SECURITY IMPLICATIONS OF CLIMATE CHANGE

Water Stress, Security and Migration in South Asia

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Possible adverse effects of climate change may, in the long run, aggravate certain existing threats to international peace and security.

--UN Security Council, 20 July 2011

Climate change is an "unholy brew" that could create dangerous security vacuums …we must make no mistake to address a clear danger that not only exacerbates threats to international peace and security rather itself is a threat to international peace and security–

-- Ban Ki-moon, UN Secretary General

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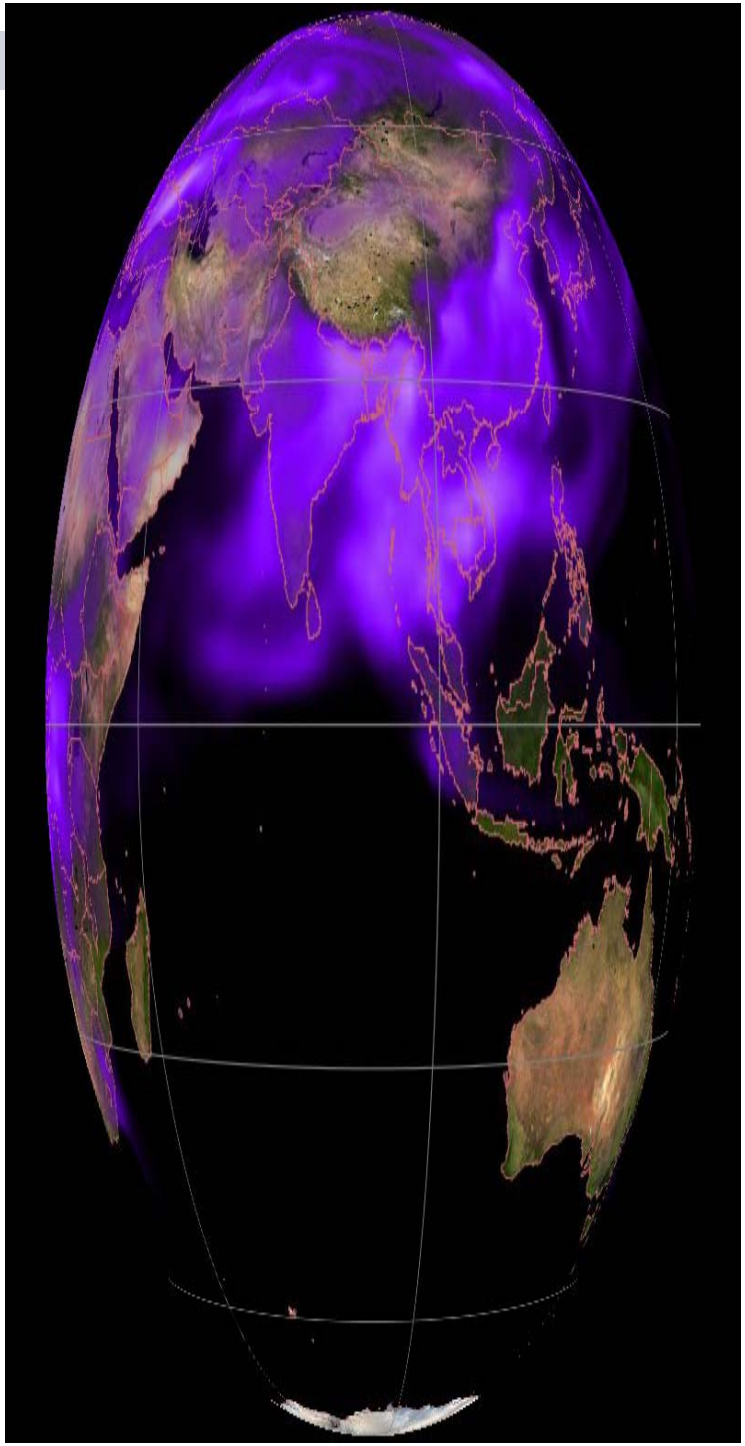
Focus of Presentation

- Introduction
- Climate Change Scenario
- Threat Landscape
- Water Stress and Implications for South Asia
- Displacement and Transboundary Migration in South Asia
- Measures to take?
- Conclusion



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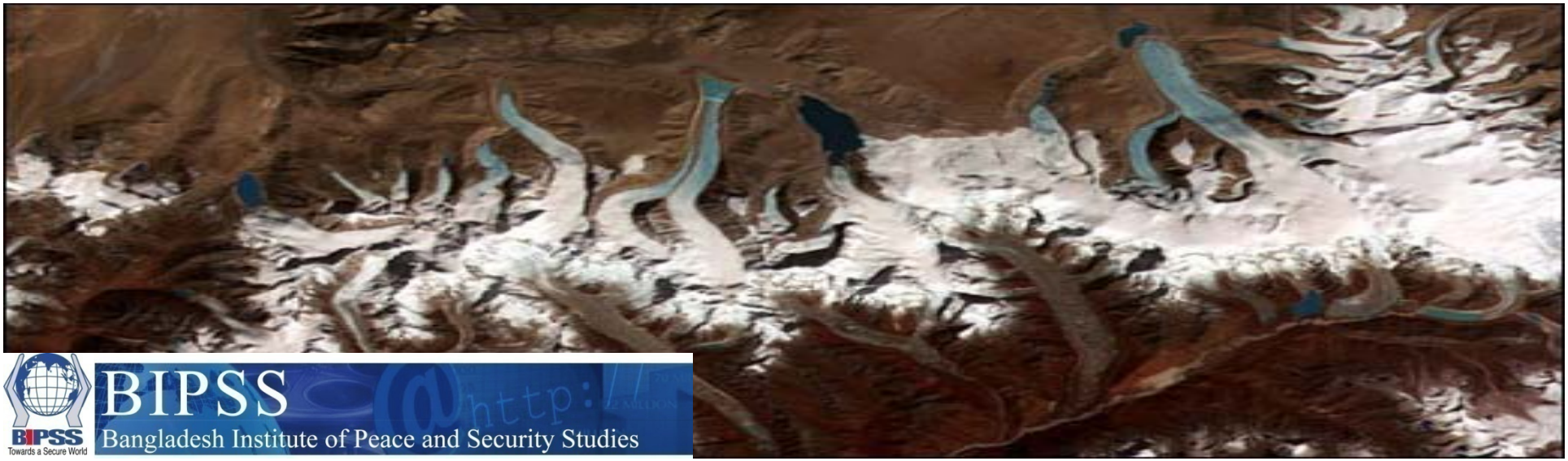
Introduction

- Climate change has appeared as one of the greatest challenges to national and international security.
- Global warming is predicted to increase the frequency and intensity of various natural disasters i.e. tropical storms, flash floods, landslides etc. which can jeopardise the security of the individual and the state to a great extent.



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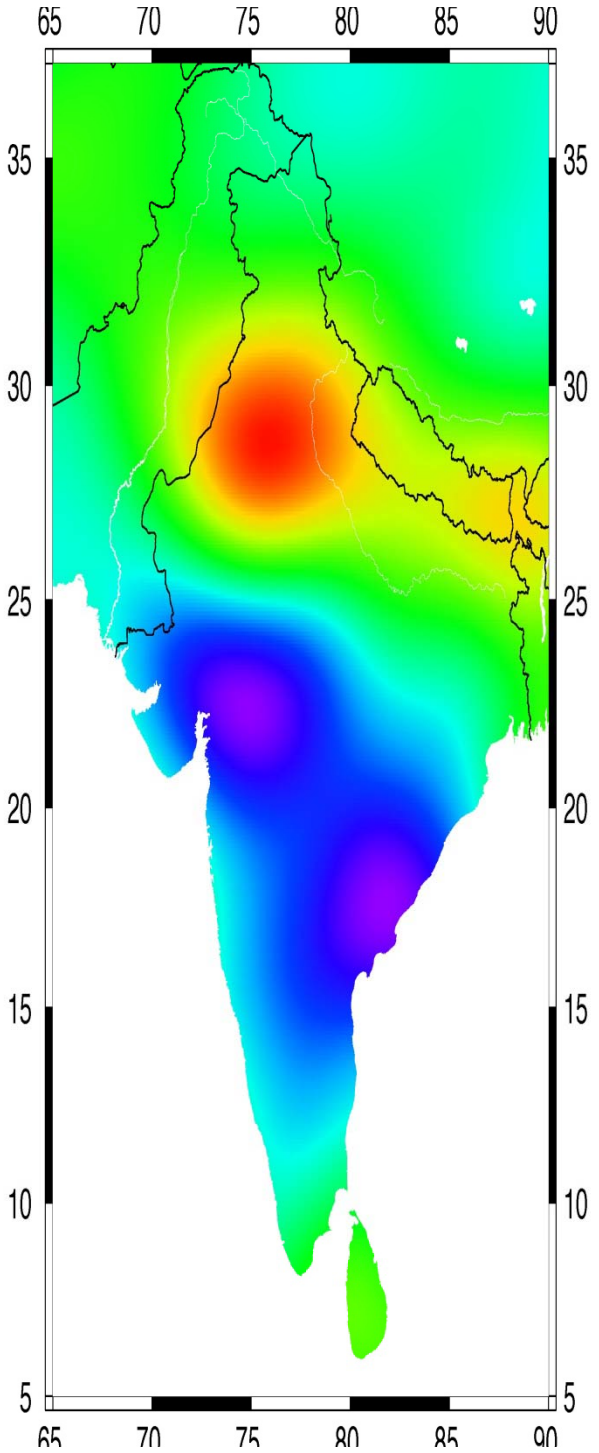
Introduction (contd.)

- In South Asia, being the most crisis-ridden in the world, climate change will induce water crisis and large-scale migration and thereby reinforce present trends of instability and conflict while at the same time draw new lines of conflict within and between states.
- Disastrous impact of climate change requires joint effort to abate the vulnerability of the region to climate change.

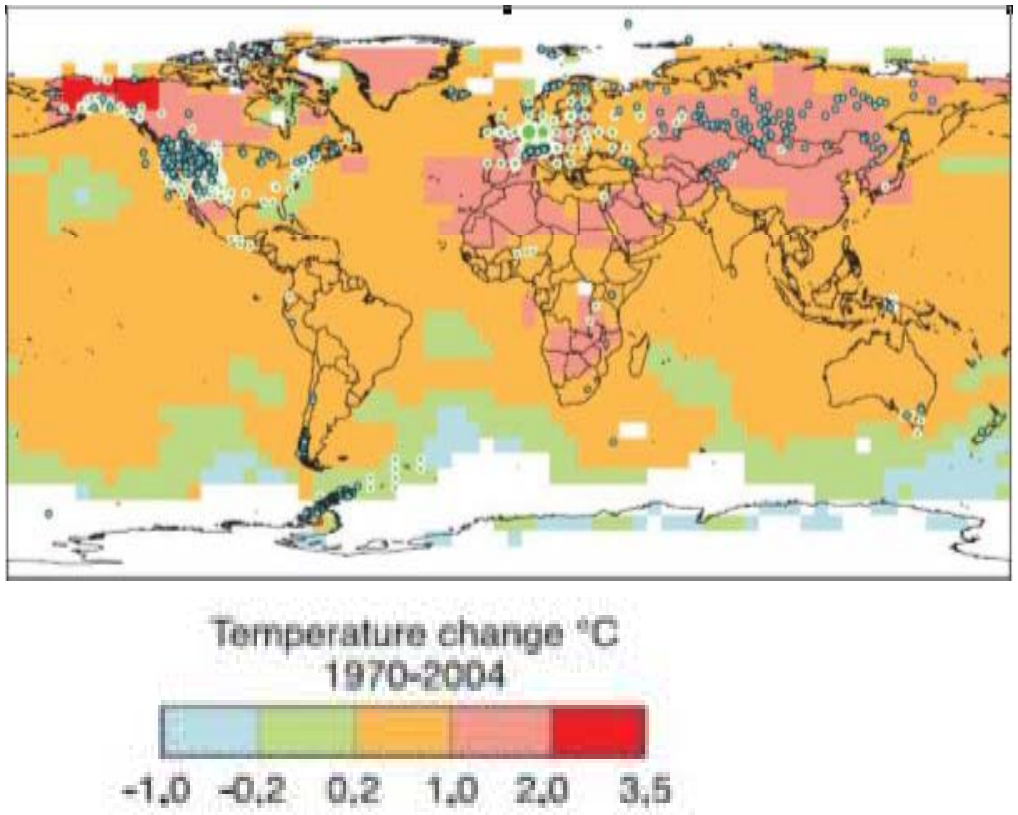


Climate Change Scenario

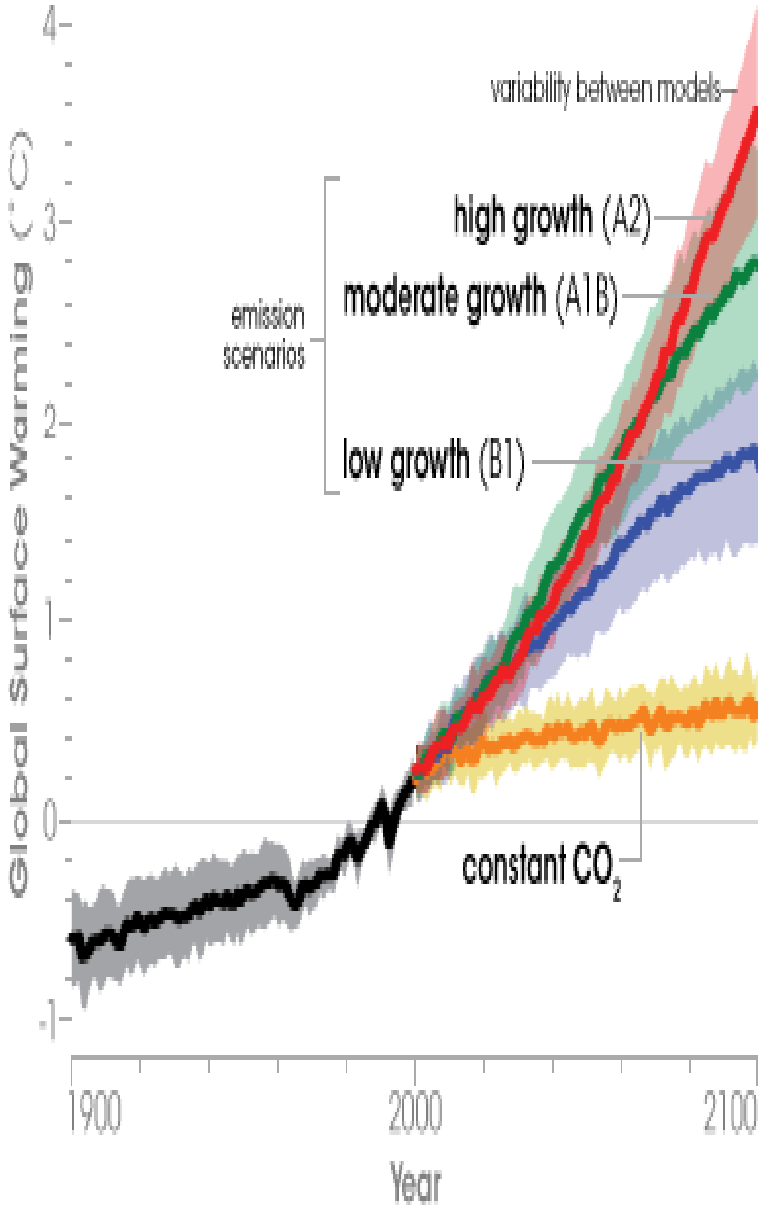
- Long-term changes in climate observed:
  - arctic temperatures and ice
  - precipitation amounts
  - ocean salinity
  - wind patterns and
  - aspects of extreme weather including droughts, heat waves and
  - the intensity of tropical cyclones

Current Scenario, (contd.)

- The 2007 IPCC report predicts temperature rise of 1.1 - 6.4 °C (2 - 11.5 °F) by 2100.



