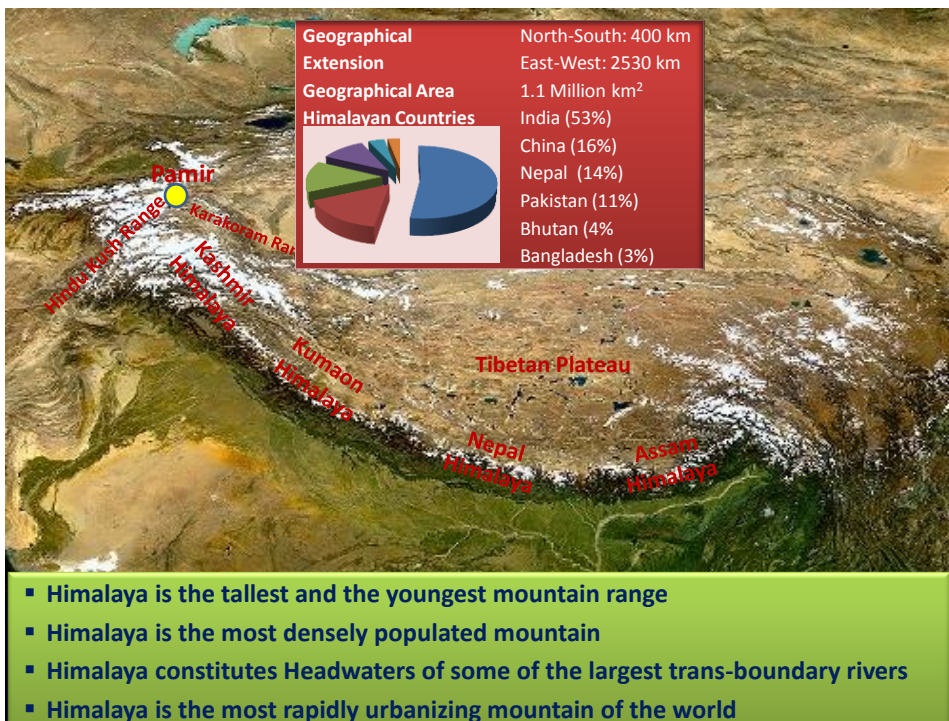


# Regional Headwater Governance in Himalaya for Water Security in South Asia Under Climate Change

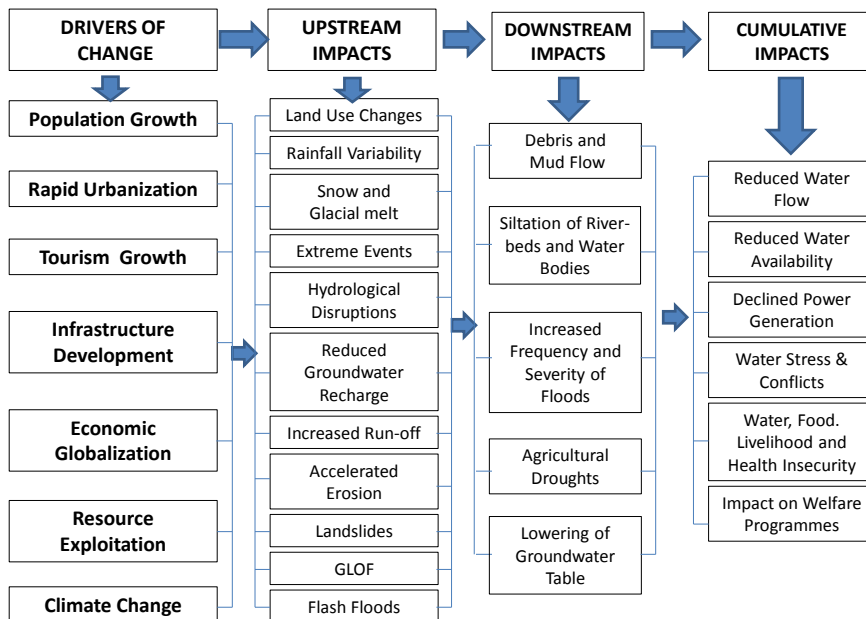
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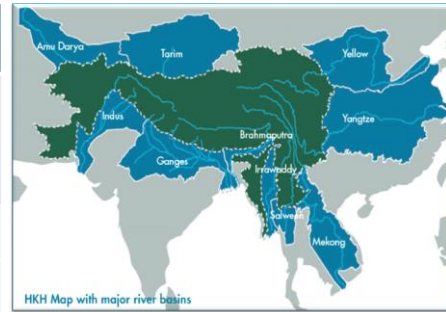
## Himalaya: The Most Vulnerable Mountain Ecosystem

