cent of forests in Bhutan are susceptible to frequent fires.
- *Fisheries*: Employs 7.5 mn. And produces 8.5 mn tons of fish annually. Negative impacts of CC on the fisheries sector would include: stress due to increased temperature and demand for oxygen, uncertain quantity and quality of water, extreme weather events, increased frequency of diseases and toxic events, sea level rise and uncertain supplies of fishmeal and oils from capture fisheries. A vulnerability study of 132 countries to potential CC impacts on their fisheries found Bangladesh and Pakistan to be in the most vulnerable category.

2. *IMACT ON PEOPLE'S HEALTH*

- Water-borne diseases (diarrhoea, cholera, malaria and dengue fever), deaths and injuries due to disasters and malnutrition may be the most devastating consequences.
- In 2000, the global burden of CC attributable to diarrhoea and malnutrition was the highest in most South Asian countries including India, Bangladesh, Nepal, Bhutan and the Maldives and is expected to remain the same by 2030.



3. *CLIMATE CHANGE INDUCED MIGRATION*

- Human migration due to extreme weather events (floods and droughts), sea level rise, and melting of glaciers, implication for migrants and hosts.
- In 2010-11, more than 3.5 million people were displaced in SA by climate-related disasters.
- Both sea level rise and inland flood from melting of Himalayan glaciers may cause displacement of up to 20 million people in India and about 26 million in Bangladesh by 2050.
- Globally, climate induced migrants are expected to increase from 50 million in 2010 to 200-250 million in 2050. In India, Pakistan and Bangladesh, more than 125 million people are expected to be displaced due to CC by the end of this century.



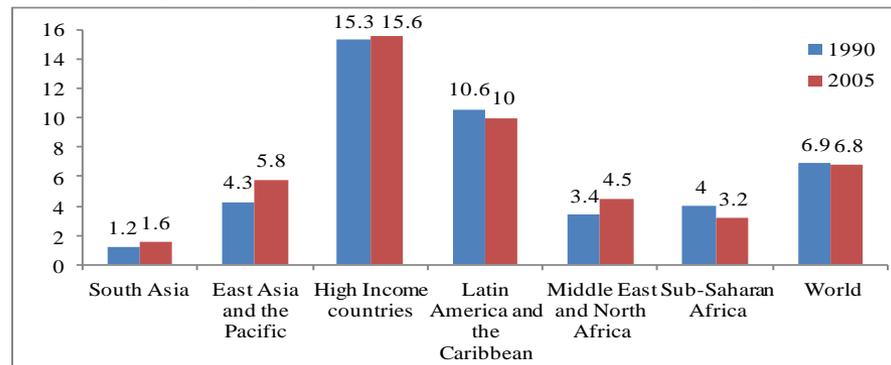
4. *IMPACT ON WOMEN*

- Women are more prone to vulnerabilities due to limited access to resources, poor adaptive capacity and their traditional responsibilities.
- In Bangladesh, the death rate was five times higher among women after the cyclone and floods of 1991. In India, *dalit* and tribal women have been found to be extremely vulnerable to sexual exploitation in times of economic crisis following floods.
- In parts of Gujarat and Rajasthan, India, an increase in women's workload has been observed in a drought situation, as they have to go longer distances to collect water and fuel.
- A decrease in agri. production increases food insecurity and hunger with more burden on women in South Asia where traditionally men are favoured over women in the distribution of food.



D. MAIN SOURCES OF GREEN HOUSE GAS EMISSIONS IN SOUTH ASIA?

- SA's share of global GHGs is lower, it is going to increase due to massive demand for energy, transport, urban systems, and agr. production.
- Between 1990 and 2005, per capita GHG emissions increased in SA from 1.2 to 1.6 metric tons of CO₂e. now rising due to growth in the industrial and service sectors, commercialization of agriculture and increase in energy use. **GHG emissions per capita (metric tons of carbon dioxide equivalent), 1990-2005**



- Total GHG emissions in SA rose at an annual rate of 3.4 % which is the highest growth rate in the world only after the MENA (3.8 %). SA's share in world's GHG emissions also increased from 3.8 to 5.3 % during this time.