IPCC Warming Projections



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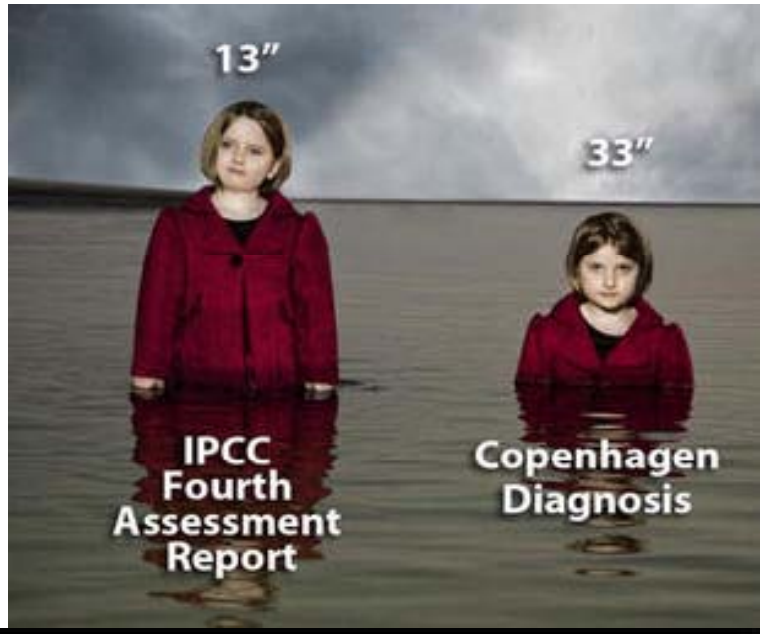
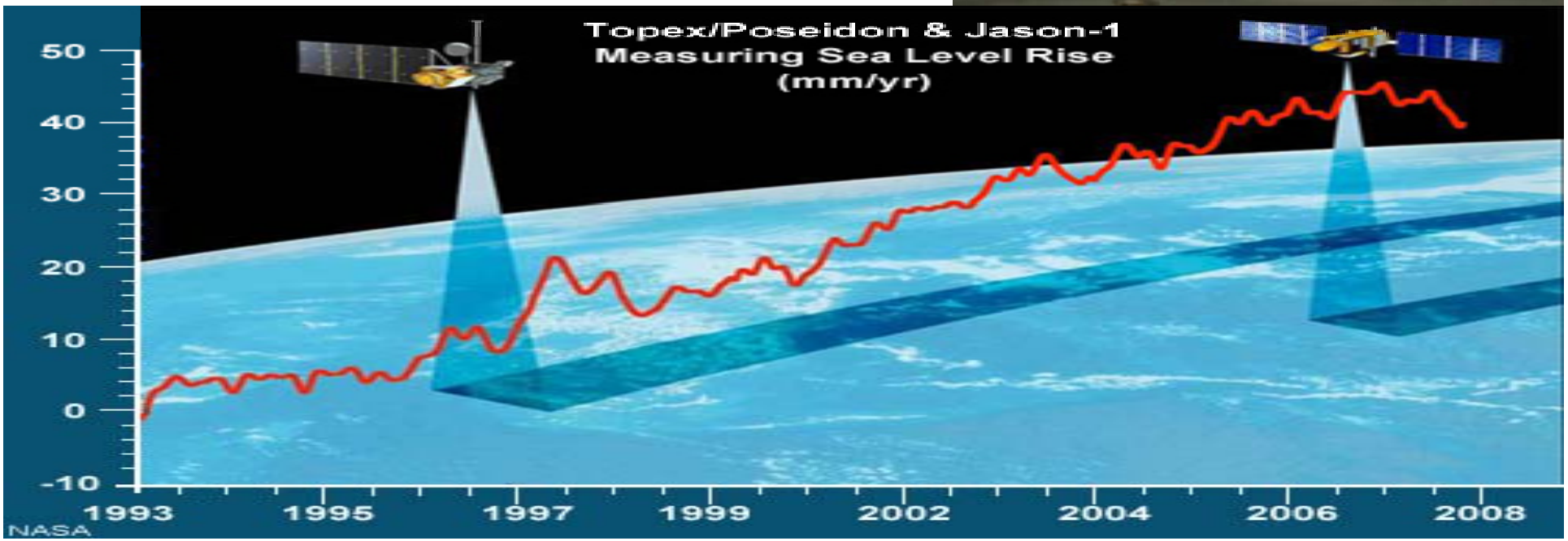
Significant Sea level rise by 2100 is predicted by IPCC.



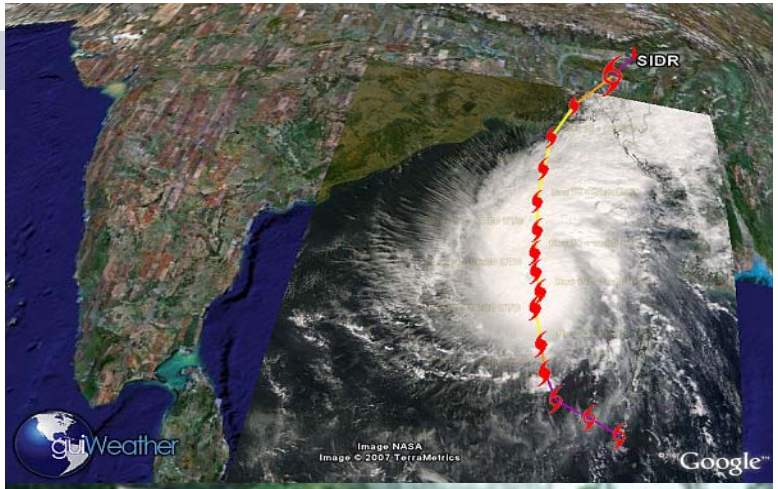


Current Scenario(contd.)

- **The number of natural disasters in the world may double during the next 10 to 15 years. (Source: WWF)**

- **3,852 disasters killed more than 780,000 people over the past ten years, affected more than two billion others and cost a minimum of 960 billion US$.**

  (Source: figures released by CRED in Geneva)



Threat Landscape

Mainly two dimension:

- Human Security
- Hard Security

Dimensions of Human Security

- Water Security
- Food Security
- Livelihood Security
- Health Security
- Disaster security.
- Energy security

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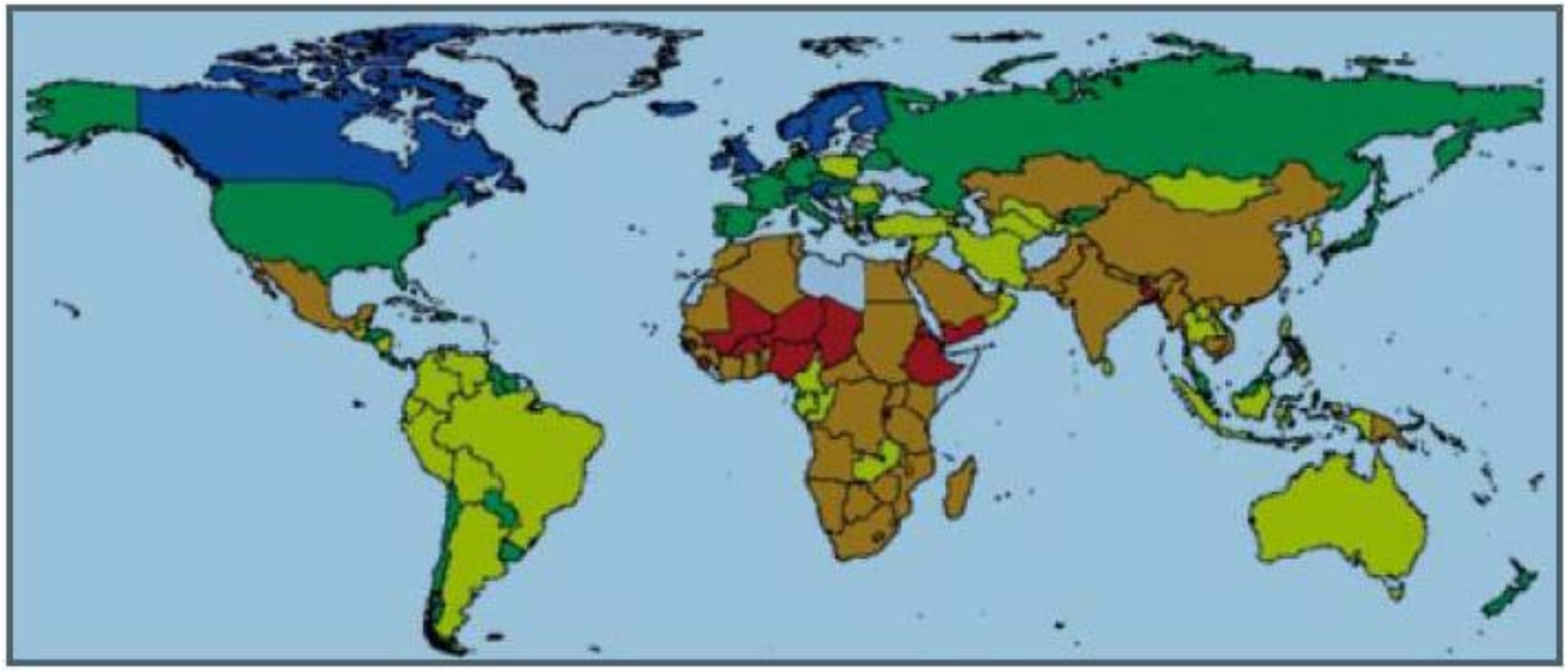
Water Security

- Climate change exacerbates water quality and availability in regions with water scarcity: Africa, South Asia, Southwest Asia, the Middle East and the Mediterranean.
- Currently 1.1 thousand million people are without access to safe drinking water.
- More than 3.5 million people die each year from water-related disease; 84 percent are children. Nearly all deaths, 98 percent, in the developing world. (Source: IPCC 4th Ass on climate change in Asia)
- Freshwater availability in Central, South, East and South-East Asia is likely to decrease that could adversely affect more than a billion people in Asia by the 2050. (Source: IPCC 4th Ass on climate change in Asia)

Areas Vulnerable to Climate Related Water Challenges



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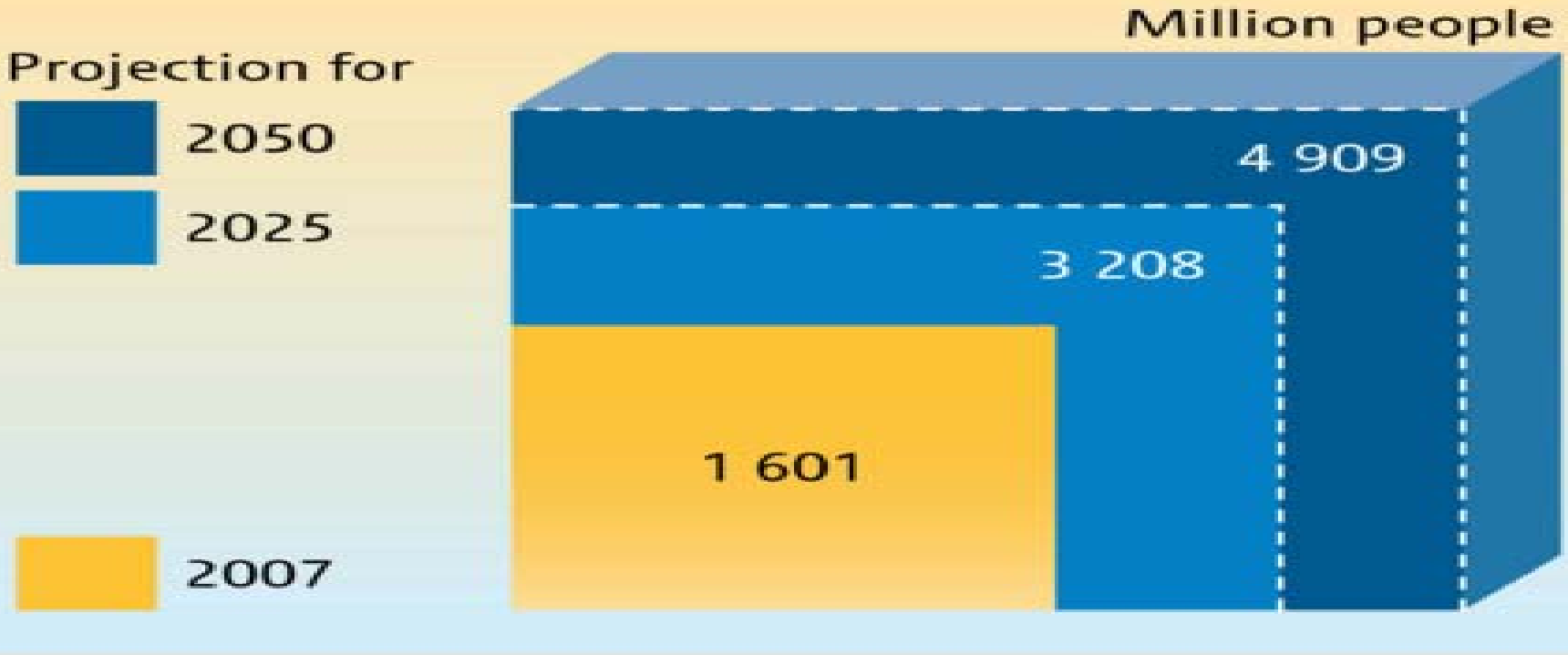
World population living in river basins with severe water stress



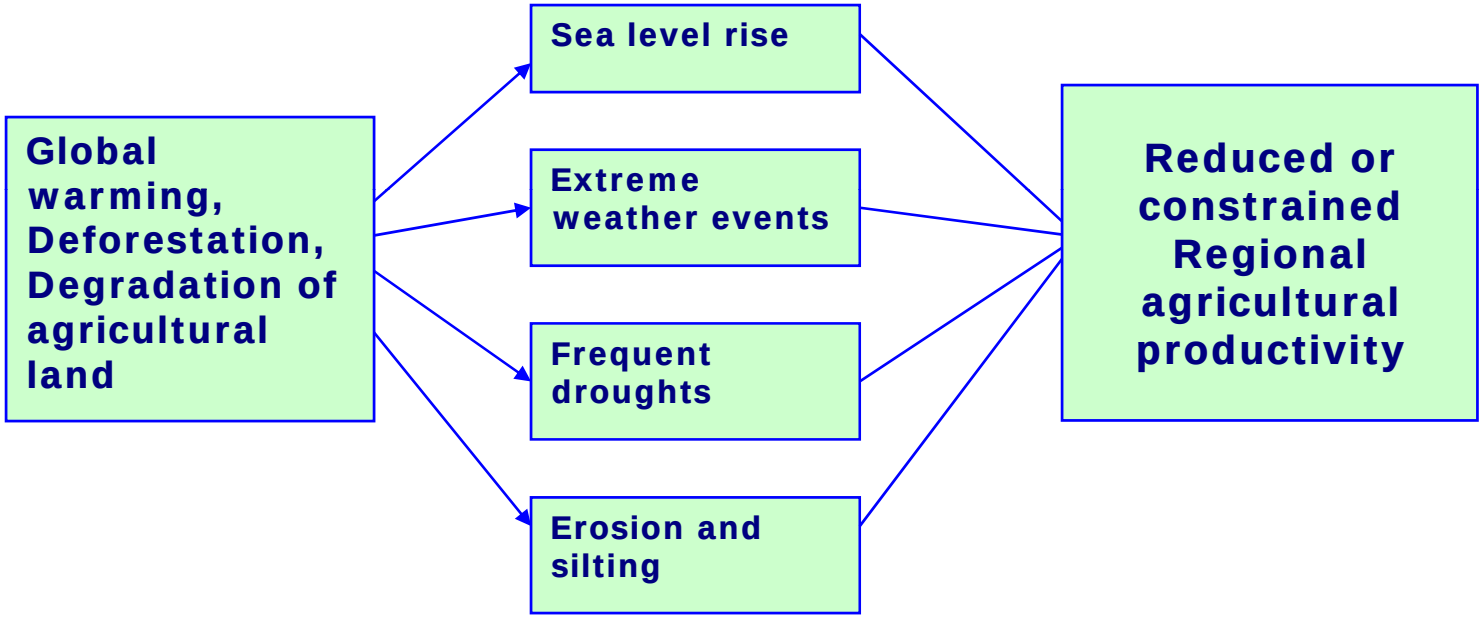
Water availability below 1 000 m3 per capita per year was regarded as an indicator of water stress.
Projections for 2025 and 2050 are computed considering socio-economic and climatic driving forces from the B2 scenario of the IPCC.

Source: Joseph Alcamo, *et al*, Future Long-term changes in global water resources driven by socio-economic and climatic changes, Hydrological Sciences Journal, 52(2), April 2007.