Natural Vulnerability	Anthropogenic Vulnerability
<ul style="list-style-type: none"> <li>▪ High Altitude</li> <li>▪ Steep Slopes</li> <li>▪ Young Mountains</li> <li>▪ Geo-tectonically Alive</li> <li>▪ Climate Change</li> </ul>	<ul style="list-style-type: none"> <li>▪ Densely Populated</li> <li>▪ Livelihood Constraints</li> <li>▪ Subsistence Economy</li> <li>▪ Food and Livelihood Insecurity</li> <li>▪ Rural Outmigration</li> <li>▪ Marginalization - Underdevelopment</li> <li>▪ Globalization-Resource Exploitation</li> <li>▪ Rapid Urbanization</li> </ul>

## Upstream and Downstream Processes



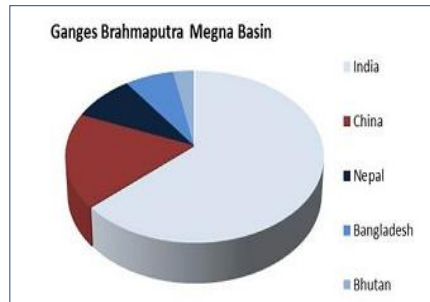
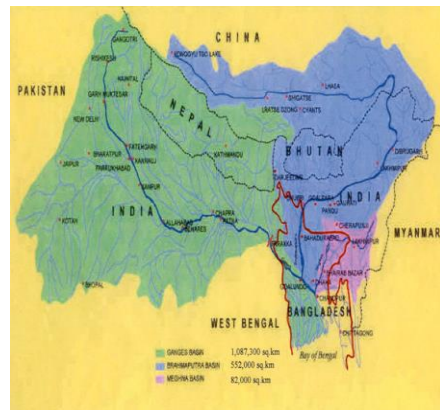
Hydrological Parameters of Principal Rivers of Hindu Kush Himalaya			
River Name	Length (km)	Mean Discharge (m <sup>3</sup> /s)	Glacier Melt in River Flow (%)
Yangtze	6,300	34,000	18.5
Brahmaputra	2,948	19,824	12.3
<b>Ganges</b>	<b>2,057</b>	<b>18,691</b>	<b>9.1</b>
Irrawaddy	2,170	13,565	Small
Mekong	4,600	11,048	6.6
<b>Indus</b>	<b>2,900</b>	<b>5,533</b>	<b>44.8</b>
Salween	2,800	1,494	8.8
Yellow	5,464	1,365	1.3
Tarim	2,030	146	40.2



Country	Basin	% of River Flow Originating Outside of Border
Afghanistan	Indus, Tarim	15.00
Bangladesh	Ganges-Brahmaputra, Meghna	91.00
Bhutan	Ganges-Brahmaputra, Meghna	00.40
China	Ganges-Brahmaputra, Meghna, Indus, Tarim	01.00
India	Ganges-Brahmaputra, Meghna, Indus	34.00
Myanmar	Ganges-Brahmaputra, Meghna	16.00
Nepal	Ganges-Brahmaputra, Meghna	06.00
Pakistan	Indus, Tarim	76.00

