QSAIG: Quaker South Asia Interest Group

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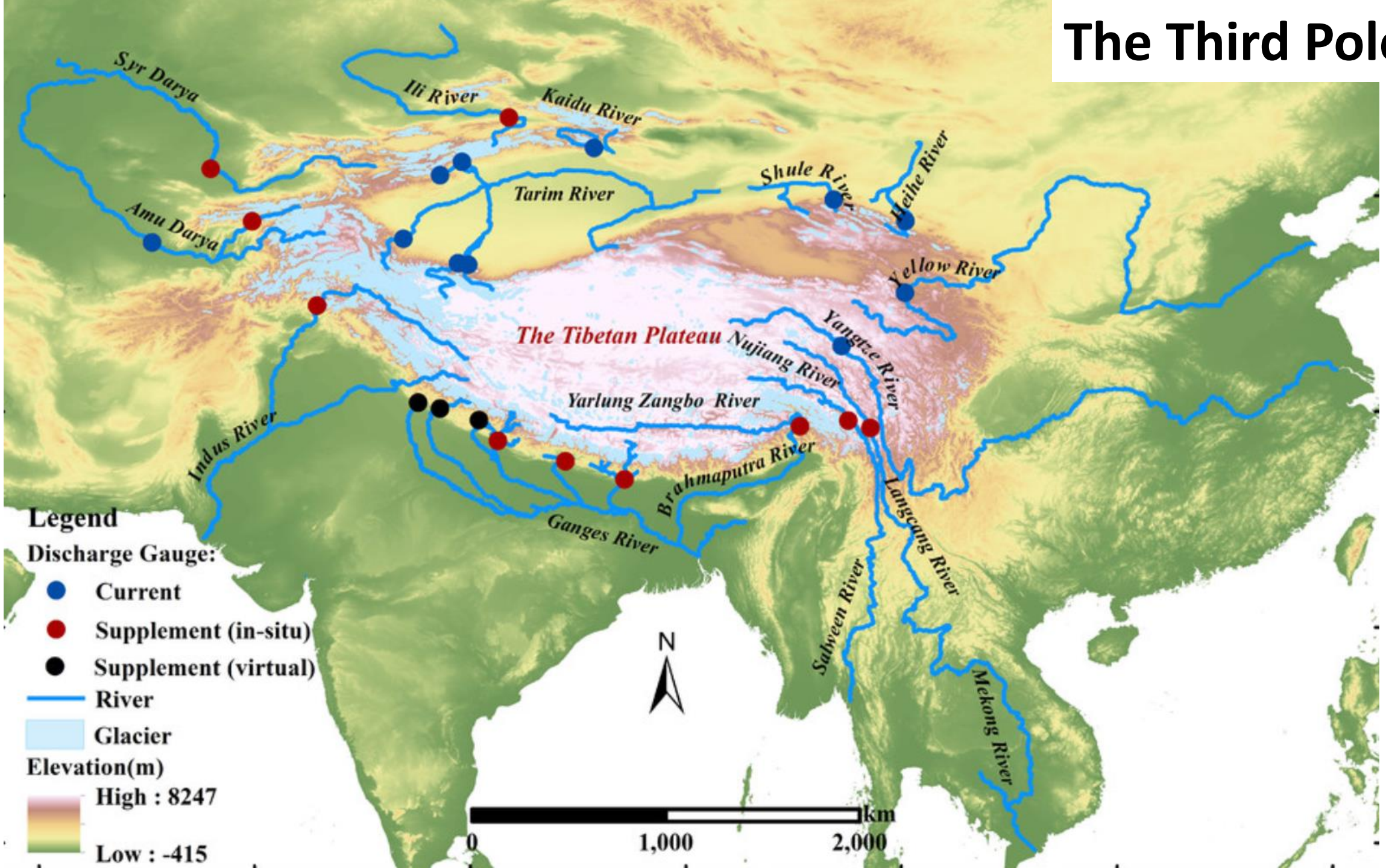
Presentation on the ‘Third Pole’ and some implications for South Asia

Saturday 23rd April 2022

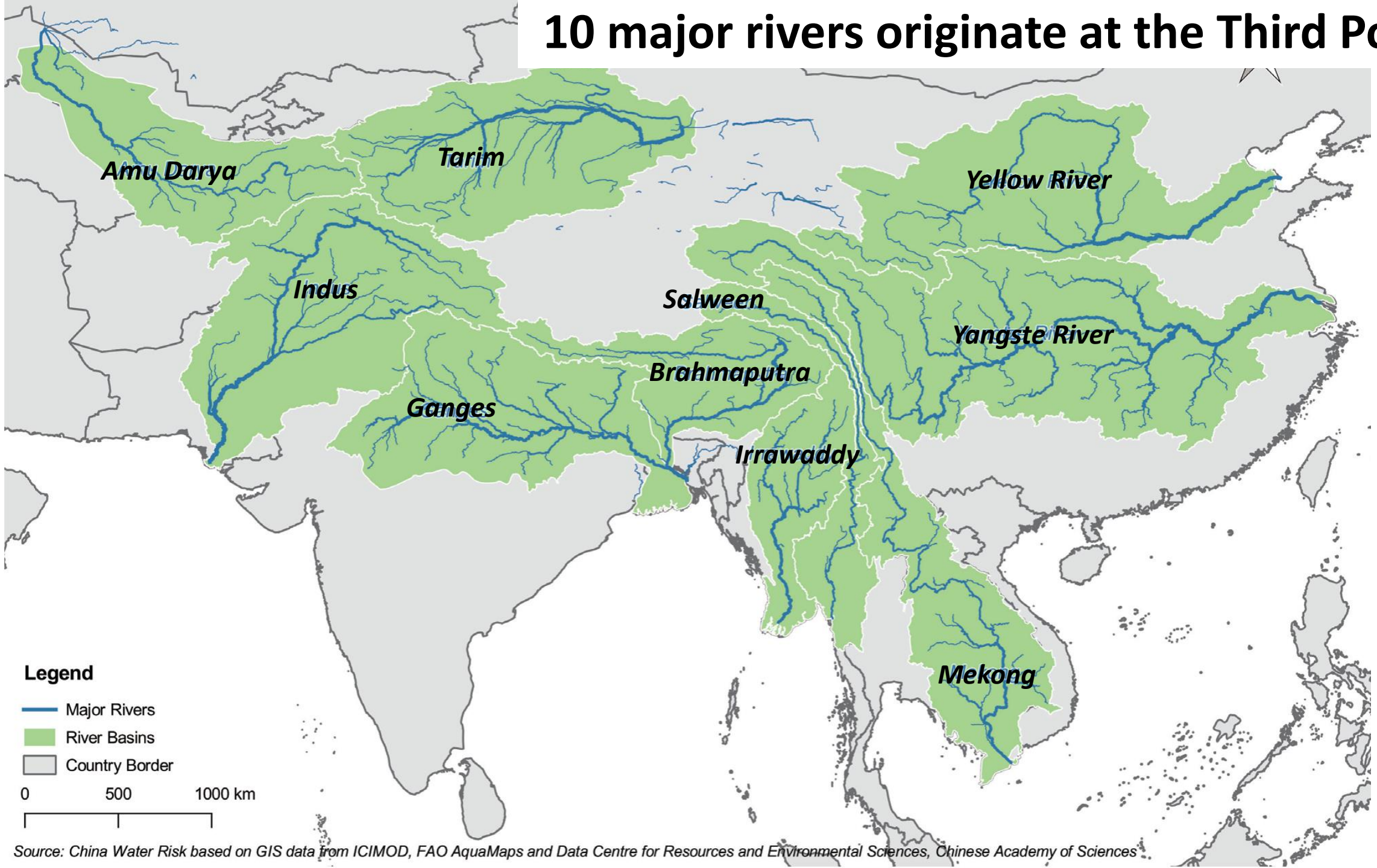
The Third Pole



What is the ‘Third Pole’?