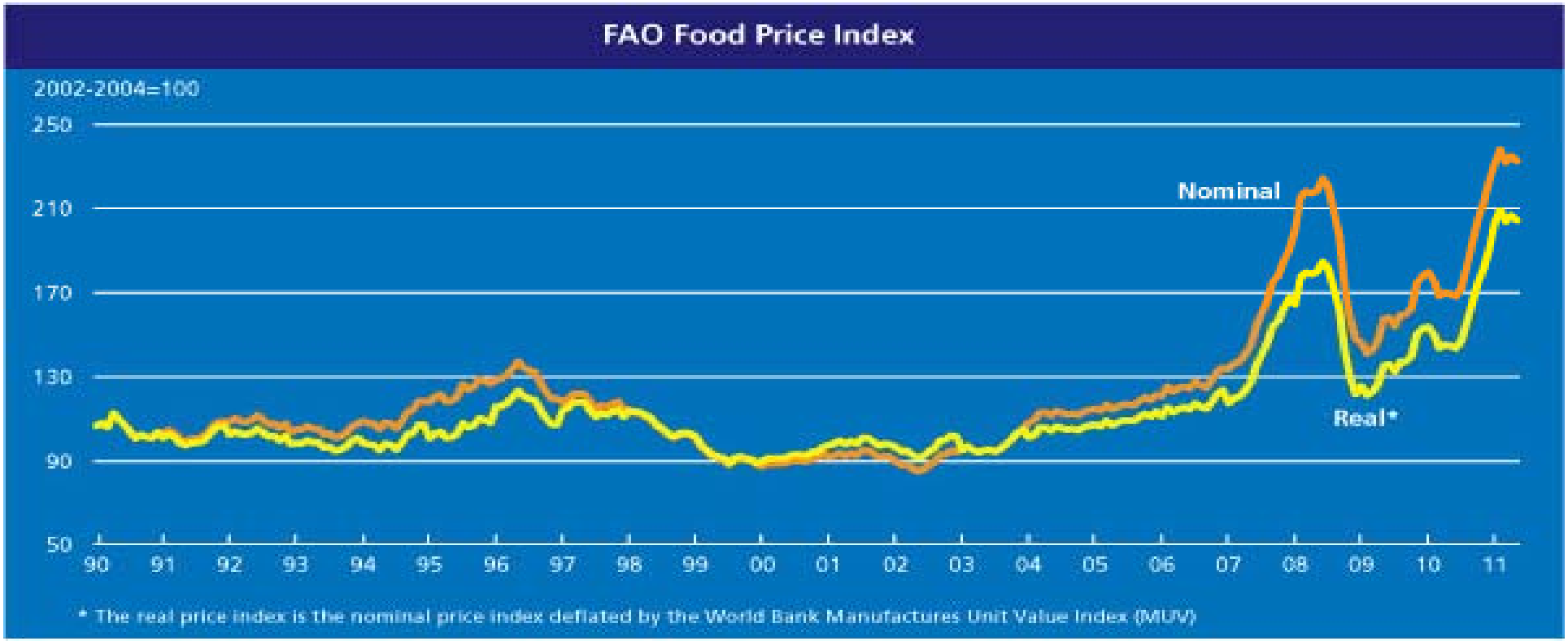
Food Security

- Reduced agricultural productivity is potentially the most worrisome consequence of climate change.
- If global warming rises to 3^0 C it is likely that the number of people suffering from hunger will increase by 250 million to 550 million. (Stern 2006:72)
- The combination of various climate change impacts will overstretch adaptive capacities in agricultural production. (IPCC, 2007)
- According to German Advisory Council on Global Change, agricultural production from rain-fed agriculture could fall by about 50% in some regions by 2020 (WBGU 2007)

Possible Effects of Environmental Change on Agricultural Productivity

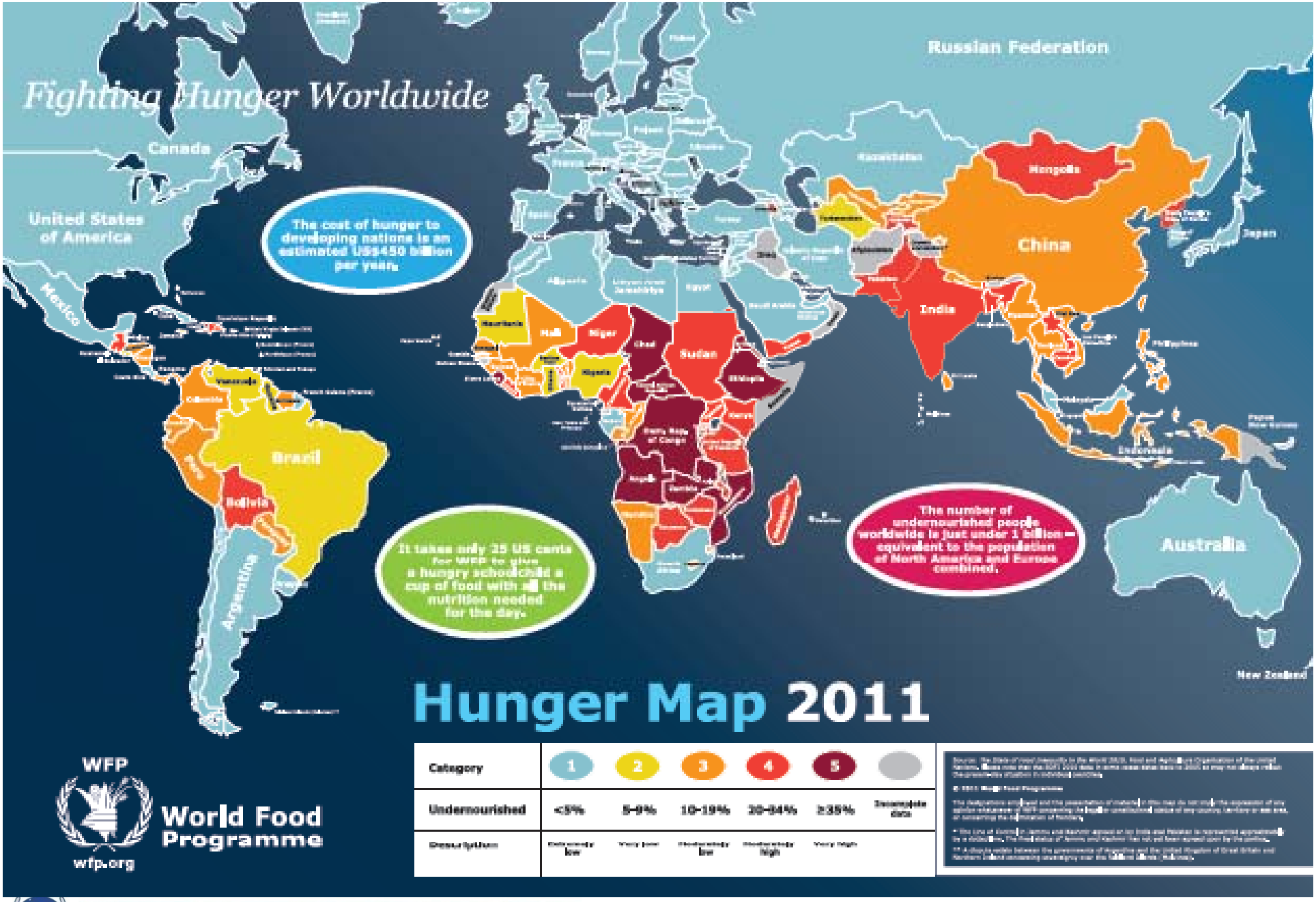


Rising Food Price



It has been estimated that rising food prices could potentially push 100 million people back into poverty
(Source: SA Forum on Food Insecurity, 2008)

Source : FAO



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Source : WFO

Health Security

- Every year the health of 235 million people is likely to be seriously affected by gradual environmental degradation due to climate change.
- Climate change is projected to cause over 150,000 deaths annually and almost 45 million people are estimated to be malnourished because of climate change.
- Climate change-related diarrhoea incidences are projected to amount to over 180 million cases annually, resulting in almost 95,000 fatalities.

Source: http://www.eird.org/publications/humanimpactreport.pdf

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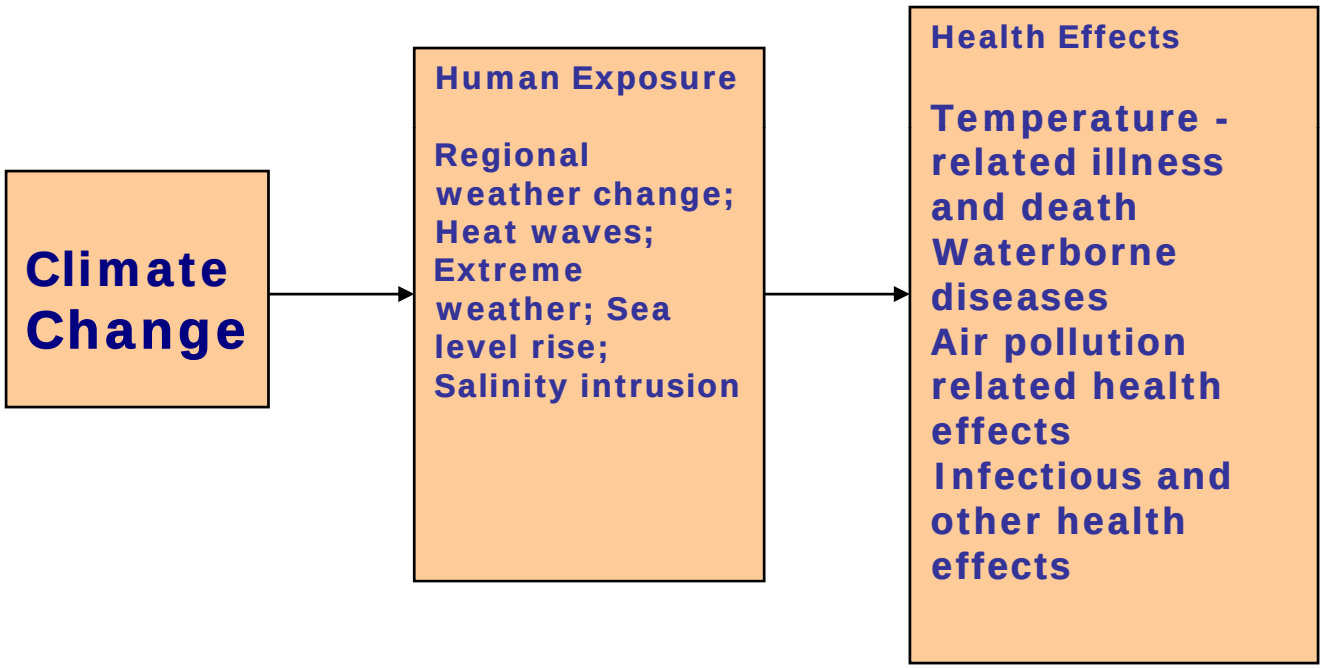
Impact of Climate Change on Human Health



Disaster Security

- Climate change and variability are factors which influence trends- frequency and intensity of disasters.
- In recent years, unprecedented floods: Africa's worst floods in three decades, unprecedented flooding in Mexico, massive floods in South Asia and heat waves and forest fires in Europe, Australia, and California.
- According to Oxfam estimate developing countries will require at least US$50bn annually to adapt to unavoidable climate change.

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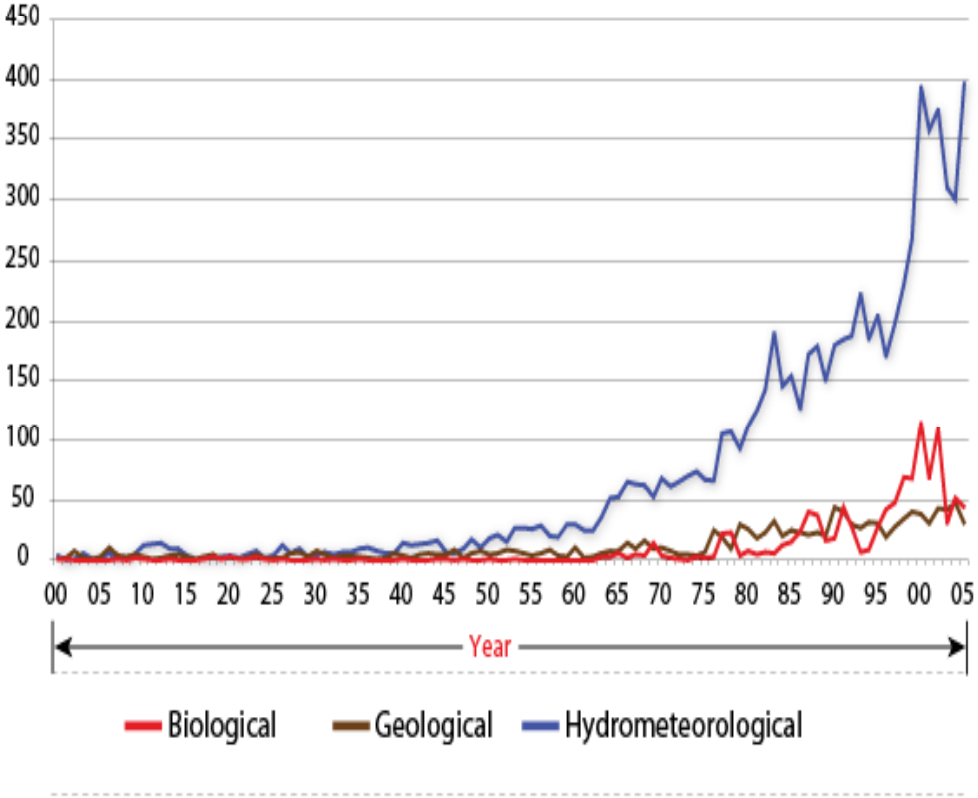
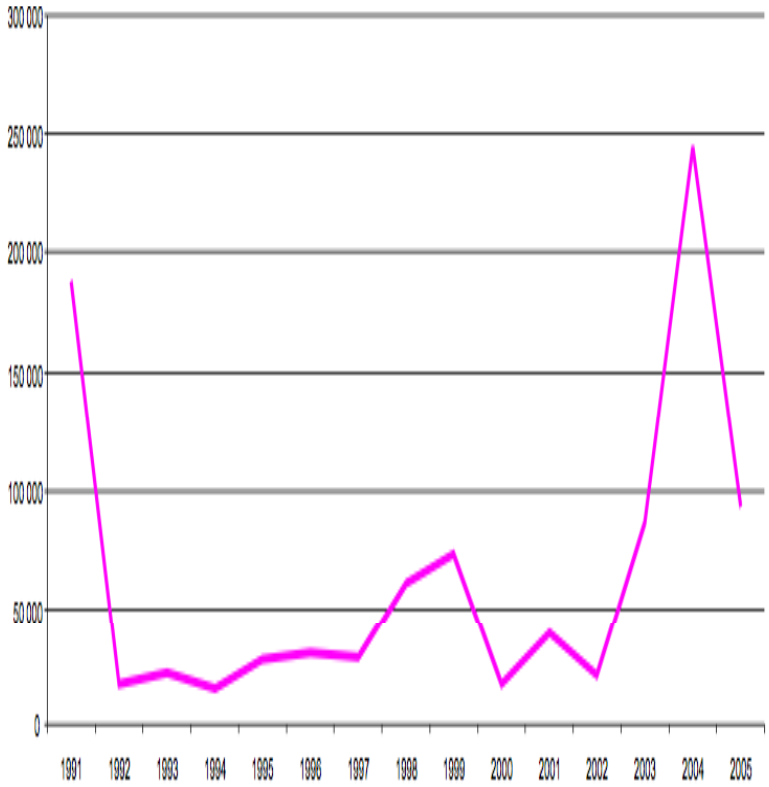
Number of natural disasters registered in EMDAT

Across the years 1900-2005



Source of data: EM-DAT : The OFDA/CRED International Disaster Database.
Http: //www.em-dat.net, UCL - Brussels, Belgium

Number of people reported killed by natural disasters
1991-2005



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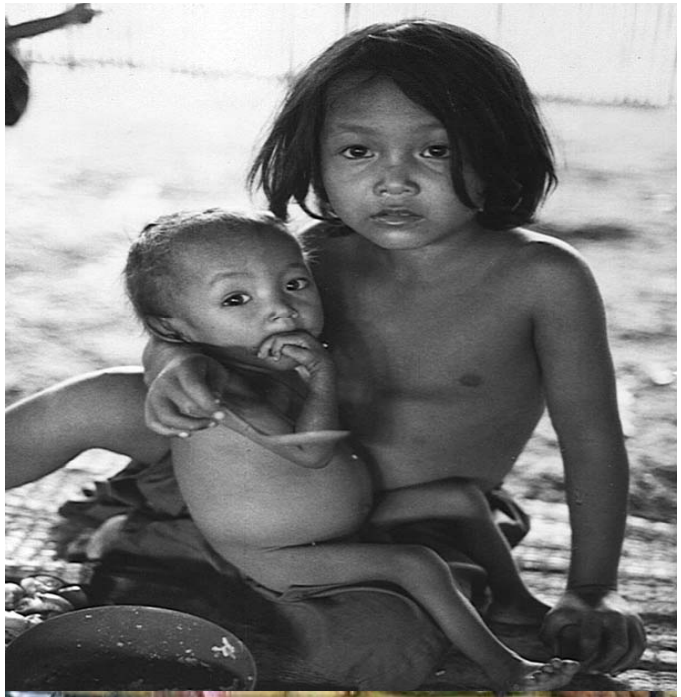
Energy Security

- The impacts of climate change may damage key infrastructures, such as energy, plants, supply pipelines, and consequently destabilise public order.
- Recent earthquake in Japan caused explosion in the Fukushima nuclear plant, for instance, causing human casualties and disruption to energy production.
- The decline in hydroelectric power generation may additionally reinforce competition/conflicts over fossil energy sources.

Climate Change and Migration

- Climate change could potentially trigger large-scale displacement and migration from one region to other in search of new avenues for employment and/or settlement.
- It is estimated that by 2050, 150 million people could be displaced by climate change related phenomenon like desertification, increasing water scarcity, floods and storm etc. (IPCC Ass. Report).
- Loss of livelihoods will trigger IDPs in vulnerable regions.