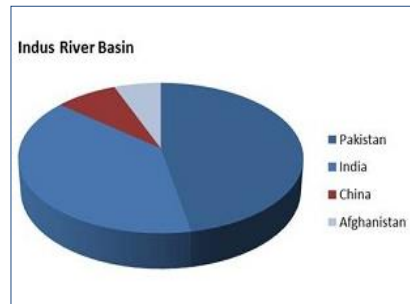
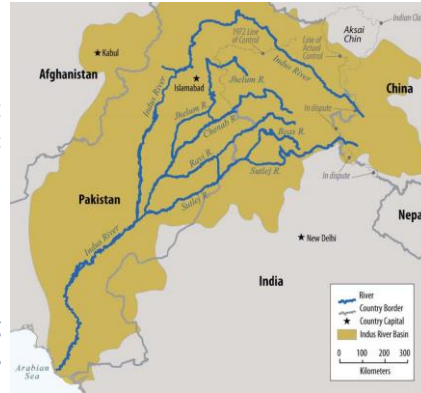
## Water Resource Stress

- South Asia being heavily populated is becoming a water-stressed region
- Water resource demand in India is expected to double and exceed 1.4 trillion m<sup>3</sup> by 2050
- Pakistan is facing the greatest water crunch with 1000 m<sup>3</sup>/person water supply
- Nepal and Bhutan are in better state but need improved management
- Bangladesh is subject to all kinds of downstream hydrological impacts



## What Are the Constraints?

- South Asia the most fragmented region characterized by political tensions, conflict and extreme political and economic imbalances increasing deficit of political trust
- Hydro-diplomacy in Bangladesh, India, Nepal and Pakistan has been freezing
- The tussle for water resources in among PINB is getting complicated with China's entry into the scene
- India is particularly involved in conflicts as it shares borders with all other countries
- India and Pakistan are facing internal security threats whereas some other countries have political instability
- This is complicating the hydro-politics and each country is viewing its water resources through 'Security Lens'



## The Existing Framework

- Sustainable Water Resources Development already endorsed by SAARC
- Indo-Pakistan Indus Treaty (1960): Both countries have differences over interpretation of treaty
- Indo-Nepal treaties regarding the Kosi (1954), Gandaki (1959), and Mahakali (1996)
- Indo-Bangladesh Ganges Treaty (1996): Sharing 54 trans-boundary rivers
- ICIMOD is promoting trans-boundary regional cooperation in Hindu Kush Himalayan countries through collaborative research



## New Opportunities for Regional Cooperation ?

- Climate change has provided great opportunity to foster regional cooperation as it is likely to modify the discharge, volume and availability water resources both in mountains and lowlands
- To water security as people of South Asia have access to less than 5% global freshwater resources, and climate change is likely to reduce availability water resources as not only glaciers are melting, but rain-fed water sources are also drying in up-streams
- To ensure food security, particularly to poor and marginalized as by 2080 food production may decline up-to 30% in South Asia due to climate change
- To ensure the availability of energy for meeting out the increasing demand of power in various sectors of fast growing economies
- To reduce the vulnerability of large population to the emerging risks of climate change induced natural disasters, particularly floods

### Potential Areas of Trans-boundary Cooperation in South Asia

Countries	Potential Fields of Cooperation	River Basin
Pakistan, Nepal and India	<ul style="list-style-type: none"> <li>▪ Construction of storage</li> <li>▪ Reservoirs</li> <li>▪ Flood mitigation</li> <li>▪ Irrigation</li> <li>▪ Hydro-power generation</li> </ul>	Indus, Ganges and its tributaries
Bhutan and India	<ul style="list-style-type: none"> <li>▪ Construction of storage</li> <li>▪ Reservoirs</li> <li>▪ Flood mitigation</li> <li>▪ Hydro-power generation</li> </ul>	Mahananda, Tista and their tributaries.
India and Bangladesh	<ul style="list-style-type: none"> <li>▪ Construction of storage</li> <li>▪ reservoirs</li> <li>▪ Flood mitigation</li> <li>▪ Hydro-power generation</li> <li>▪ Irrigation</li> <li>▪ Inter-basin transfer</li> <li>▪ Guaranteed minimum flow</li> </ul>	Ganges, the Brahmaputra, the Meghana and all their tributaries

## Way Forward: Regional River Basin Management Framework