- The ice fields of the Hindu Kush Himalayas and the Tibetan Plateau are the third largest area of frozen water on the planet
- Cover 100,000 square kilometres with some 46,000 glaciers
- The ice volume of these glaciers estimated to be about 7,500 km^3
  (this sounds a lot, but only a tiny fraction of the ice at the North and South Poles)
- 10 major river systems** directly serve nearly 2 billion people in Asia – roughly one-quarter of the world’s population (***Yellow River, Yangtze, Irrawaddy, Ganges, Brahmaputra, Mekong, Indus, Salween, Amu Darya, Tarim)*
- 16 countries: Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, Pakistan, Cambodia, Kyrgyzstan, Laos, Tajikistan, Thailand, Turkmenistan, Uzbekistan and Vietnam

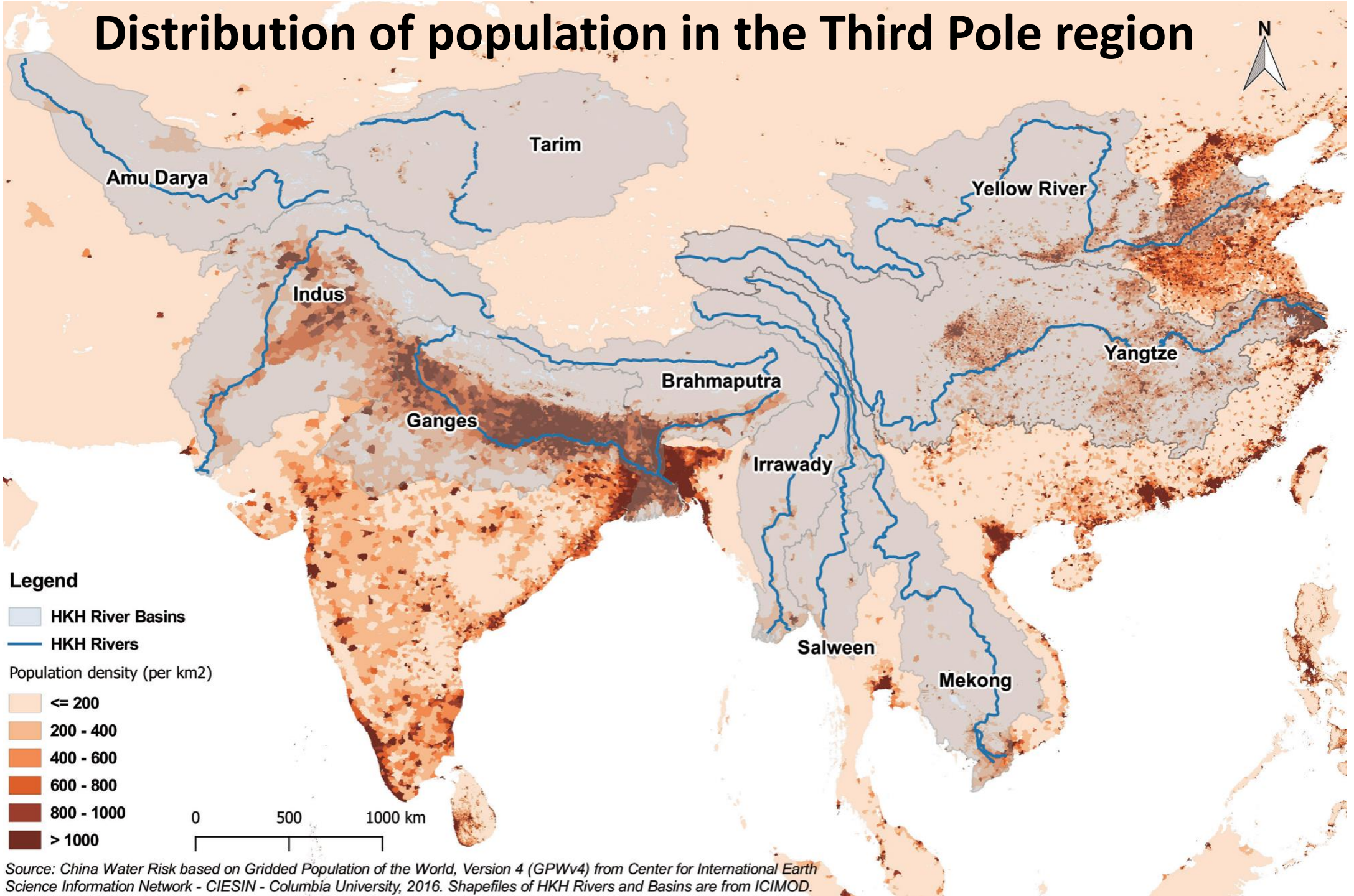
10 major rivers originate at the Third Pole



Source: China Water Risk based on GIS data from ICIMOD, FAO AquaMaps and Data Centre for Resources and Environmental Sciences, Chinese Academy of Sciences

South Asia: Main River Basins

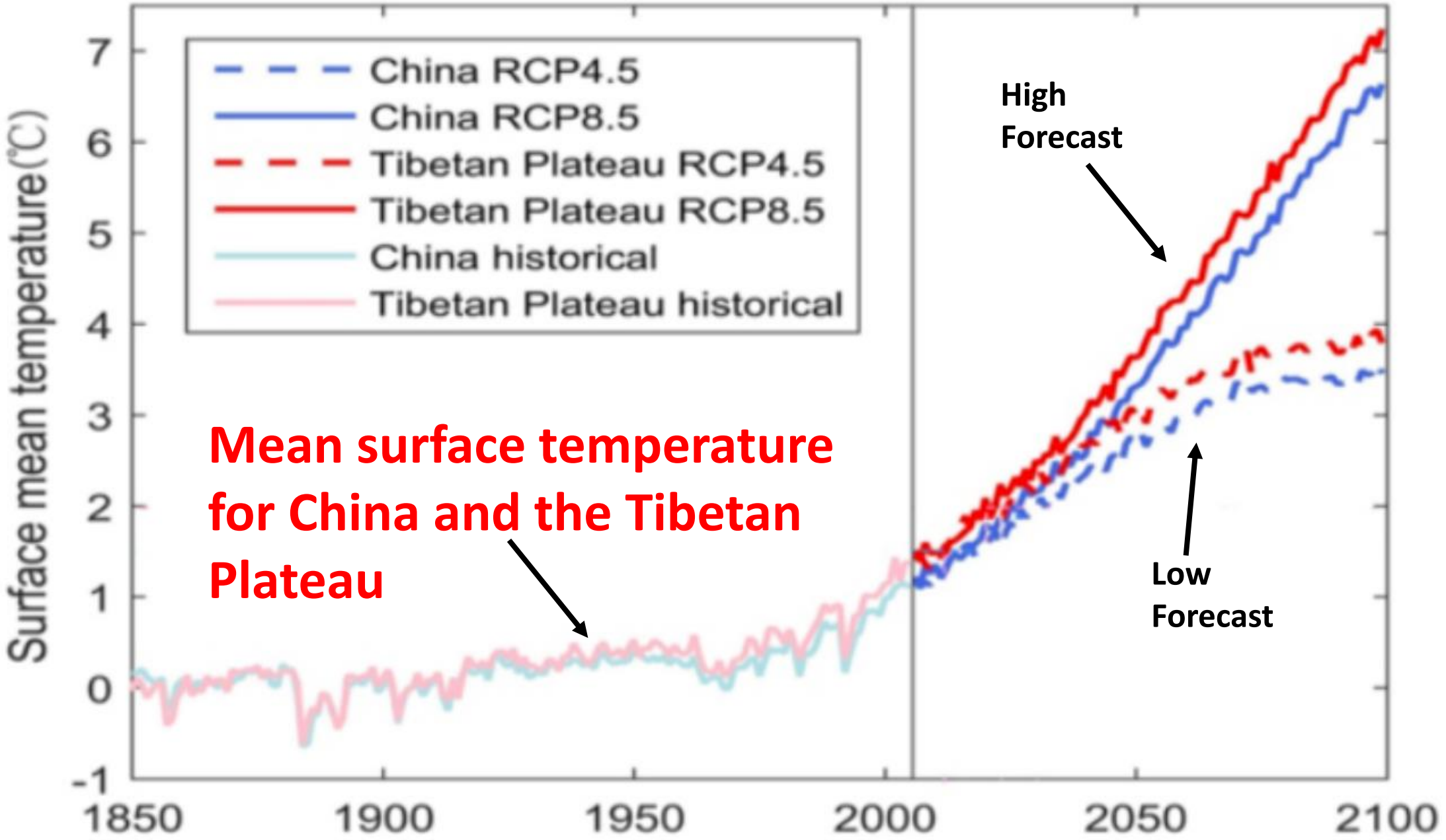
Distribution of population in the Third Pole region



Source: China Water Risk based on Gridded Population of the World, Version 4 (GPWv4) from Center for International Earth Science Information Network - CIESIN - Columbia University, 2016. Shapefiles of HKH Rivers and Basins are from ICIMOD.