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- The 2001 World Disasters Report of the Red Cross estimated of 25 million current “environmental refugees”.
- UN University’s Institute for Environment and Human Security estimates the rise of environmental refugees up to 50 million.
- It is estimated that by 2050, 150 million people could be displaced by desertification, increasing water scarcity, floods and storm etc. (IPCC Ass. Report)

Hard Security

- Socio-political and economic unrest.
- Radicalisation and terrorism
- Resource conflict
- Inter and/or Intra-state conflict potentials.
- State collapse.
- Regional conflicts.

Radicalisation and Terrorism

- Radicalisation and terrorism may increase in many developing societies due to the consequent migration from climate induced social and economic deprivation.
- When a government can no longer deliver services to its people, conditions are ripe for the extremists and terrorists to fill the vacuum.
- The Rohingyas of Myanmar is a very relevant example of how marginalized people get involved in radicalisation and subsequently to terrorism.

Conflict over Resources

- Resource scarcity has the potential to be a contributing factor to conflict and instability.
- The 1994 genocide in Rwanda was furthered by violence over agricultural resources.
- The 1974 Nigerian coup that resulted largely from an insufficient response to famine.
- Situation in Darfur, Sudan, which had land resources at its root and which is increasingly spilling over into neighboring Chad.
- In the late 1990s conflict took place over timber resources in Liberia.

(Source: CNA Report, 2009)

Challenges of Environmental Scarcity

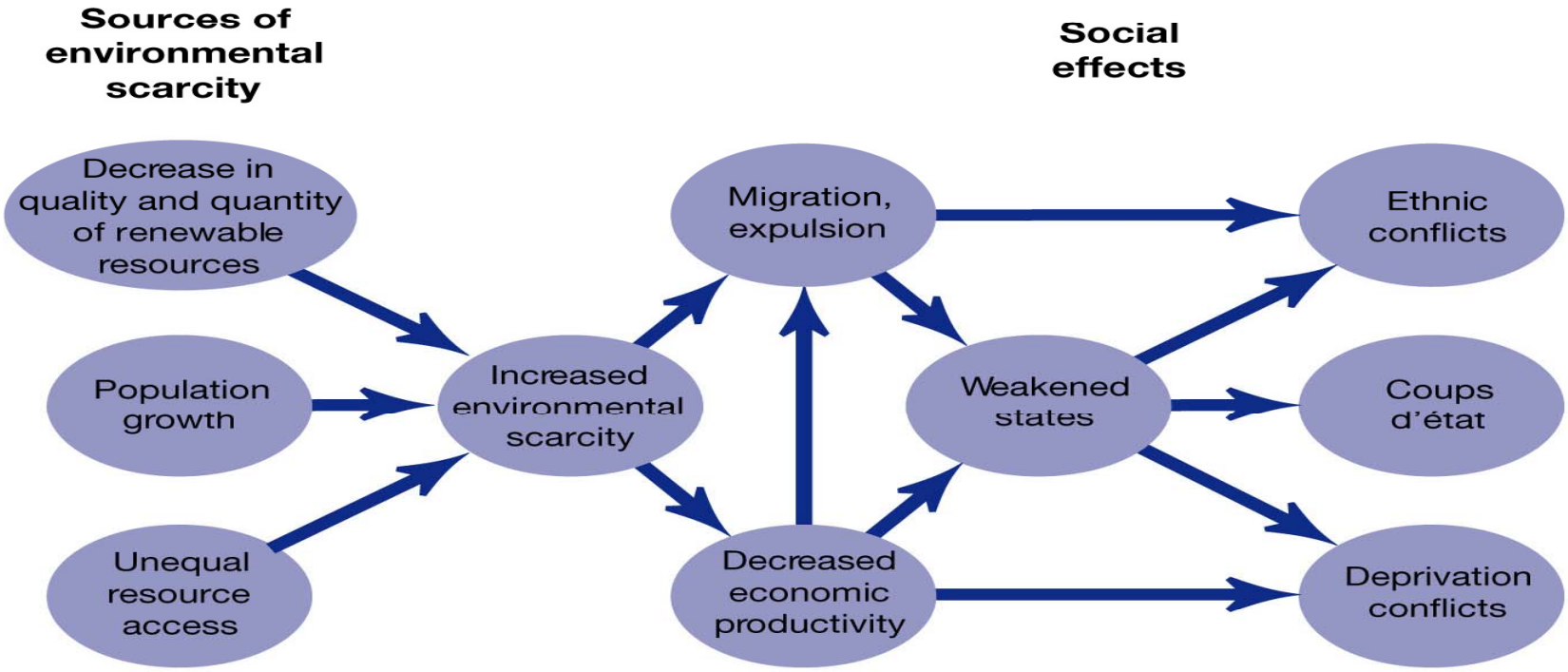


FIGURE 10.3 Some Sources and Consequences of Environmental Scarcity

Inter-state Conflict

- Bilateral Disputes
- Rising tension
- Localised war
- Inter-state conflict/war

"For centuries, wars have been fought for territorial expansion, ideological or religious dominance, and national pride. In the future, as climate change progresses and its effects become more pronounced, conflicts between states over natural resources could increasingly take centre-stage."

Byers & Dragoilovic, Human Security Bulletin, October 2004

Intra-state Conflict

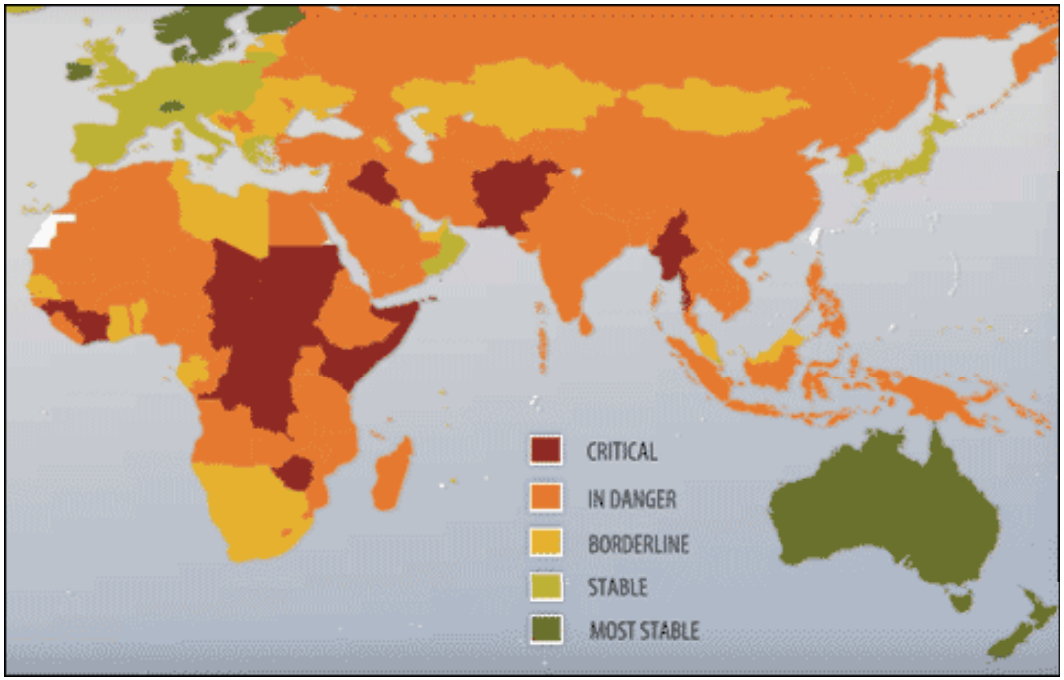
- Ethnic conflict
- Civil strife
- Terrorism
- Social Fragmentation

State Collapse

"*When climate change significantly or environmental conditions deteriorate to the point that necessary resources are not available, societies can become stressed sometimes to the point of collapse*"

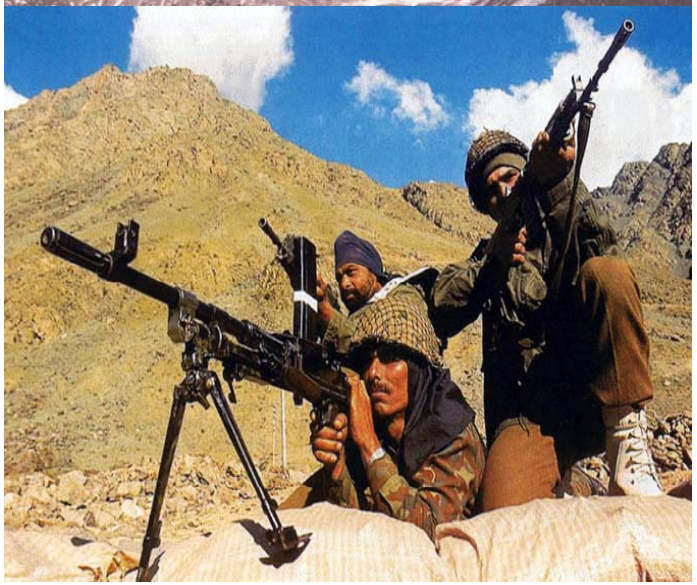
CNA Report on the National Security and the Threat of Climate Change

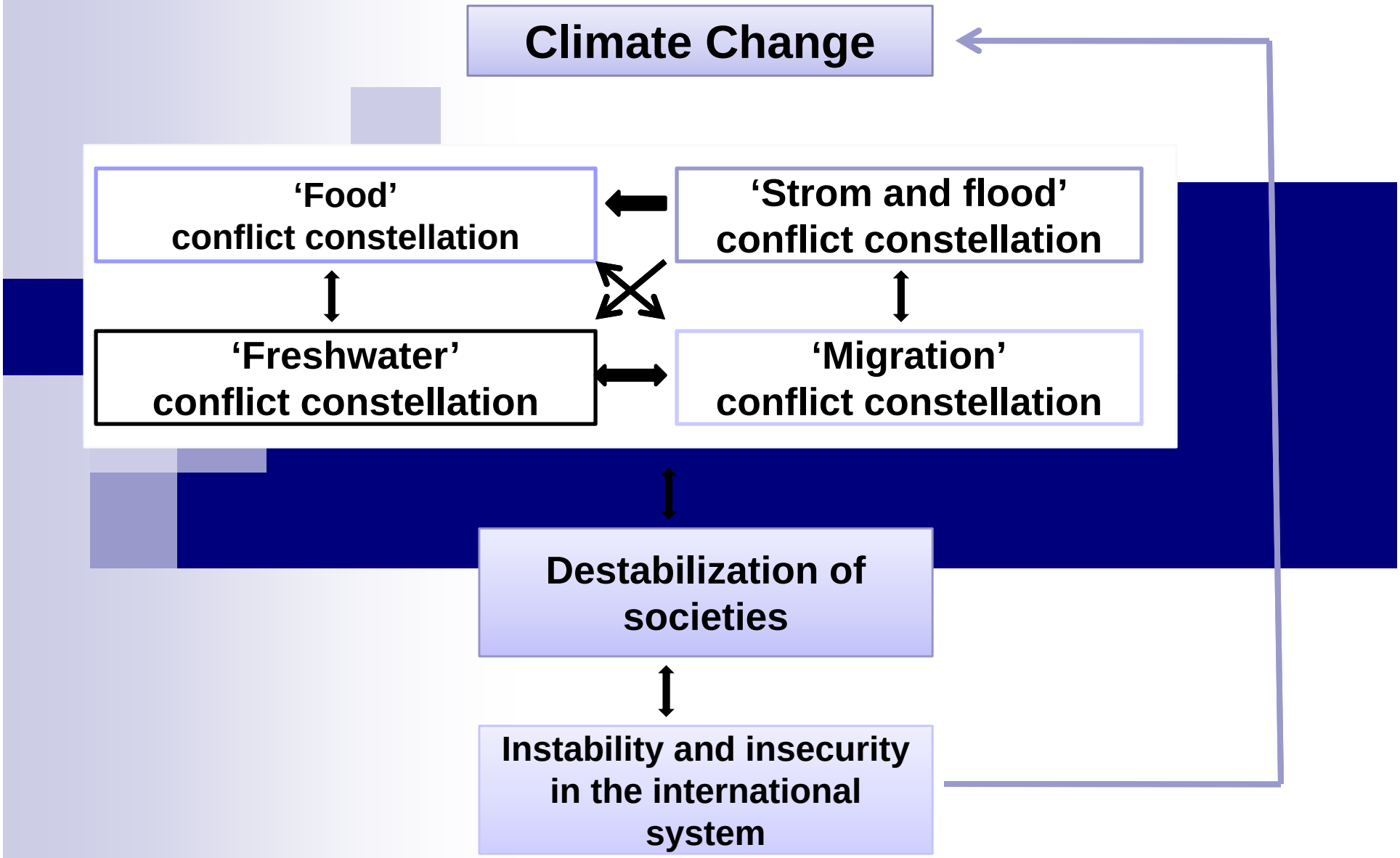
- **Vulnerable state**
- **Weak state**
- **Fragile state**
- **Failed state**
- **Non-state**



Regional Destabilisation

- Climate change acts as a threat multiplier for instability in some of the most volatile regions including South Asia.
- Projected climate change will seriously exacerbate already marginal living standards in many Asian, African, and Middle Eastern nations, causing widespread political instability and the likelihood of failed state.





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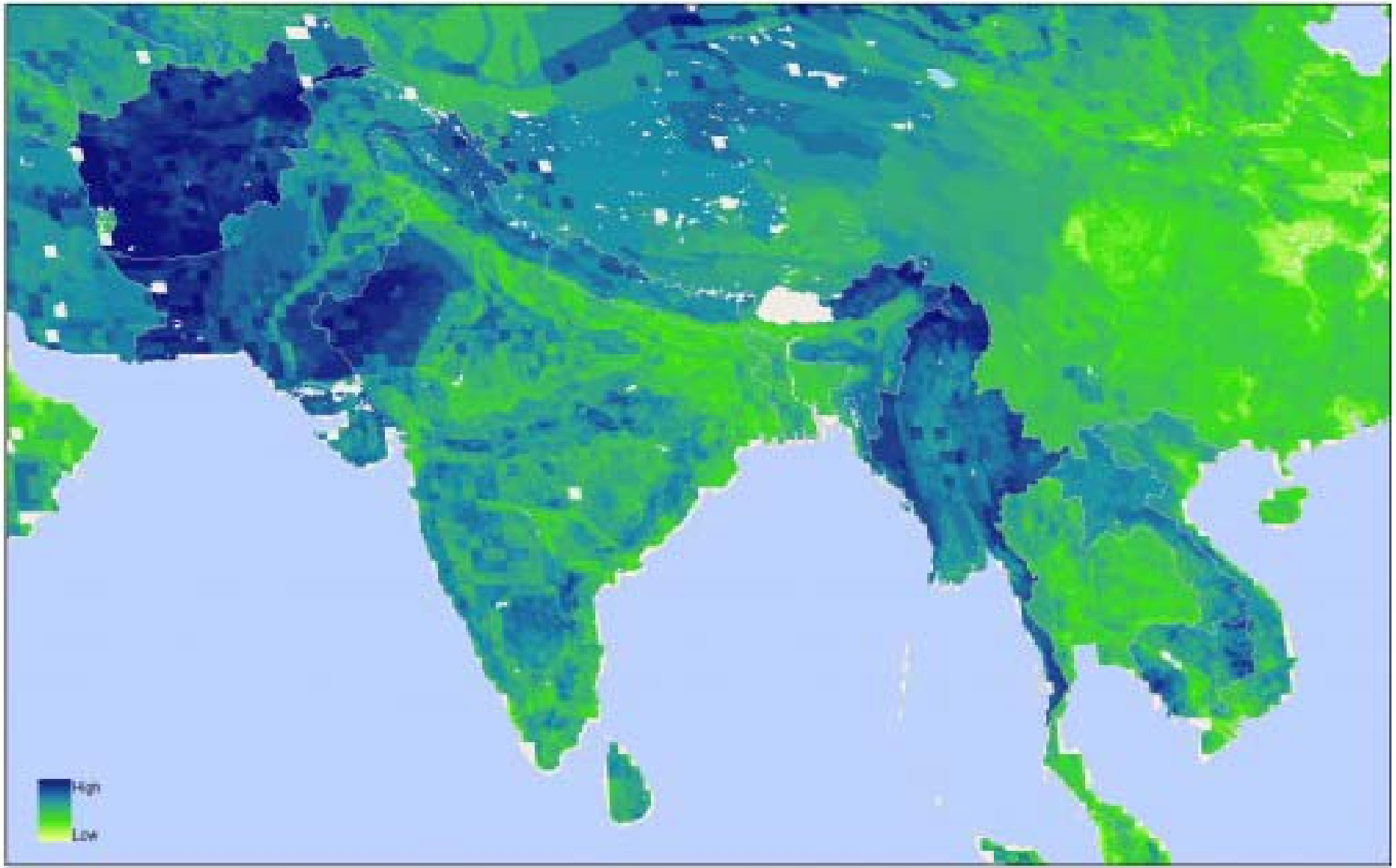
Climate Change as drivers of international destabilization