- In SA, the energy sector (61 %) is the largest contributor in GHG emissions followed by agriculture (27 %), waste (7 %) and industry (4 %) sectors.
- Unlike developed countries, SA does not have the option to grow first and then to address CC, means region has to develop without increasing the pace of CC. It means, major shifts in life style and a transformation of how we produce and consume.
- **Energy:** Share of fossil fuel in energy increased from 54 to 71 % b/w 1990-2006. Sustainable development requires using power resources that pollute less such as gas as well as biomass, solar power, wind, hydro and geothermal and using energy efficiently. In India energy demand can reduce by 25 % in 2030 by improving the energy efficiency in buildings and appliances, industry, power distribution, agriculture and transportation.
- **Agri:** emissions from crop production, livestock, and land use and deforestation. SA accounts for 17 % of global agri. sector emissions. In future, increase agri Y due to growing demand for food and change in dietary patterns , GHG. Need for sustainable pattern of Y and C.
- **Waste management:** Recycling of solid waste is a sustainable solution, increase in E. 173,832 urban poor from the informal sector in Delhi, 120,000 in Dhaka, and 40,000 in Bangalore are involved in the recycling trade chains. In Bangladesh 800,000 of the 3.5 million potential jobs associated with environmental sustainability are in recycling

E. WAYS AND STRATEGIES TO ENSURE ECONOMIC GROWTH IN CITIES OF SOUTH ASIA IN A WAY TO ENSURE SUSTAINABLE HUMAN DEVELOPMENT?

1. Climate change adaptation and mitigation plans and policies
2. The way forward



1. CLIMATE CHANGE ADAPTATION AND MITIGATION PLANS AND POLICIES

- National level initiatives: NAPAs: Bangladesh in 2005, Afghanistan in 2009, Nepal in 2010, Bhutan in 2006, and the Maldives in 2008. problems of exclusion and narrow focus.
- NAMAs: Some developing countries agreed to implement NAMAs voluntarily to reduce GHG emissions. So far 55 developing countries including some South Asian countries (India, Bangladesh, Afghanistan, Bhutan and the Maldives) have worked on NAMAs + CDM
- Countries own national level adaptation and mitigation policies and plans: National Action Plan on Climate Change 2008 and National Water Mission 2009 in India, Climate Change Task Force 2008, Climate Change Policy 2011 and Sustainable Development Policy 2012 in Pakistan, Bangladesh Climate Change Strategy and Action Plan 2009
- Very comprehensive documents, but have not resulted in significant adaptation or mitigation practices so far. This is evident from an increase in the incidence and intensity of climate-related disasters in SA and a rising proportion of fossil fuels in total energy production.



Regional level initiatives:

- The melting of Himalayan glaciers, the frequency and intensity of extreme weather events, and increasing sea levels go beyond national boundaries. SA need to find coordinated regional solutions
- Three regional level plans: SAARC Action Plan on Climate Change 2009-11, Comprehensive Framework on Disaster Management 2006-15, and Thimpu Statement of Climate Change 2010.
- Four regional level institutions: SAARC Forestry Centre 2008 in Thimphu, Bhutan, SAARC Disaster Risk Management Centre 2006 in New Delhi, India, SAARC Coastal Zone Management Centre 2005 in Male, the Maldives, and SAARC Meteorological Research Centre 1995 in Dhaka, Bangladesh.



Global efforts:

- The UNFCCC was set up in 1992 at the Earth Summit in Rio and entered into force in 1994 (for coordinated, joint and effective actions). Twenty years later, Rio+20 was held as a follow up of the Earth Summit of 1992, to reaffirm the Rio Principles, and to come up with new action plans to address the crises emerging over the last 20 years.
- A number of initiatives have been taken recently to support climate change adaptation and mitigation efforts in developing countries including the formation of a Green Climate Fund (GCF), and developed countries announced US\$30 billion as fast start funds from 2010 to 2012 and US\$100 billion per year as long term finance by 2020. Also, it has been agreed in the Rio+20 that there will be a follow up process in finance. This issue was also discussed in the recent annual UN Conference, known as COP 2012. However, the conference faced criticism for the lack of funds for developing countries.
- An evaluation indicates that such initiatives have resulted in the provision of some resources, information and capacity building to developing countries. However, they still have to facilitate significant implementation, technology access, or the establishment of strong national institutions to carry out the climate change adaptation and mitigation agenda forward. The next COP and follow up of Rio+20 are expected to accelerate progress and deliver more concrete results.



2. *THE WAY FORWARD/ CONCLUSION*

- The region has a formidable and overbearing challenge to reduce poverty and deprivation and promote human development in the face of climate change.
- The region does not necessarily have to take climate change as a challenge, but rather as an opportunity to address issues of poverty, inequality, deprivation and underdevelopment which are inextricably linked to various aspects of climate change.
- The countries have to focus on inclusive and sustainable development. This will require both climate change adaptation and mitigation measures. For adaptation there is need to institutionalize good practices and incorporate them into sustainable development planning. For mitigation, the region has to follow a different growth path using energy efficient technologies, cleaner sources of energy, and reducing its carbon intensity of output. A coordinated regional level solution can benefit by improving energy efficiency, increasing economic growth, decreasing poverty and inequality, and reducing vulnerabilities of the poor.