The Climate Change Problem

- The Third Pole is one of the most sensitive areas to climate change
- Mountain regions are especially sensitive to climate change – the rate of warming increases at higher elevations because of absorbing energy from rising, warm, moisture-laden air
- Consequently, the rate of warming in the Third Pole region is considerably greater than the global average
- The Tibetan plateau, like the North and South Poles, is warming by 0.3 °C per decade, up to three times as fast as the global average
- The region has warmed by about 1.8 °C over the past half century *(see next slide)*
- Even if the world-wide increase in global temperatures is kept below 1.5 °C, the region will experience more than 2 °C of warming. If we fail to reduce emissions, the rise may be more than 5 °C *(see next slide)*



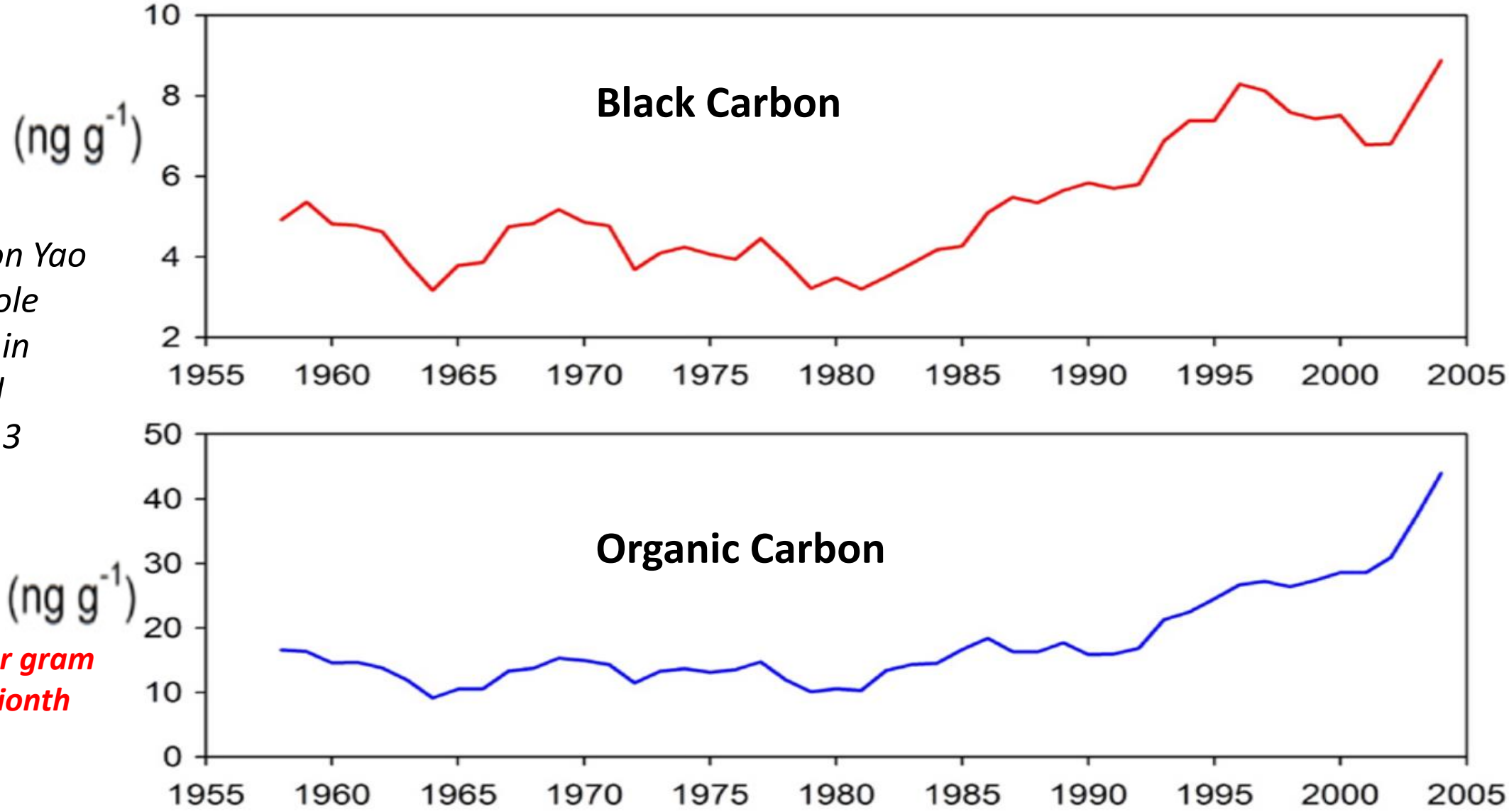
Source: https://public.wmo.int/en/resources/bulletin/third-pole-climate-warming-and-cryosphere-system-changes

The Third Pole is melting fast

- ICIMOD** predicts that two thirds of the glaciers of Hindu Kush and Himalayas (HKH) could melt by the end of the century if the planet remains on the same trajectory of greenhouse gas emissions ***ICIMOD = International Centre for the Integrated Development of Mountains*
- Even limiting the increase to 2.1° C (as targeted in the Paris Agreement), one third will have melted by 2100
- There has already been a significant decline and thinning of the snowpack
- The phenomenon is aggravated by air pollution depositing black dust on the glaciers
- Snow and glaciers are particularly vulnerable because they are so white and reflective. The black soot significantly increases the solar radiation absorbed at the surface

Ref: https://medium.com/@firdosi/the-third-pole-of-the-world-is-also-melting-badccc87becc Posted 16/02/2019

Increase in black carbon and organic carbon compounds in a Tibetan ice core since the 1980's



Source: Tandon Yao et al, 'Third Pole Environment ' in Environmental Development, 3 (2021) 52-64

Nano-grams per gram
Nano = one-billionth

Shrinking Glaciers

The Kyetrak Glacier on the northern slope of Cho Oyu in the Tibetan Plateau, as photographed in 1921 by Major E.O. Wheeler and in 2009 by David Breashears

(Source: Yale, 2014)

Origins of the black soot

- Black soot deposited on Himalayan glaciers derives primarily from two directions: west and south
- The northern and north-western plateau is under control of the westerly jet stream all year, so upwind sources are principally Europe and the Middle East
- Glaciers in the southern part of the plateau receive deposits from the west in winter and from the south in summer
- So the main sources of black soot in the Third Pole are from the Indian Plains, Middle East and Europe
- In some months, up to 80% of the black soot comes from South Asia

Source: https://www.pnas.org/doi/10.1073/pnas.0910444106 Proceedings of the National Academy of Sciences, 2009

Impact on region of Third Pole melting

Need to consider both: (1) General impacts due to global warming; (2) Specific impacts due to Third Pole changes

(1) Climate change impacts due to global warming:

- Increased variability of weather events:
  - Heavier rainfall
    - Floods (flash floods, area-wide floods)
    - Landslides, erosion
  - Longer and more severe droughts
    - Agricultural crop failures
    - Pressure on water supplies
- Higher temperatures overall:
    - Lower agricultural yields – e.g. wheat
    - Increased fire risk

General impacts (continued):