Water Stress in South Asia



Human Implications of Climate Change: Vulnerability of South Asia

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Water Stress- Impact on South Asia

- Decreased water availability and water quality in many arid and semiarid regions.
- An increased risk of floods and droughts in many regions
- Reduction in water regulation in mountain habitats
- Increased incidence of waterborne diseases such as malaria, dengue, and cholera.
- Decreased agricultural productivity
- Adverse impacts on fisheries
- Adverse effects on many ecological systems
- Decreases in reliability of hydropower and biomass production
- Increased damages and deaths caused by extreme weather events

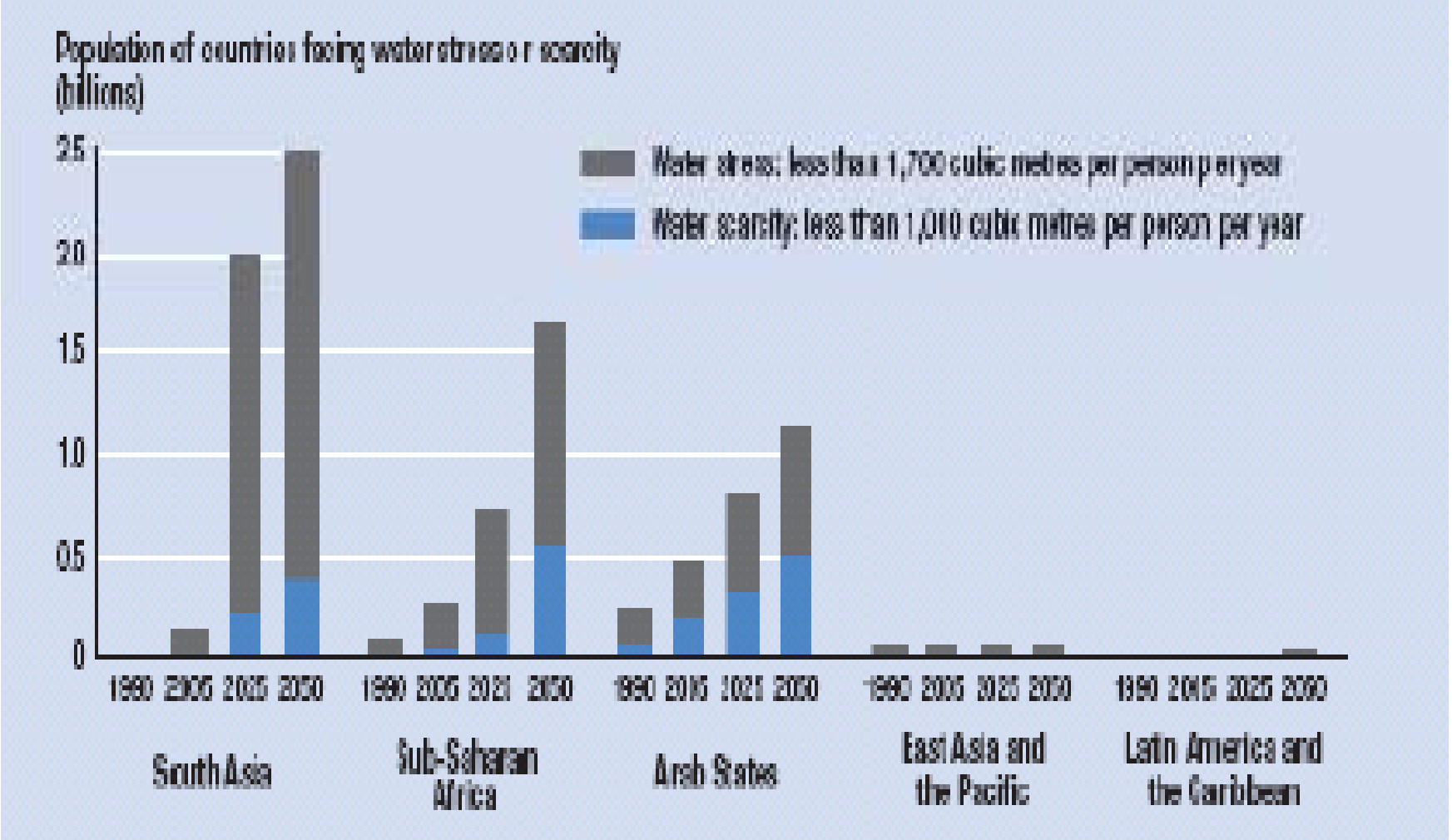
(Contd.)

- Water availability on per capita cubic metre basis in the Himalayan River Basins is likely to decline from 7320 to 5700 in case of Bangladesh in 2030, from 8500 to 5500 in case of Nepal and from 1730 to 1240 in case of India.

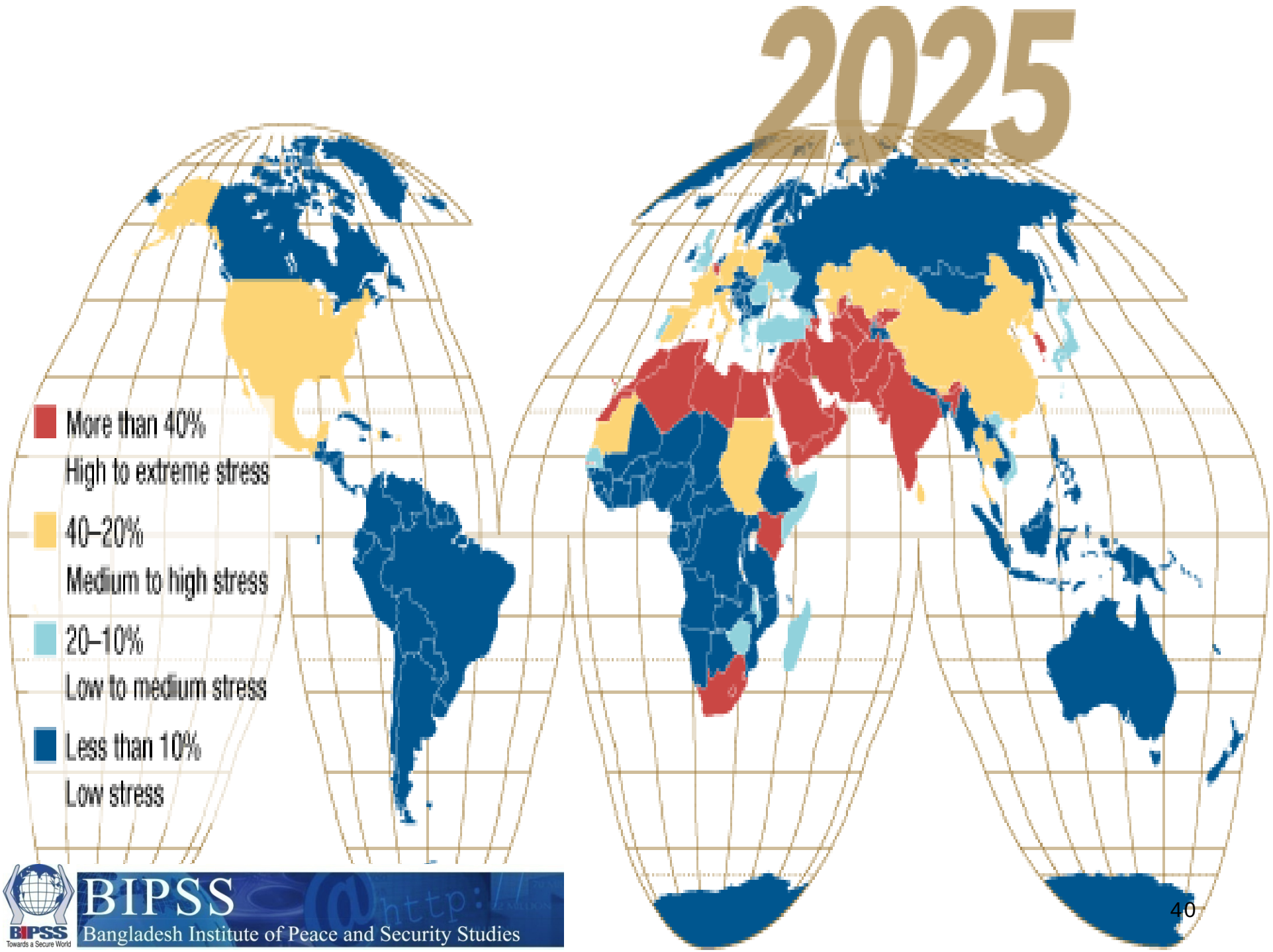
-Report of the Himalayan Challenge: Water Security in Emerging Asia

- The report assessed implications of the likely decline 275 Billion Cubic Meters (BCM) renewable fresh water in the four countries by 2030 for food security, health, migration, bio-diversity, social stability and interstate relations in the region.

Projected Stress in Water Availability (2025-2050)



Source: HDR, 2006



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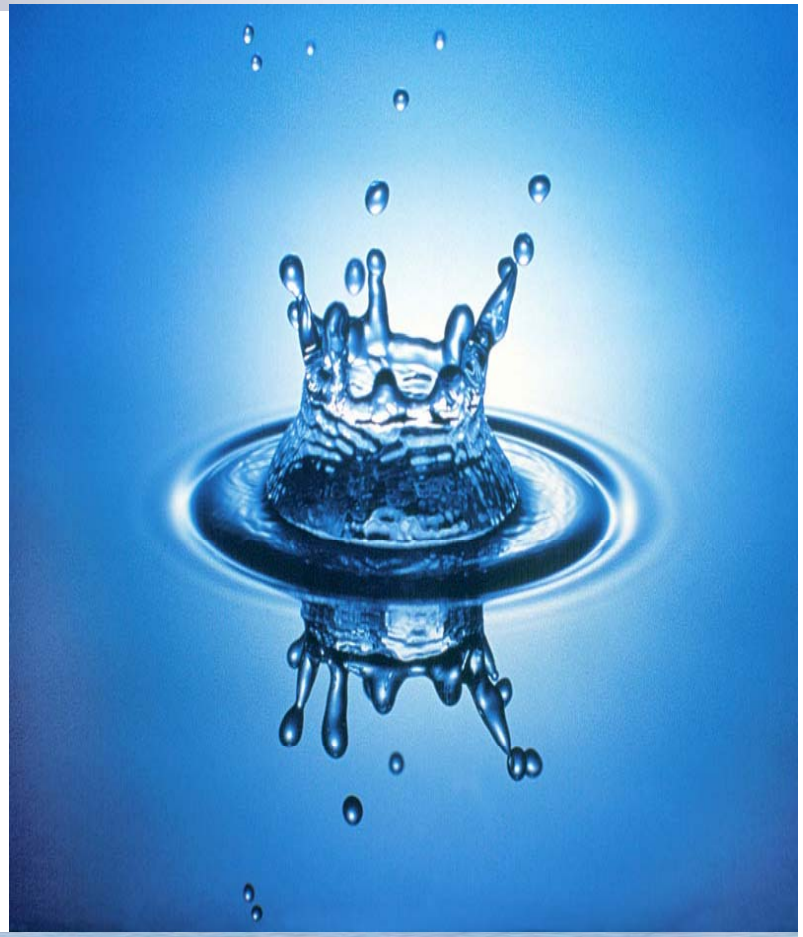
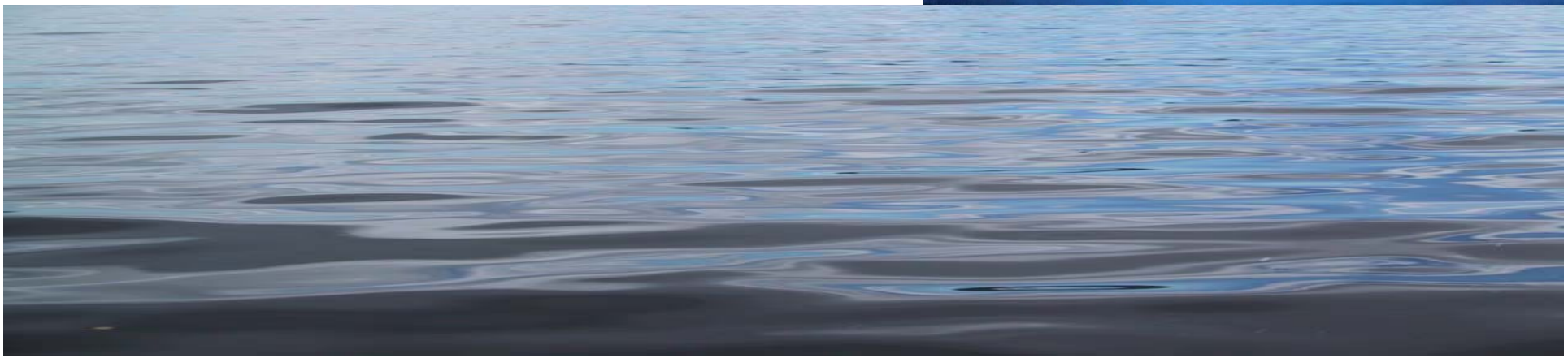
- Water has become an element of 'mixed vulnerability' for South Asia. The region has more water when it doesn't need and less water when the need is most acute.





Access to water

*Source: www.unicef.org/...**pdf**/03_SafeDrinking**Water**_D7341Insert_English.**pdf***

Water Availability in South Asia

	Sanitation (%) (1990-97)		Safe drinking water(%) (1995)		Health services(%) (1985-95)		Illiteracy* (%)	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Bangladesh	83	38	49	n.a	n.a	n.a	38	67
India	70	14	n.a	82	100	80	27	55
Nepal	28	14	61	59	n.a	n.a	36	64
Pakistan	93	39	85	56	99	35	43	n.a
Sri Lanka	68	62	88	65	n.a	n.a	7	15

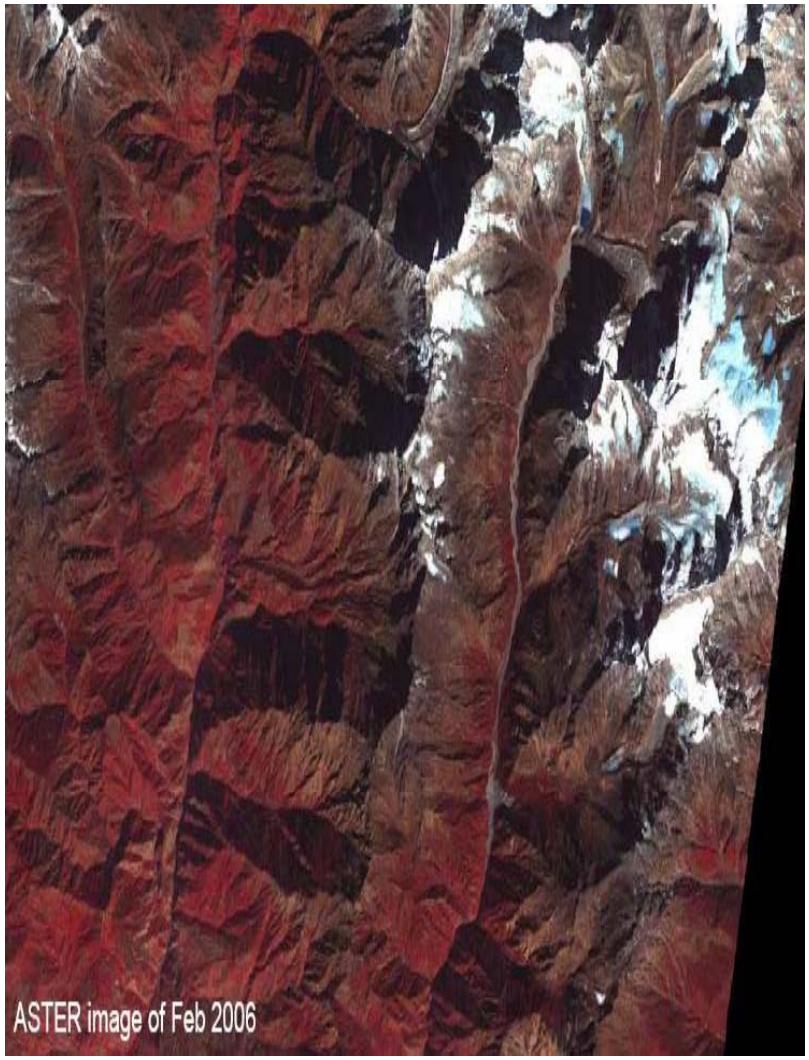
IFAD, 2001
n.a data not available
Illiteracy data: Bangladesh :1991, India: 1991, Nepal:1995, Pakistan: 1994, Sri Lanka: 1981

Himalayan Glacier Melting

- Glaciers in the Himalayas are receding faster than in any other parts of the world.
- In Northwest China, 27% of the glacier area will decline by 2050 (equivalent to an ice volume of 16,184 km3), as will 10 to 15% of the frozen soil area.
- IPCC made a forecast that if current trends continue, 80% of Himalayan glaciers will be gone in 30 years.

A map of the outline of the glaciers clearly identifies the new outcrops and the separation of the glaciers.

Snow-cover Change in the Himalayas



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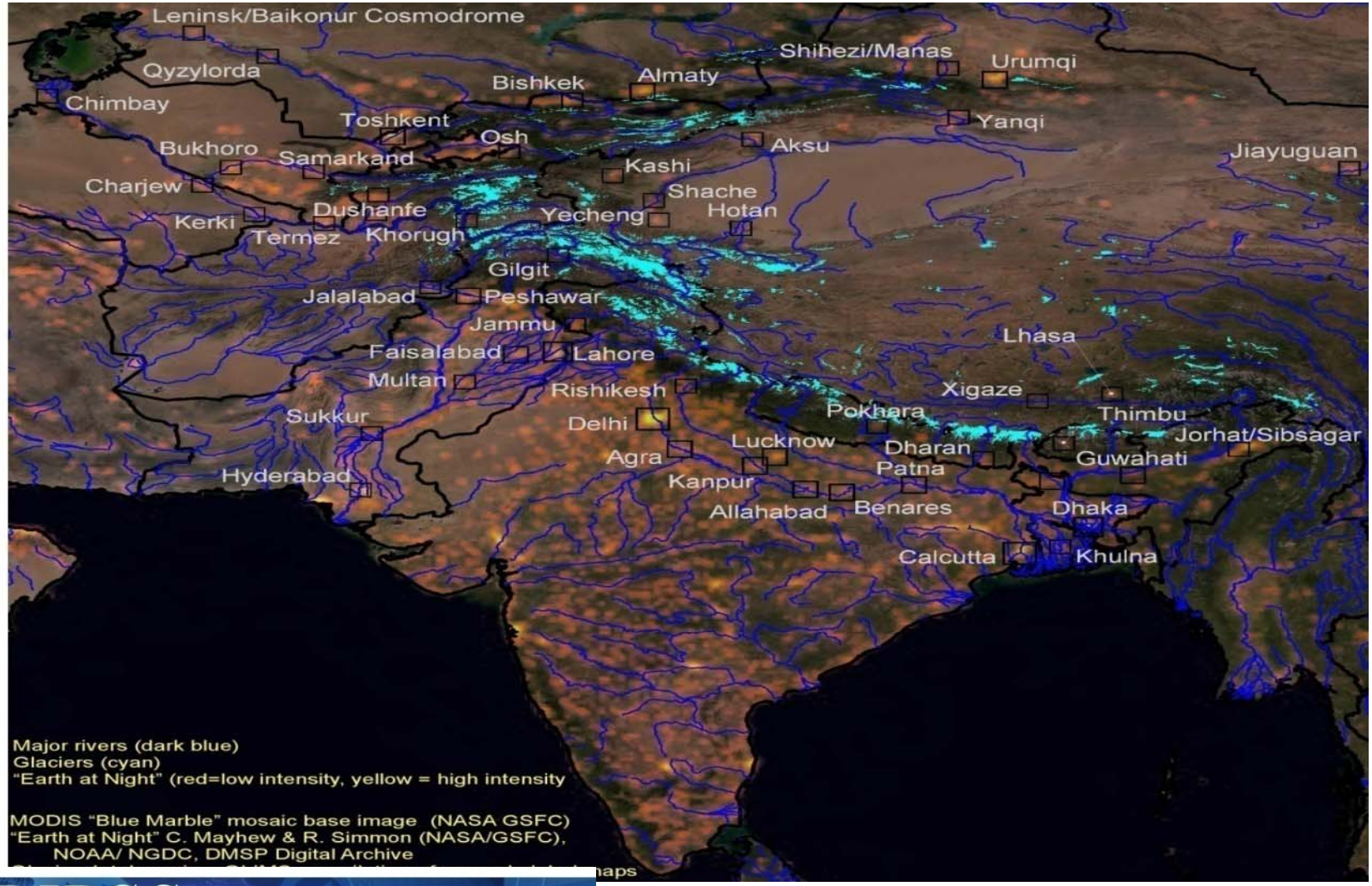
- The current trends of glacial melt suggest that the Ganges, Indus, Brahmaputra and other rivers across the northern Indian plain could likely become seasonal rivers in the near future.
- This poses a challenge for reducing the vulnerability of the more than 1.3 billion people living in the major river basins downstream from the Hindu Kush-Himalayan region.

Map of countries depending on Himalayan river basin

Map of the Himalayan River Basin Area



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	Area, sq km	Mean discharge (m^3/s)	% of Glacier melt in river flow	Population x1000	Population density	Water availability per person m3/year
Indus	1,081,718	5,533	44.8	178,483	165	978
Ganges	1,016,124	18,691	9.1	407,466	401	1,447
Brahmaputra	651,335	19,824	12.3	118,543	182	5,274
Irrawaddy	413,710	13,565	Small	32,683	79	13,089
Salween	271,914	1,494	8.8	5,982	22	7,876
Mekong	805,604	11,048	6.6	57,198	71	6,091
Yangtze	1,722,193	34,000	18.5	368,549	214	2,909
Yellow	944,970	1,365	1.3	147,415	156	292
Tarim	1,152,448	146	40.2	8,067	7	571
Total				1,324,386		

Source: Jianchu Xu et al. 2007

Current condition of the Himalayan River Basin Countries

- The rapid retreat of the Himalayan glaciers has consequences for water-related hazards, such as glacier lake outburst floods, and for water stress, as a result of the decline in fresh water supplies during the lean season.

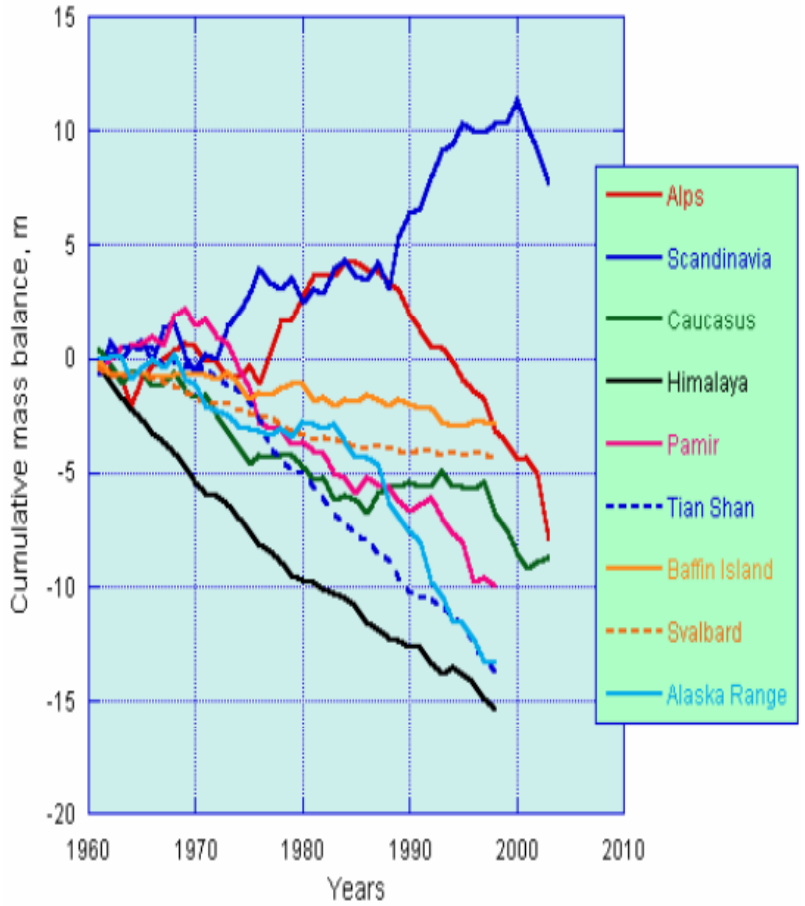


Figure 3: Rapid retreat of greater Himalayan glaciers in comparison to the global average (Source: Dyurgerov and Meier 2005).

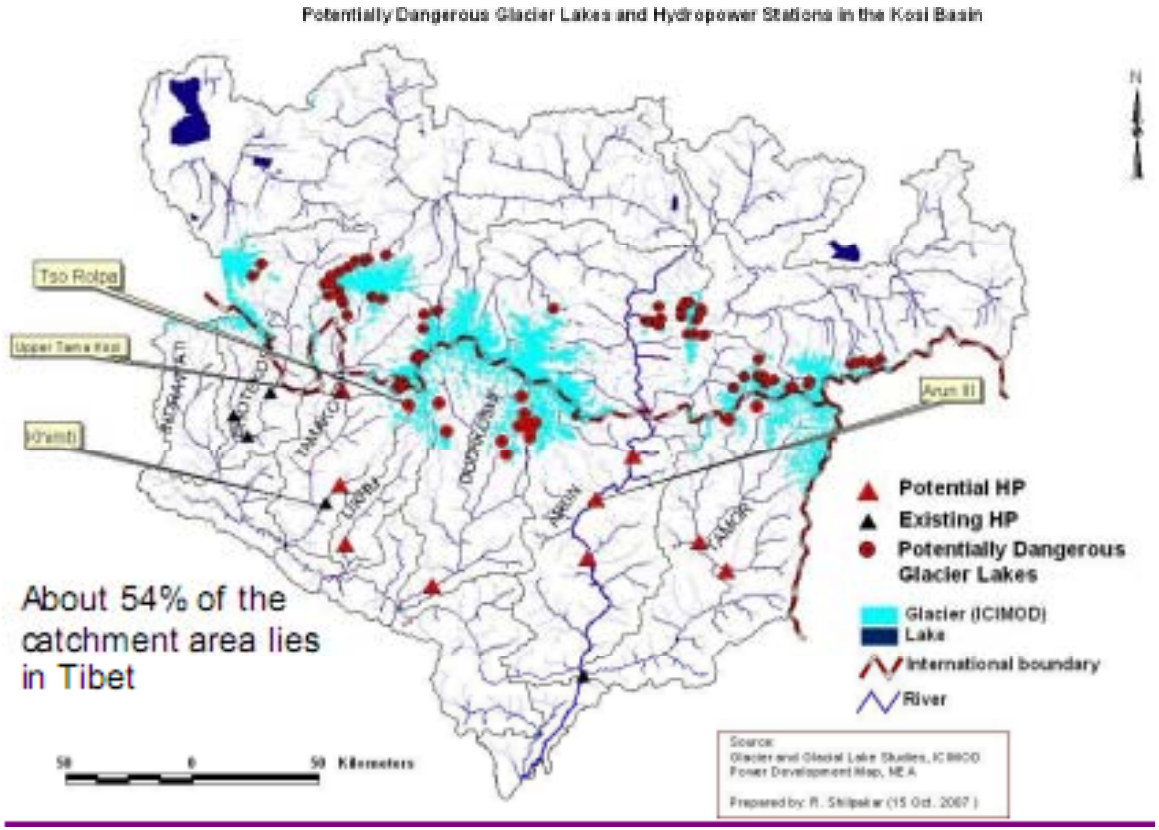
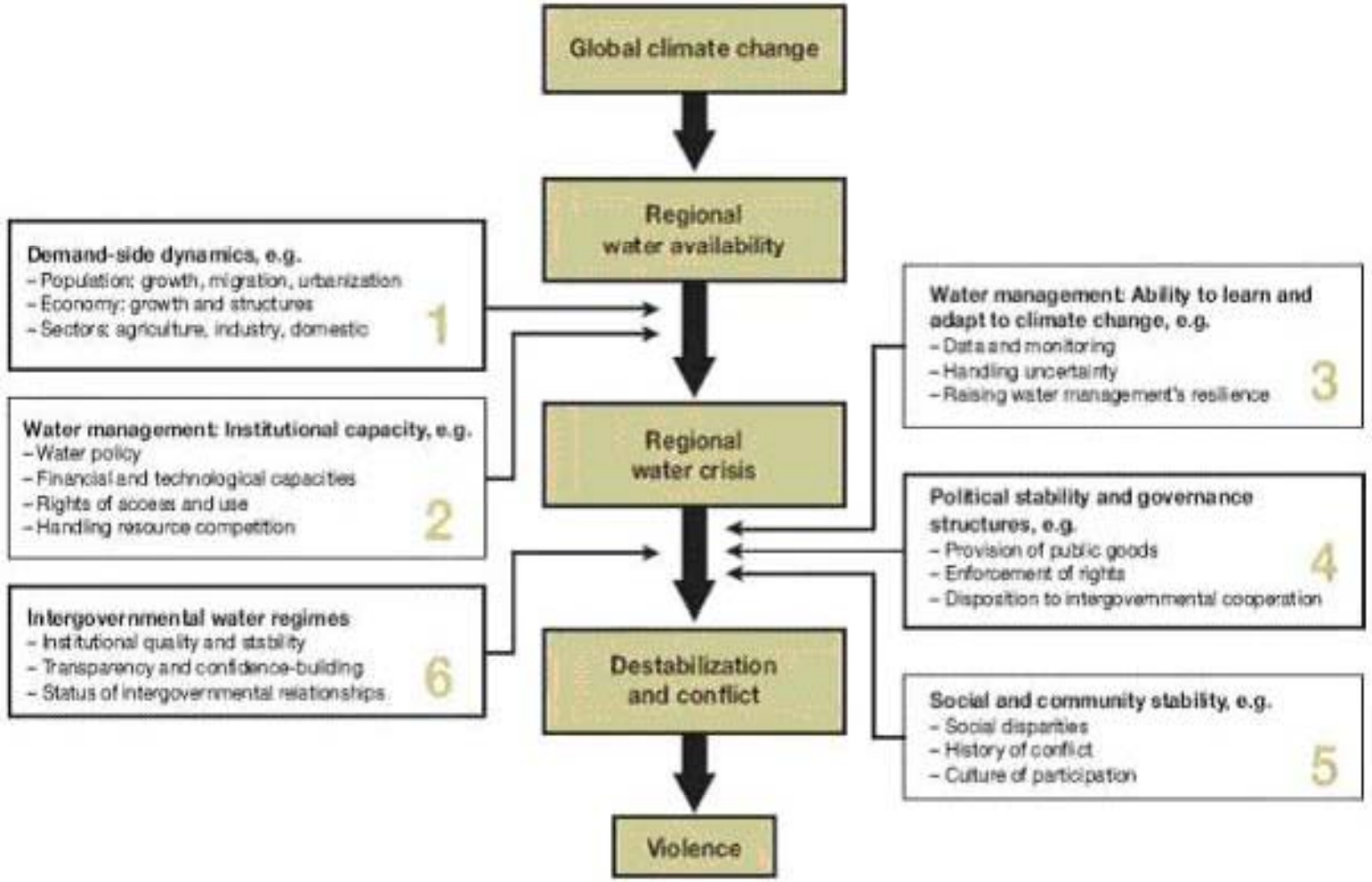


Figure : Potentially dangerous glacier lakes and hydropower stations in the Kosi basin

Factors leading to cross-border water-related conflicts

Some of the critical indicators of vulnerability to conflict among nations related to water availability are :

- Per capita water availability,
- The level of water withdrawals for annual use in relation to its availability, and
- The extent of dependence on water resources that flow in from the borders.