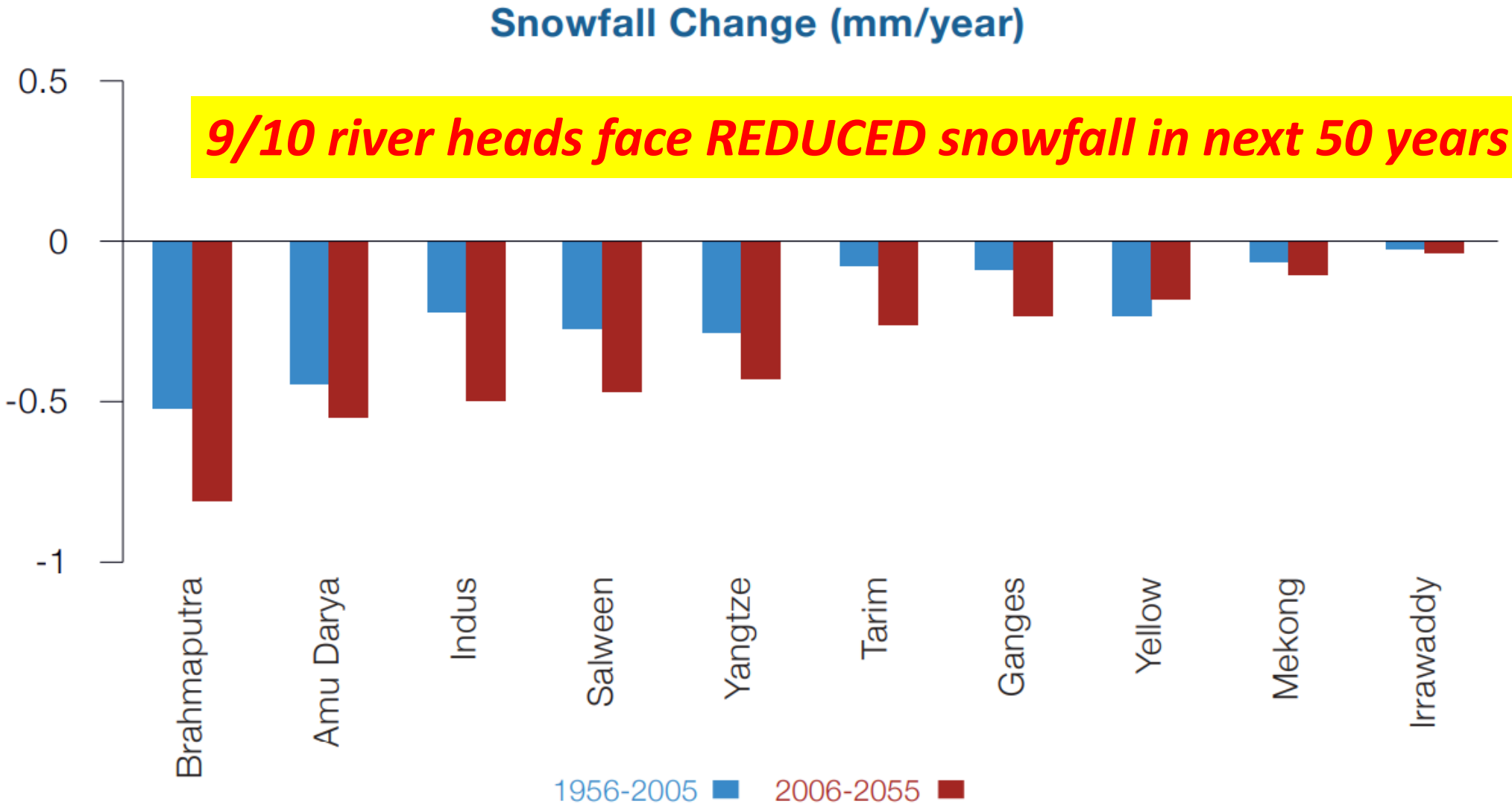
- Sea level rise:
    - Increased salinity in coastal areas
    - Increased vulnerability to storm surges
    - Loss of property and infrastructure
- Increased frequency and magnitude of extreme weather events:
    - Cyclones, tornadoes, hail, etc.
- Impact on wildlife – flora and fauna
    - The immense upland of the Third Pole is one of the most ecologically diverse and vulnerable regions on Earth
- Socio-economic impacts:
    - Loss of livelihoods
    - Migration
    - Increased constraints on economic activities

(2) Specific impacts due to Third Pole warming/melting:

- Increased glacial hazards: e.g.
    - Glacial lake outbursts
    - Flash floods
    - Landslides, debris falls
- Reduced river flows (especially in rivers dependent on meltwater):
    - Indus River and Tarim River are particularly at risk, due to high dependency on snow and glacier melt (60-80% and 45% respectively)
- Strengthening of the south-east monsoon, with heavy and unpredictable downpours
- Climate effects further afield: e.g.
    - changing snow cover in Tibetan Plateau contributed over 30% of total variances of heatwave variability in southern Europe as well as north-eastern Asia