Climate Change, water stress and violence

Per capita water availability in 2000 and 2005 (cubic metres/person/ year)

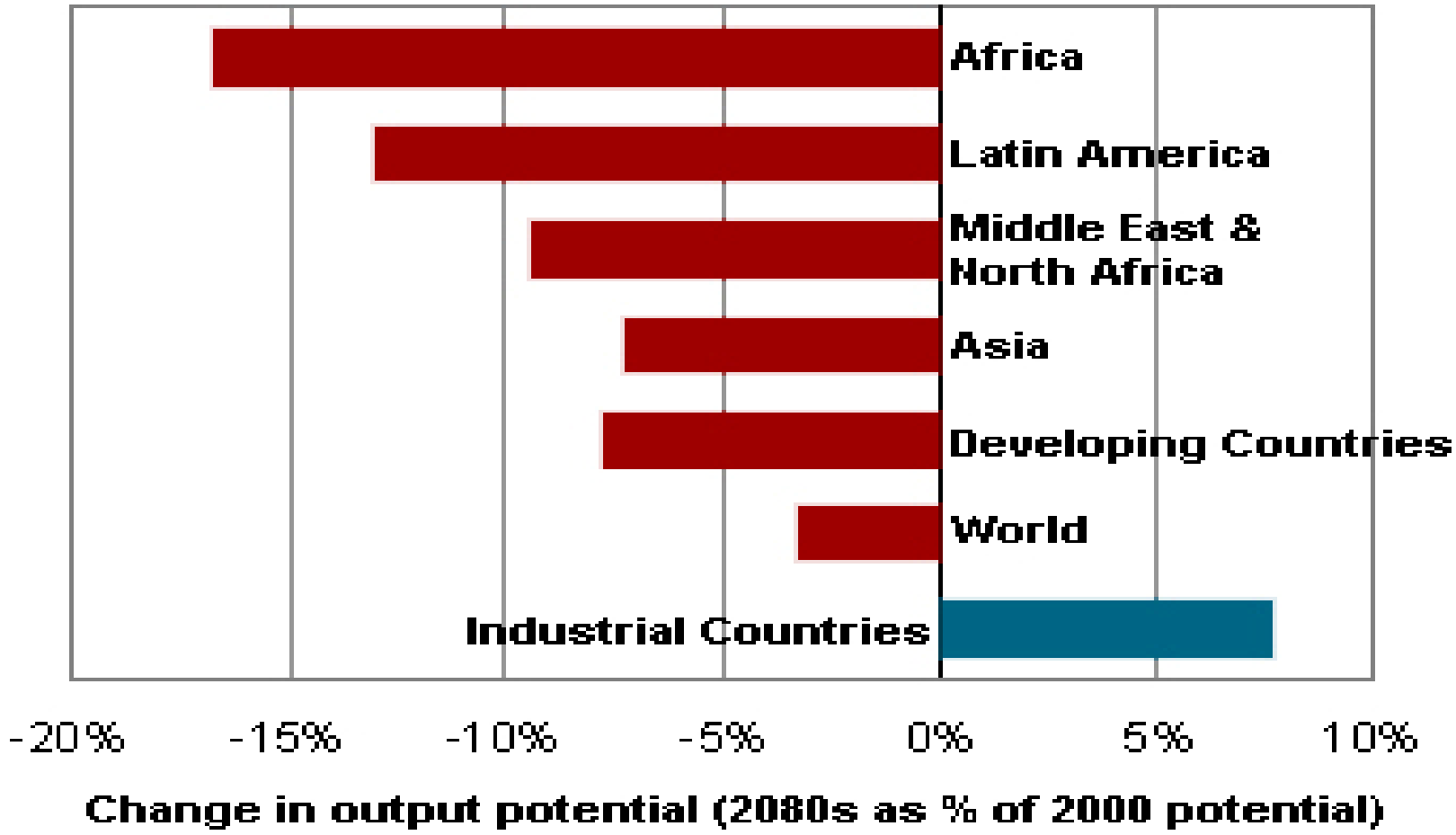
Country	Basin Name	Population, Thousands	Per Capita Water Availability* 2000	Per Capita Water Availability* 2005
Afghanistan	Indus, Tarim	24,926	2,986	2,610
Bangladesh	GBM	149,664	8,809	8,090
Bhutan	GBM	2,325	45,564	40,860
China	GBM, Indus, Tarim	1,320,892	2,259	2,140
India	GBM, Indus	1,081,229	1,880	1,750
Myanmar	GBM	50,101	21,898	20,870
Nepal	GBM	25,725	9,122	8,170
Pakistan	Indus, Tarim	157, 315	2,961	1,420s

Source: FAO‟s AQUASTAT 2005
Availability: Total Actual Renewable Water Resources

Water Stress as driver of Food Insecurity

- In the next 20 years, the four countries in the Himalayan sub-region will face the depletion of almost 275 billion cubic meters (BCM) of annual renewable water.
- The agricultural sector will continue to be the major consumer of water in China, Nepal, India and Bangladesh, although the industrial and domestic sectors will also need more water in the future.
- The crop yield will drop by 30-50% in the case of all the four countries by the middle of the century.
- In China, agriculture consumes about 65% of water. This proportion will decline to 55% by 2030 before rising again slightly around 2050.

Impact on Agriculture Output Potential



Source: Earth Trends, 2008

Cont.

- In India, agriculture accounts for almost 90% of the water usage but this will decline to 70-75% by 2050. Nepal and Bangladesh presently use more than 95% of their water for agriculture and will continue to do so until 2030.

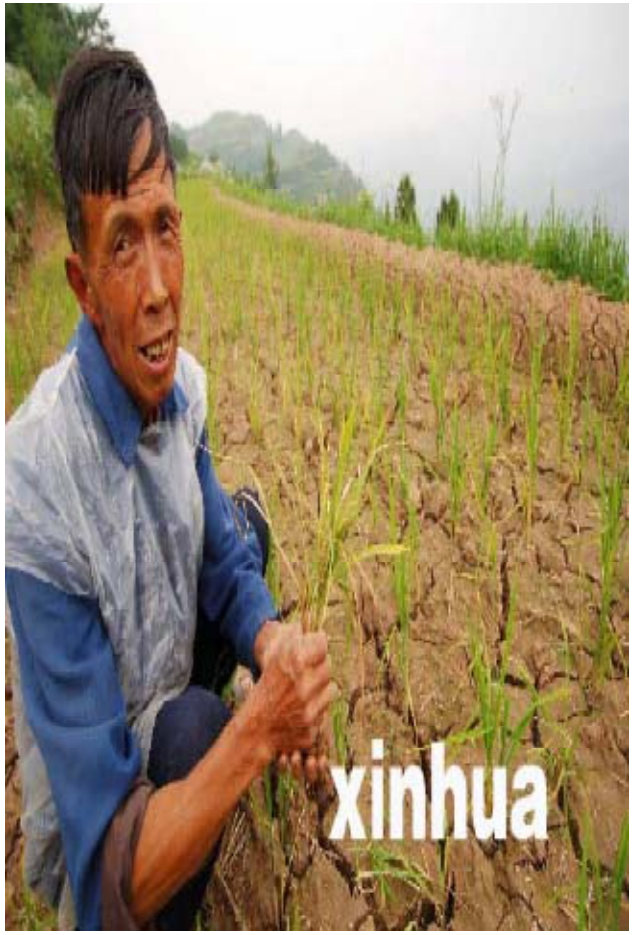
Cont.

- According to the Ministry of Agriculture and Cooperatives, Nepal will have a food deficit of more than 316,465 tonnes in 2010, owing to the unfavorable monsoon. With changing weather patterns, erratic monsoons and rising temperatures, the 'too much water, too little water' syndrome is likely to continue in Nepal.

- Reports from the "China Daily" indicate that the 1995 grain harvest in Shandong province declined by 2.7 million tons (food for 9 million people) due to water failures of the Yellow River.

Cont.

- Bangladesh had to import nearly 20 lakh tonnes of food grains in the last fiscal year on top of around 3 crore tonnes of rice and wheat produced domestically.
- The combination of weak prices, falling water tables, and severe drought dropped the grain harvest in 2001 to 335 million tons, down from the all-time high of 392 million tons in 1998.



Water Borne Diseases in South Asia

- Almost one in five people in South Asia still lack improved water resources making them susceptible to water borne diseases like Anaemia, Arsenicosis, Cholera, Diarrhoea, Hepatitis, Malaria, schistosomes, Typhoid and so on.
- In South Asia, over two million people die due to water-borne diseases like typhoid and cholera annually.
- 37.7 million Indians are affected by waterborne diseases annually, 1.5 million children are estimated to die of diarrhoea alone.
- In Bangladesh alone, 35 million people are exposed to elevated levels of arsenic in their drinking water, which will ultimately threaten their health and shorten their life expectancy. (Lancet)

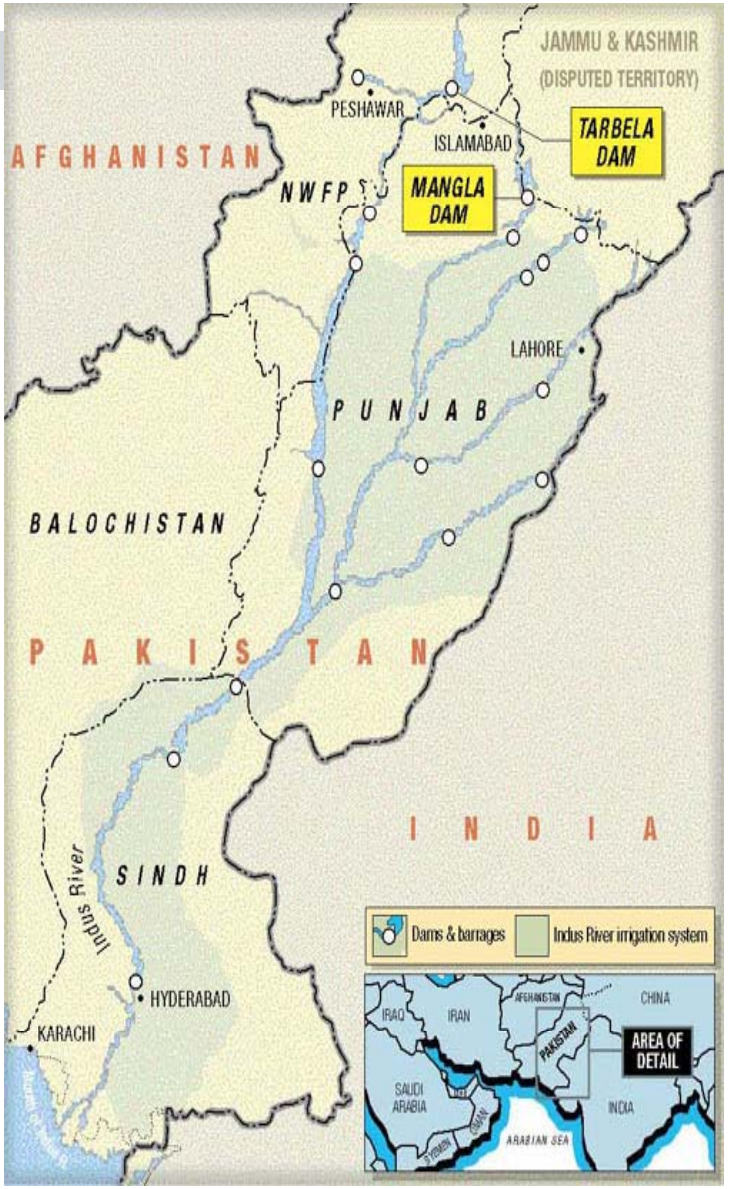
River Management and Violent Hydro-Conflict

- Water- related issues led to interstate tensions and significantly hampered development, such as along the Nile, Euphrates, Indus and Ganges rivers.
- The United Nations estimates 300 potential conflicts over water exist around the world today.
- Water flow ignores political and community boundaries, decisions in one place affect water use elsewhere.
- In the case of shared river basins, water use upstream can affect downstream quality and quantity, thus creating the potential for conflicts of interest.

Indo-Pak Water Disputes

- Concern is growing in Pakistan that India is controlling the water flow of rivers that flow from India into Pakistan, especially the Indus, Chenab and Jhelum rivers that pass through India's Jammu & Kashmir state.

- The Indus Water Treaty sets out the legal framework for the sharing of the waters of six rivers: Indus, Chenab, Jhelum, Sutlej, Beas, and Ravi - flow through northern India into Pakistan.



Indo-Pak Water Disputes

- Pakistan has raised objections to Indian water projects.
- Pakistan is losing 13 million cusecs [approximately 368,119 cubic meters/second] of water every year from its rivers into the sea, as it does not have enough reservoirs or dams to store water.

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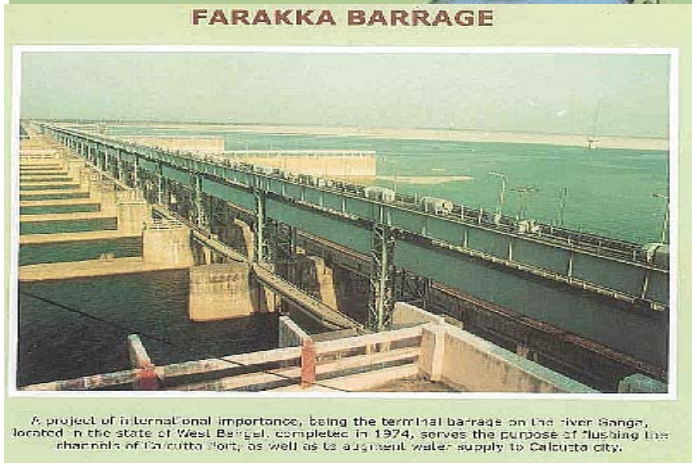
Indo-BD Water Disputes

- From independence, India takes exhaustive water surface management measures
- Diverts the Padma 18 km from future border
- 38 km canal feeding the Bhagirathi-Hooghly
- 1974 Unilateral diversions of water begin
- Supply more during the season that cause flood and less supply in dry season resulting in draughts.
- Construction of Dam: Tipai Mukh



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Indo-BD Water Disputes (contd.)

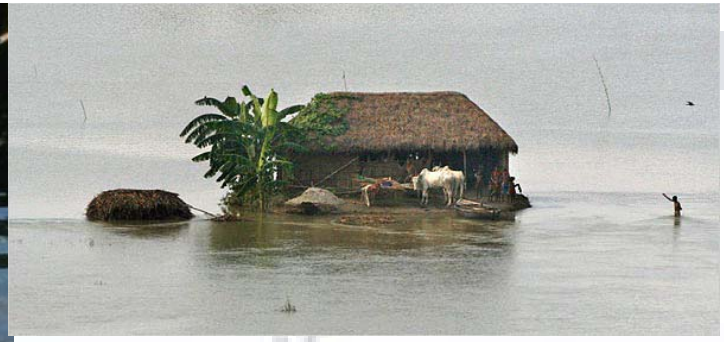
- Acute ecological and social fallout in Bangladesh
- 1975 average dry-season, the average minimum discharge at the Farakka Barrage was 55,000 cubic feet/second
- 1995 Bangladesh records receiving 9,000 cubic feet/second during dry season shortage
- Saltwater intrusion, vegetation damage, erosion, reduced conveyance capacity, disrupted fishing
- Overall: major financial losses and losses of livelihood

Implications of Water Stress: Bangladesh Case

- Floods
- Salinity intrusion
- Droughts
- Riverbank erosion
- Lack of fresh water in the coastal zones
- Natural Calamities

Water Shortage in Bangladesh

- Lack of access to adequate safe and drinking water
- Contamination & disease due to lack of safe water
- Lack of water for irrigation & cultivation
- Irregular discharge of water
- Between 35 and 77 million of the 125 million Bangladeshis were at risk of drinking contaminated water.(WHO, 2000)



Flood: Is Bangladesh Sinking?

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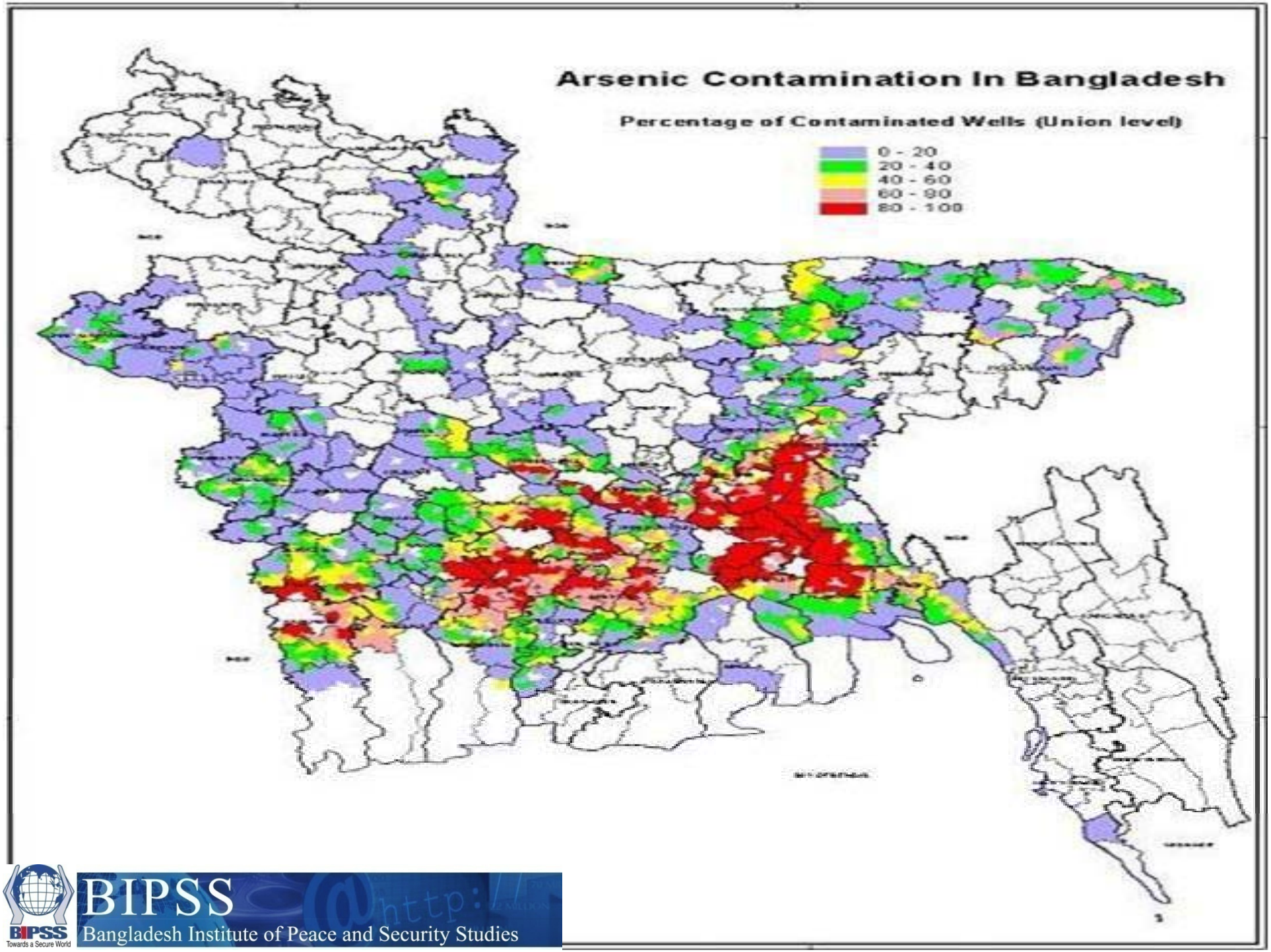
Impacts of Major Floods in Bangladesh

Event	Impact
1954 floods	Affected 55% of country
1974 flood	Moderately severe, over 2,000 deaths, affected 58% of country, followed by famine with over 30,000 deaths
1984 flood	Inundated 52,520 sq-km, cost estimated at US$378 million
1987 floods	inundated over 50,000 sq-km, estimated damage US$ 1.0 billion, 2055 deaths
1988 floods	Inundated 61% of country, estimated damage US$ 1.2 billion, more than 45 million homeless, between 2,000-6,500 deaths
1998 floods	1,100 deaths, inundated nearly 100,000 sq-km, rendered 30 million people homeless, damaged 500,000 homes, heavy loss to infrastructure, estimated damage US$ 2.8 billion
2004 floods	Inundation 38%, damage US$ 6.6 billion, deaths 700, affected people nearly 3.8 million

Arsenic Poisoning

- World Health Organization described the arsenic contamination in Bangladesh as “the largest mass poisoning of a population in history”.
- Half of Bangladeshis, up to 77 million people, have been exposed to the toxic arsenic (according to British Medical Journal “The Lancet”)

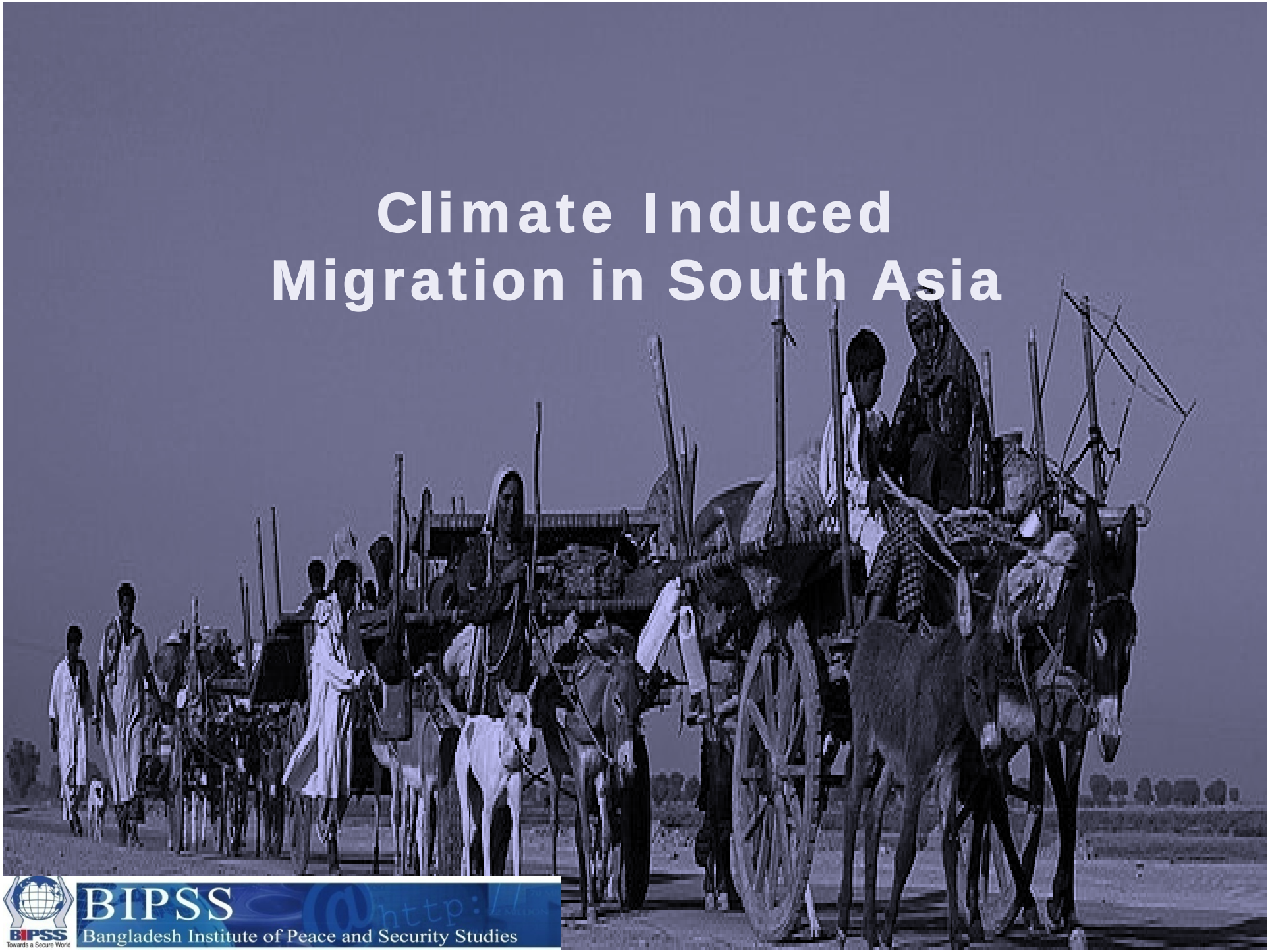


Salinity affected areas in the coastal and offshore regions of Bangladesh

Description	Total cultivated area(ha)	Saline Area(ha)
Non-saline with very slightly saline	4,25,490	1,15,370 (27%)
Very slightly saline with slightly saline	4,20,420	3,09,190 (73%)
Slightly saline with moderately saline	2,57,270	2,40,220 (93%)
Moderately saline with strongly saline	1,98,890	1,98,890 (100%)

Source:http://www.pakbs.org/pjbot/PDFs/38(5)/PJB38(5)1359.pdf

Climate Induced Migration in South Asia



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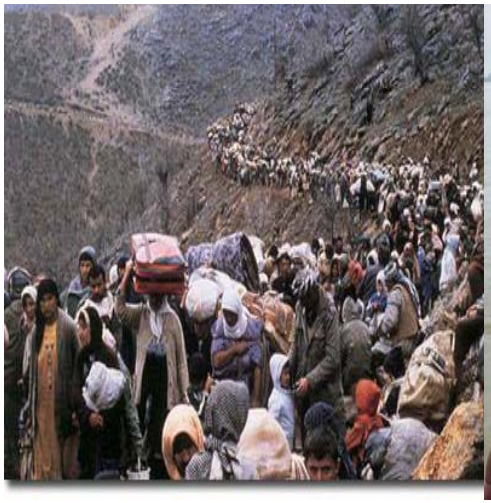
Transboundary Migration in South Asia

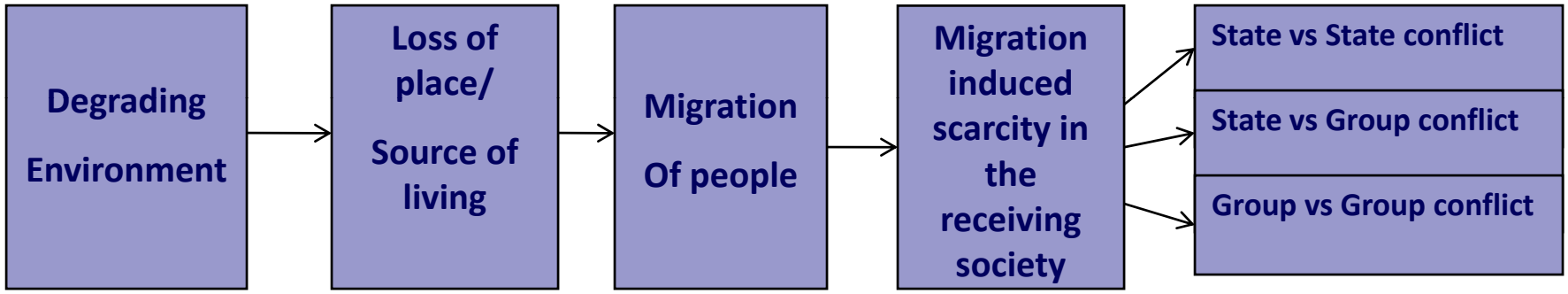
- Climate change induced migration is going to be in acute condition in South Asia.
- One third of the population live under poverty line and climate induced vulnerabilities may cause large scale impoverishment, loss of livelihood, shelter and food availability.
- Major disasters-flood, earthquake or cyclone may induce massive transboundaty migration.
- One of the riskiest places to live is in low-elevation coastal zones. Worldwide, the largest populations living on low-lying coasts are in Asia-Pacific, in countries like China, India, Bangladesh, Vietnam, Indonesia and the Philippines.




Contd.

- A recent report has indicated that the major deltas of the world such as the Ganges may be adversely affected due to climate change.
- The delta has 8.5 million hector of agricultural lands, of which 486 thousand hector would be inundated by a 2 meter sea level rise leading large scale migration both internal and transboundary.
- Glacier melting could profoundly induce migration by affecting the livelihoods of people who are directly dependent on irrigated water, small scale fishing and aquaculture.

Migration and Conflict



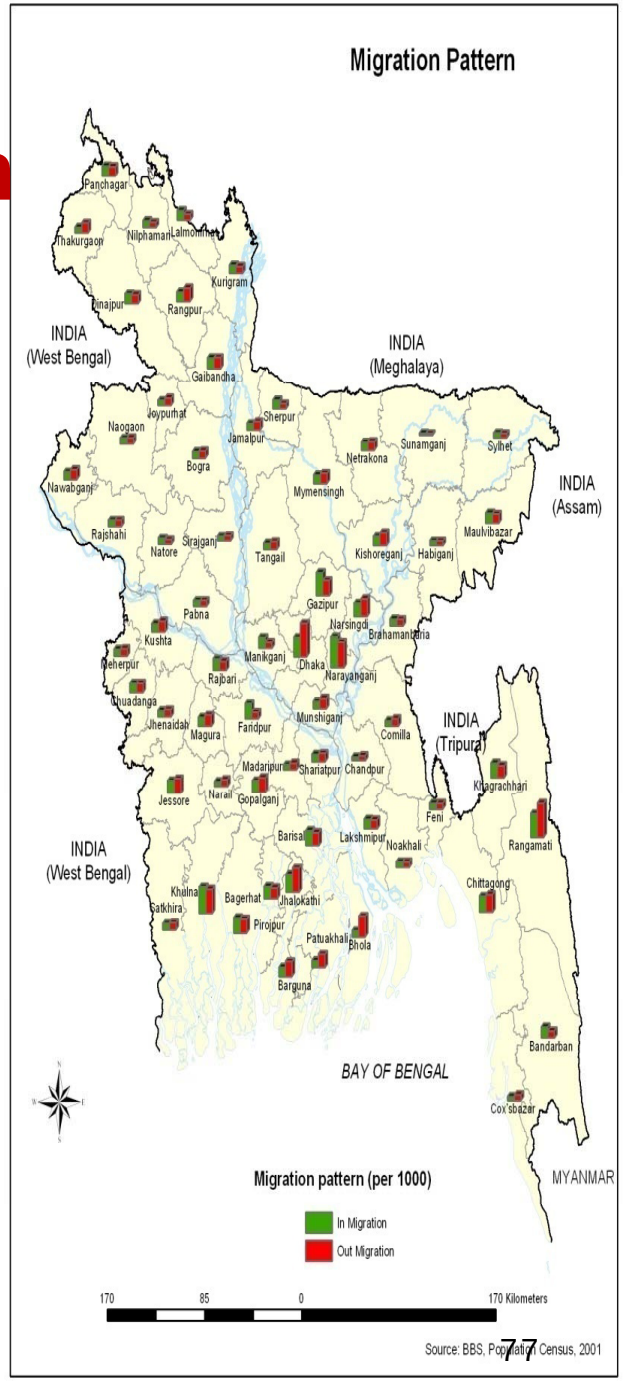
- Large-scale migration will add extra pressure on the scare resources in the society and thereby heighten competition and conflict over resources.

- Intra-regional forced migration, such as those from Bangladesh to India is subject to stimulate bilateral tensions.

Climate Induced Migration in Bangladesh: the worst case

The potential impact of a destructive flood in Bangladesh that sent hundreds of thousands of refugees streaming into neighboring India, touching off religious conflict, the spread of contagious diseases and vast damage to infrastructure. Indicating the severity of the problem, the deputy assistant secretary of defense for strategy Amanda J. Dory commented that: "It gets real complicated real quickly."

-New York Times, August 8, 2009



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Contd.

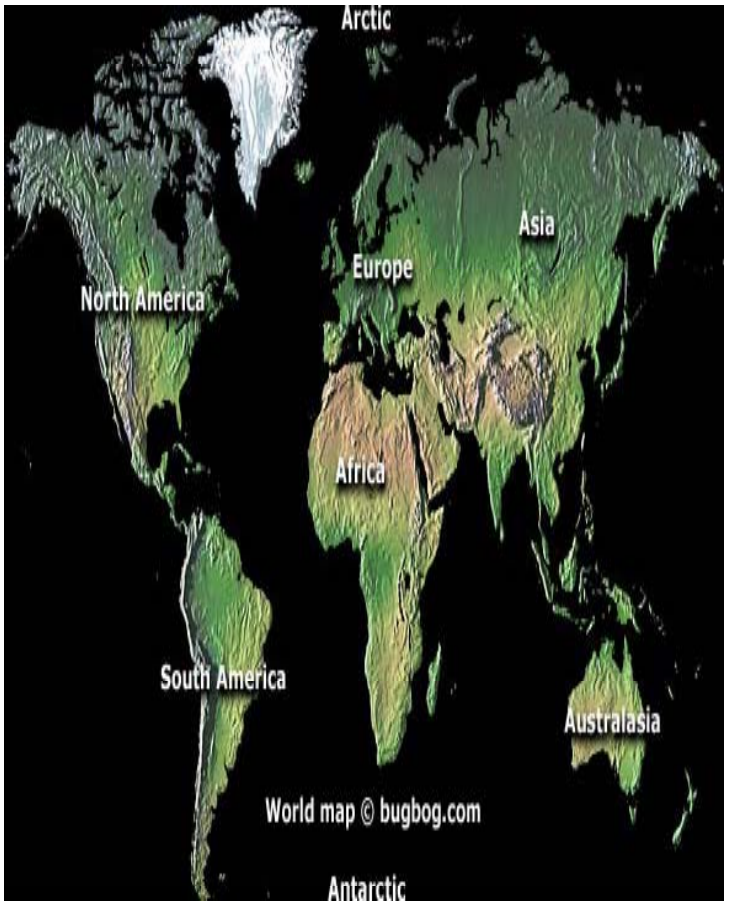
- Changes in local and regional climatic conditions in the form of sea level rise, heat stress, desertification, flooding and drought may severely restrict livelihood options for large groups in Bangladesh that are eventually aggravating climate induced migration domestically and across the border.
- According to several authors, between 64, 000 and 1 million Bangladeshis are rendered homeless every year due to riverbank erosion alone (Haque and Zaman 1994; Lein 2000; Siddiqui 2005).

Contd.

- Myers (2002) argues that climate refugees from Bangladesh alone might outnumber all current refugees worldwide. He projected that 26 million refugees will come from Bangladesh.
- One of the earlier studies by Homer-Dixon (1994) concludes that Bangladeshi migrants have expanded the population of neighboring India by 12 to 17 million over the last 40 years caused by environmental scarcity.

Measures to take

- Capacity building of the states, military and the community.
- Knowledge, information, technology and expertise sharing and exchange.
- International/ Regional policy framework.
- Public Awareness.
- Political will and co-operation.
- Strengthening the Role of international organization.
- Legal regimes.
- Global consensus.



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Conclusion

- Common problems need common solutions
- Only cooperation among the countries of South Asia can reduce the imminent natural disasters and the consequent man made conflicts.
- Improved relations among the countries of the region and harmonisation of strategies and actions.

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"It is undoubtedly true that development rarely takes root without security; it is also true that security does not exist where human beings do not have access to enough food, or clean water, or the medicine they need to survive...This is why the world must come together to confront climate change. There is little scientific dispute that if we do nothing, we will face more drought, famine and mass displacement that will fuel more conflict for decades."

-Barack Obama, US President

US President Barack Obama's Nobel Award Acceptance Speech

Questions and Comments

Thank You

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