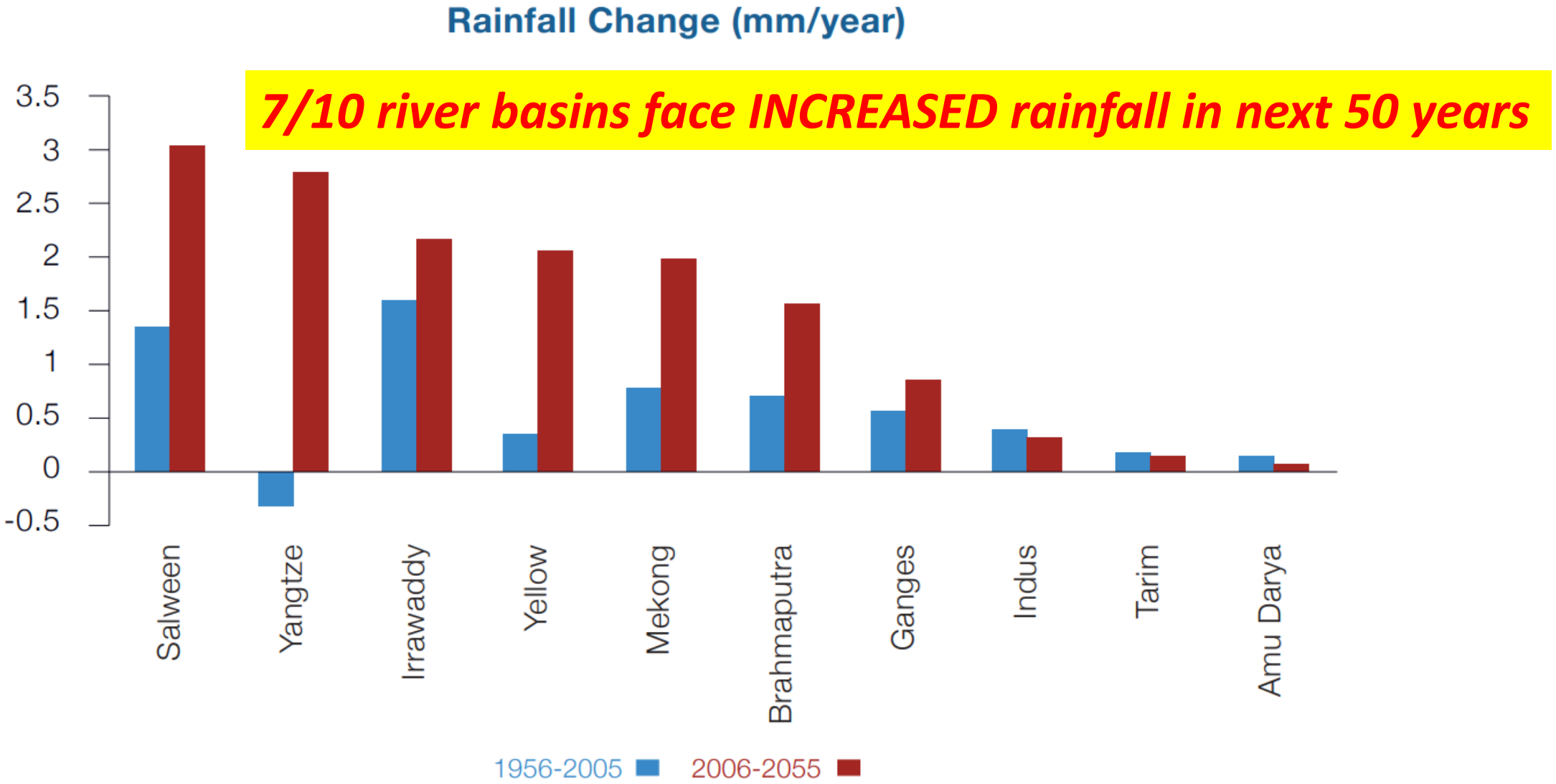
Predicted Impacts on Third Pole Rivers

Ref: CWR page 77



Source: China Water Risk based on data from Center for Water Resources Research, Chinese Academy of Sciences. Rainfall, snowfall and runoff change are expressed in equivalent water height. All data are calculated from five ensemble model (BCC-CSM1.1, CanESM2, CCSM4, MIROC5, MPI-ESM-LR) in IPCC AR5.

Predicted Impacts on Third Pole Rivers



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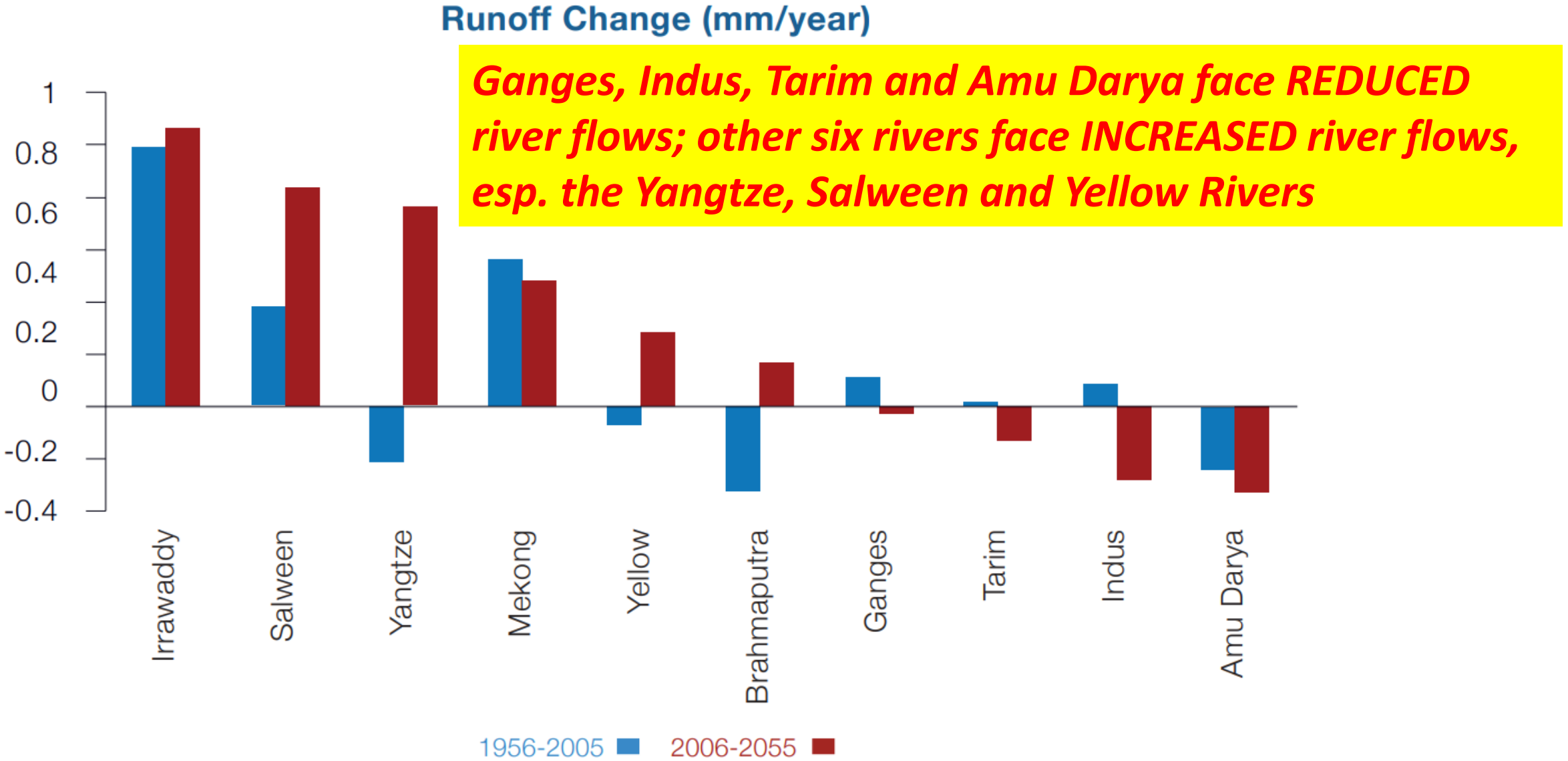
Predicted Impacts on Third Pole Rivers



Ganges, Indus, Tarim and Amu Darya face REDUCED river flows; other six rivers face INCREASED river flows, esp. the Yangtze, Salween and Yellow Rivers

Source: China Water Risk based on data from Center for Water Resources Research, Chinese Academy of Sciences. Rainfall, snowfall and runoff change are expressed in equivalent water height. All data are calculated from five ensemble model (BCC-CSM1.1, CanESM2, CCSM4, MIROC5, MPI-ESM-LR) in IPCC AR5.

Consequences

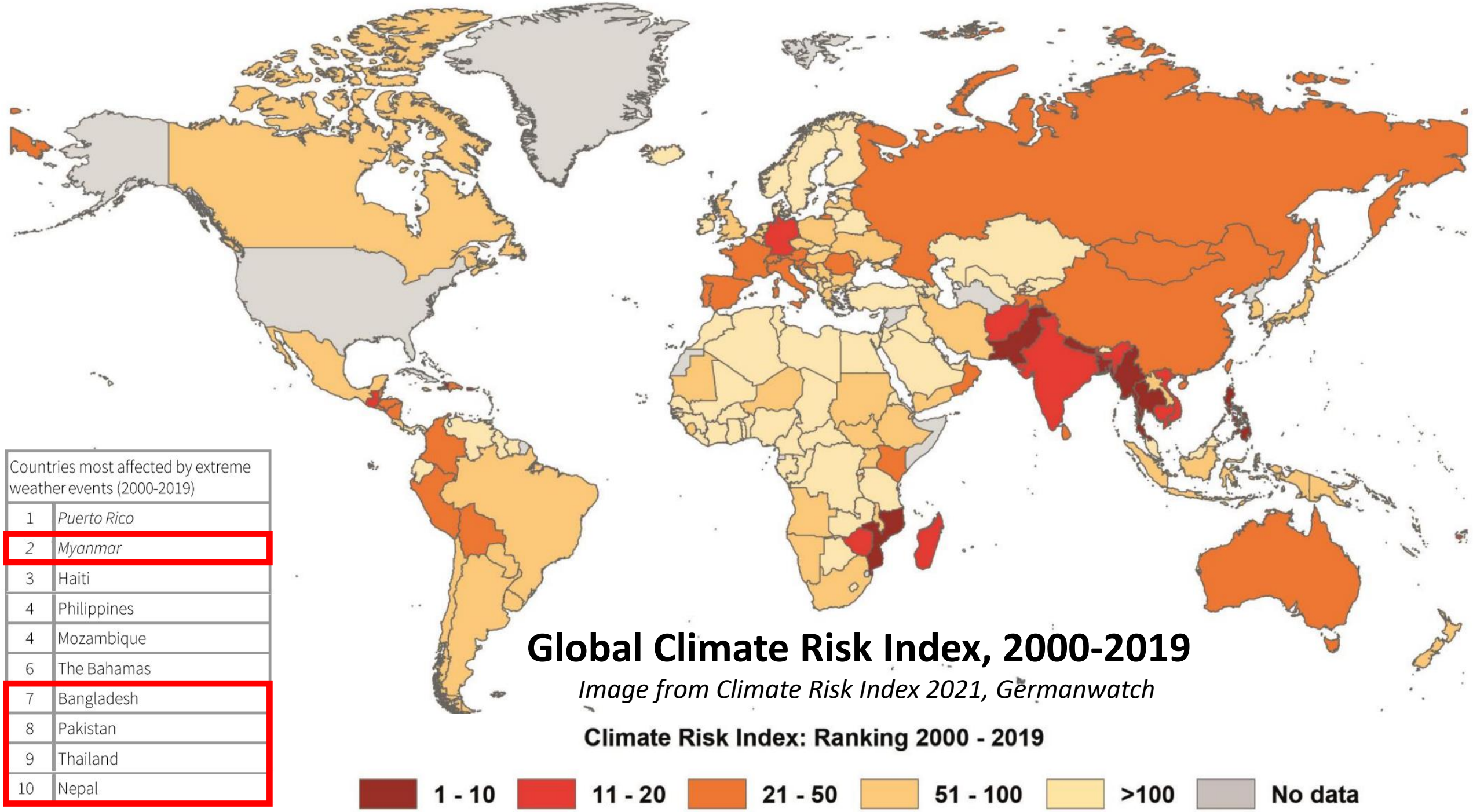
Towards the end of this century, pre-monsoon water-flow levels in all these rivers will drastically reduce without glacier buffers, affecting agricultural output as well as hydropower generation, and these stresses will be compounded by an increase in the number and severity of devastating flash floods. “The impact on local water resources will be huge, especially in the Indus Valley. We expect to see migration out of dry, high-altitude areas first but populations across the region will be affected,”

Source: Guardian, 15th Sept. 2019, ‘The world has a third pole – and it's melting quickly’, by Gaia Vince
https://www.theguardian.com/environment/2019/sep/15/tibetan-plateau-glacier-melt-ipcc-report-third-pole

Countries most affected by extreme weather events (2000-2019)	
1	*Puerto Rico*
2	*Myanmar*
3	Haiti
4	Philippines
4	Mozambique
6	The Bahamas
7	Bangladesh
8	Pakistan
9	Thailand
10	Nepal

Global Climate Risk Index, 2000-2019

Image from Climate Risk Index 2021, Germanwatch



Global Climate Risk Index

- South Asia is already one of the world's most vulnerable areas for natural disasters:
  - 4 of the world's top 10 countries most affected by extreme weather events over past 20 years are in South Asia (Myanmar, Bangladesh, Pakistan, Nepal)
  - Three other South Asian countries (Afghanistan, India and Sri Lanka) are in the top 23 countries most affected
- This risk index is based on extreme weather events (not slower changes such as sea level rise or water scarcity)
- When changes to water availability are included, the risks to South Asian countries are even greater

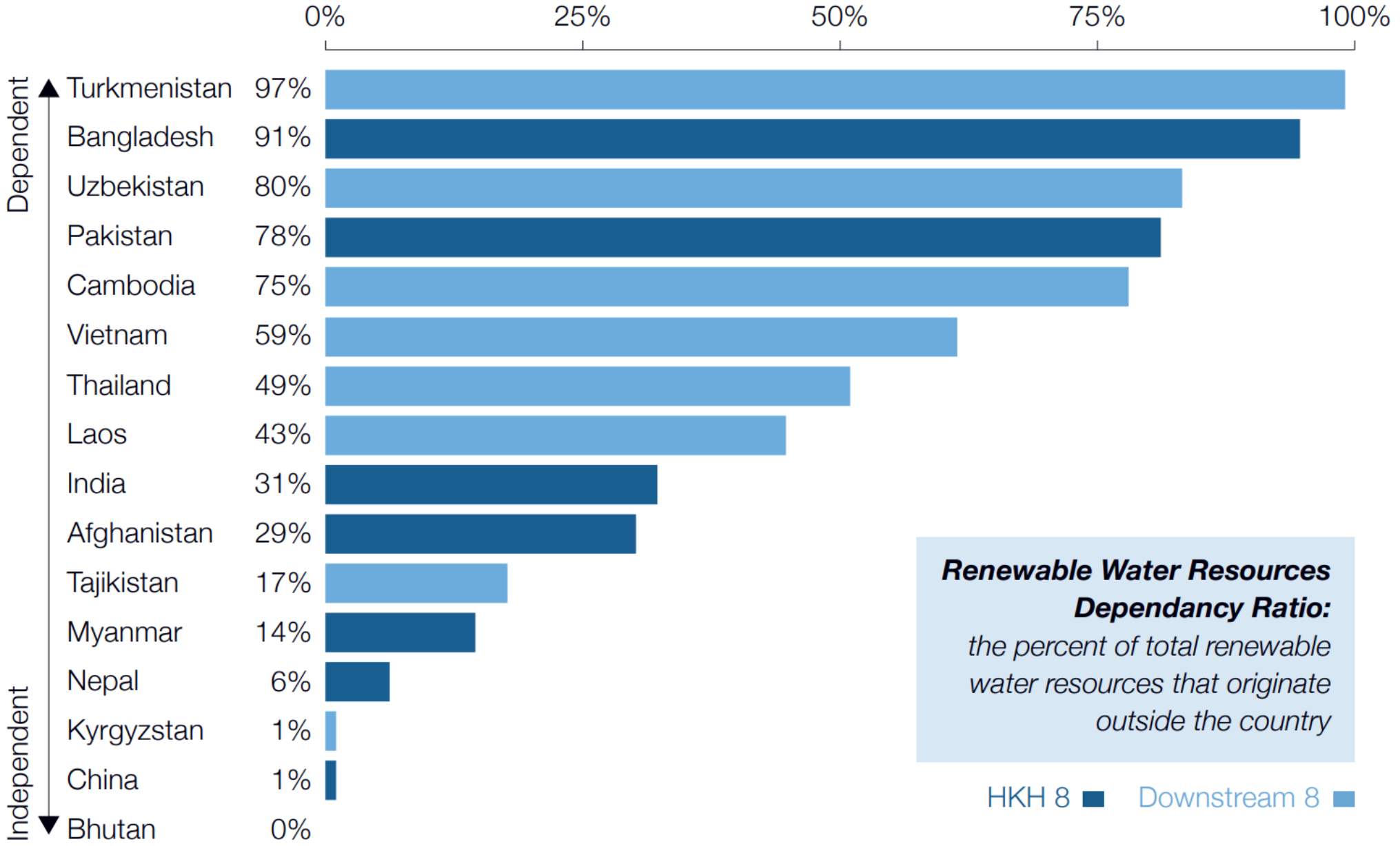
Source: Global Climate Risk Index 2021, Germanwatch, Jan 2021. Note: the Index focuses on extreme weather events. It is not weighted for population (i.e. number of people affected)
https://www.germanwatch.org/en/cribut

Trans-boundary Issues

- co-operation between the countries in the Third Pole region will be essential for their mutual well-being

- Eight out of the 10 HKH rivers are trans-boundary. Decisions made by one country will affect the others – e.g. water resource management, agriculture, economic/ infrastructure development, energy mix
- Among the South Asian countries, Bangladesh and Pakistan are particularly dependent on river water originating outside their territories (91% and 78% respectively) – the river water comes mainly through India
- Regional bodies and programmes have been set up to facilitate bilateral/ multilateral agreements between the various countries to ensure equitable utilisation of shared water resources

Percentage of renewable water resources originating outside the country



Source: China Water Risk based on FAO AQUASTAT data

Rivers Most at Risk

The 2018 China Water Risk (CWR) report** identified four priority rivers as ‘greatest risk’:

Ganges
Indus
Yangtze
Yellow River

This was based on three key parameters:

1. Areas under ‘high’ / ‘extremely high’ water stress
2. Population
3. GDP exposure

** *China Water Risk, Sept. 2018, ‘No Water, No Growth: Does Asia have enough water to develop?’*
https://www.chinawaterrisk.org/notices/new-cwr-report-no-water-no-growth/

Climate change impacts specifically in Bangladesh

Source: Govt. of Bangladesh, 'Bangladesh Delta Plan 2100', Ministry of Planning, 2018, Abridged version, pages 8-11 (prepared by national and Dutch consultants with Govt. of Netherlands support)

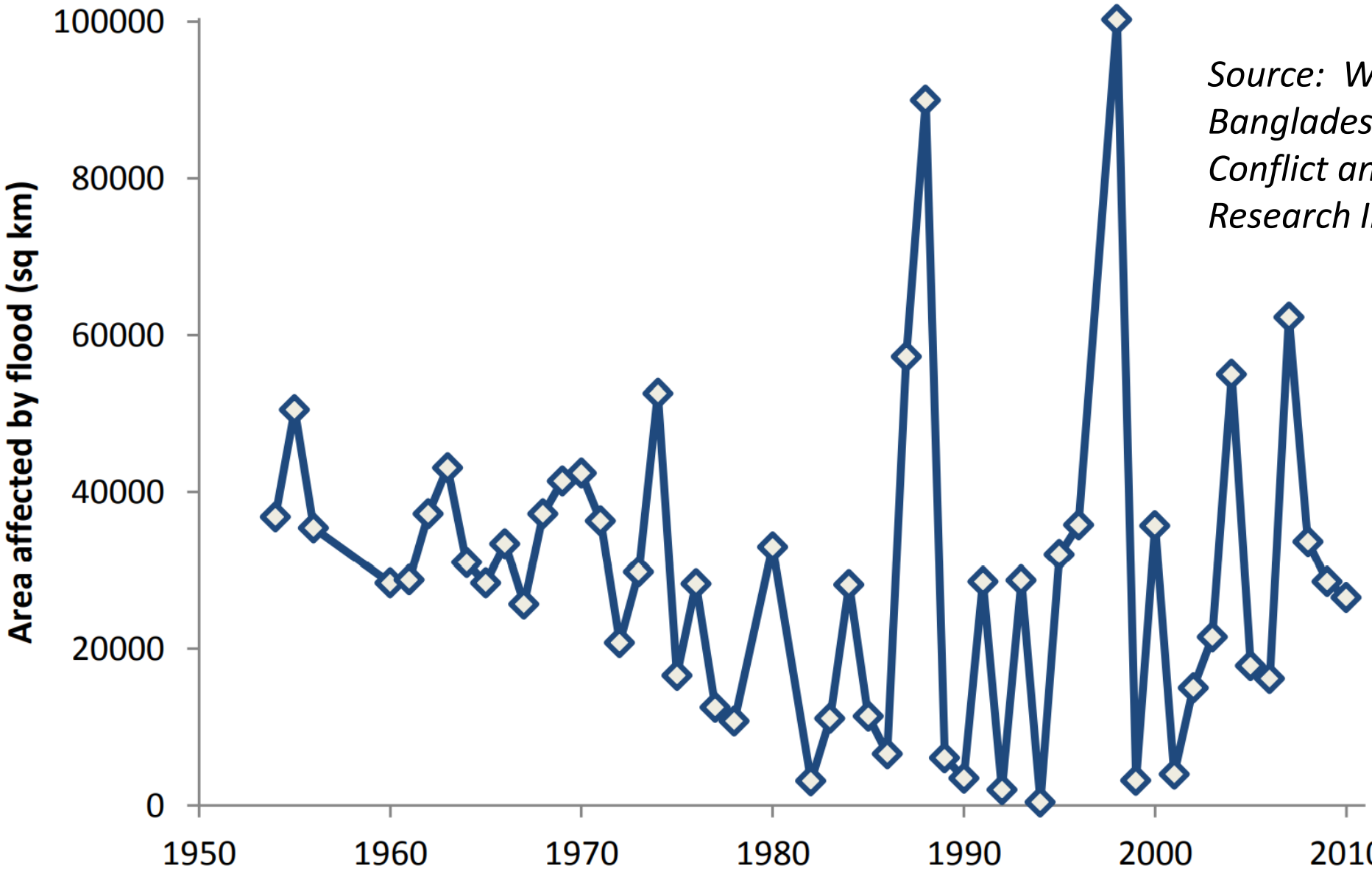
Rainfall: Rainfall pattern will be more variable and erratic. Pre-monsoon and monsoon rainfall will increase in most regions by 2030, but by 2050, southern parts and also the eastern hills may see reductions

Floods: Research suggests that the flood extent will be increased for all areas of the country by mid-century (2050)

Droughts: The droughts occurring in Bangladesh are not meteorological droughts but agricultural droughts, which could be also termed as severe moisture stress. The drought risk has been shifted forward as surface water reduction from diversion of river water upstream in India and inadequate rainfall in the dry season continues to lower the water table. So, climate change that lowers rainfall further in the dry season could hurt agriculture in the Barind Tract (the land area between the Ganges and Brahmaputra)

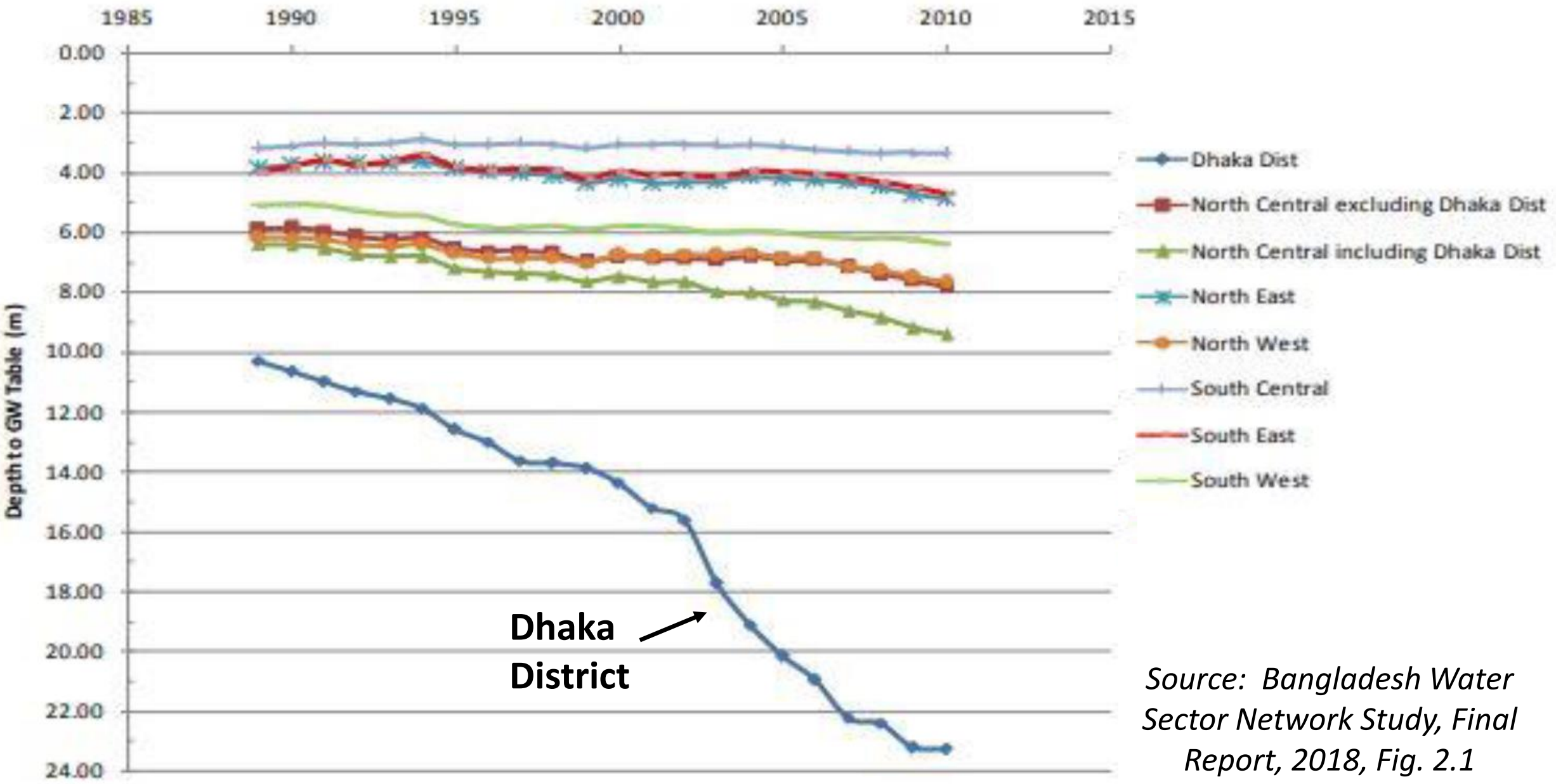
Floods in Bangladesh 1954-2010

- increasing variability and scale



Source: Water Scarcity in Bangladesh: Transboundary Rivers, Conflict and Cooperation, Peace Research Institute Oslo (PRIO), 2013

Decline in Groundwater Levels in Bangladesh (5-year moving average)



Source: Bangladesh Water Sector Network Study, Final Report, 2018, Fig. 2.1

Climate change impacts specifically in Bangladesh *(continued)*

Bangladesh Delta Plan 2100, pages 10-11

River Erosion: The rising peak discharges of the Ganges and the Brahmaputra mean increasing probability of future river erosion. Along with erosion, there is also some land accretion from river movements and associated transport of sediments. On balance land accretion is significantly **lower** than land erosion for all three major rivers

Sea Level Rise (SLR) and Salinity Intrusion: Sea level rise and consequently, salinity intrusion are the most prominent issues now in Bangladesh delta. IPCC (2013) predicts Bay of Bengal sea level rise from 0.2 meter to 1 meter for low to high emission scenarios in 2100. The rising sea level impedes fresh water availability in coastal area, expediting intrusion of salinity front. Projections suggest that area of high salinity (5 ppt) will increase from 16% (2005) to 24% by 2025

Cyclones and Storm Surges: Currently, a severe cyclone strikes the country every three years, on average. Intensity of cyclonic storm surges as well as depth and extent of induced coastal inundation are likely to increase in changing climate through rising sea surface temperature (SST) and sea level.

Bangladesh – Potential Impacts on Foodgrain Production

Bangladesh Delta Plan 2100, page 12

- The most vulnerable sector is agriculture:
  - High temperature reduces yields of high-yielding varieties of Aus, Aman, and Boro rice
  - Climate change, especially in temperature, humidity, and radiation, increases the incidence of insect pests, diseases, and micro-organisms
  - Simulation studies predict about 17% decline in overall rice production and as much as 61% decline in wheat production compared with the baseline situation. By 2050, this could lead to a reduction in 4.5 million tonnes of rice output at the 2002 level of production
  - Agriculture will also suffer from increase in soil salinity. Simulations show that under the BAU (business-as-usual) scenario, due to the reduction in yield, annual paddy production would fall by 1.60% in 2050 and 5.1% in 2100

Bangladesh – Losing land and infrastructure to Sea Level Rise

Bangladesh Delta Plan 2100, page 12

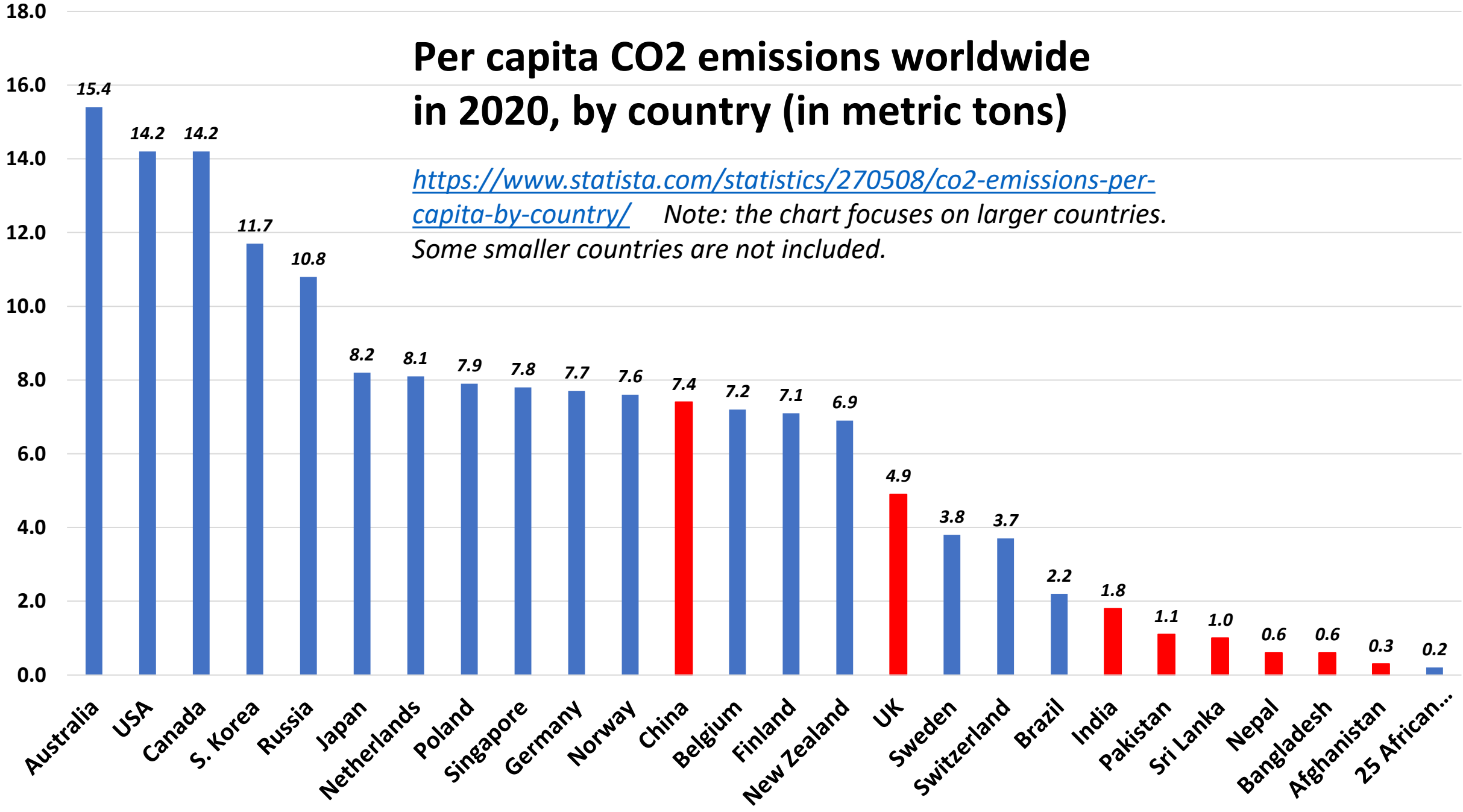
- Additional adverse effects will happen with loss of land and physical assets from inundation:
    - At a one meter sea level rise, a significant part of dryland in Bangladesh will be permanently inundated; the fall in production in all sectors in the economy due to the land quantity shock would lead to a fall in real GDP

Worldwide Sources of Global Warming?

- On a per capita basis, the richer nations are much the worst polluters
- But in total quantities, China, USA and India are the three biggest polluters, accounting for over half of all global CO_2 emissions
- Moreover, the volume of pollution from Third Pole countries is rising rapidly as their population growth and rising living standards are powered by fossil fuels

Per capita CO2 emissions worldwide in 2020, by country (in metric tons)

https://www.statista.com/statistics/270508/co2-emissions-per-capita-by-country/ *Note: the chart focuses on larger countries. Some smaller countries are not included.*

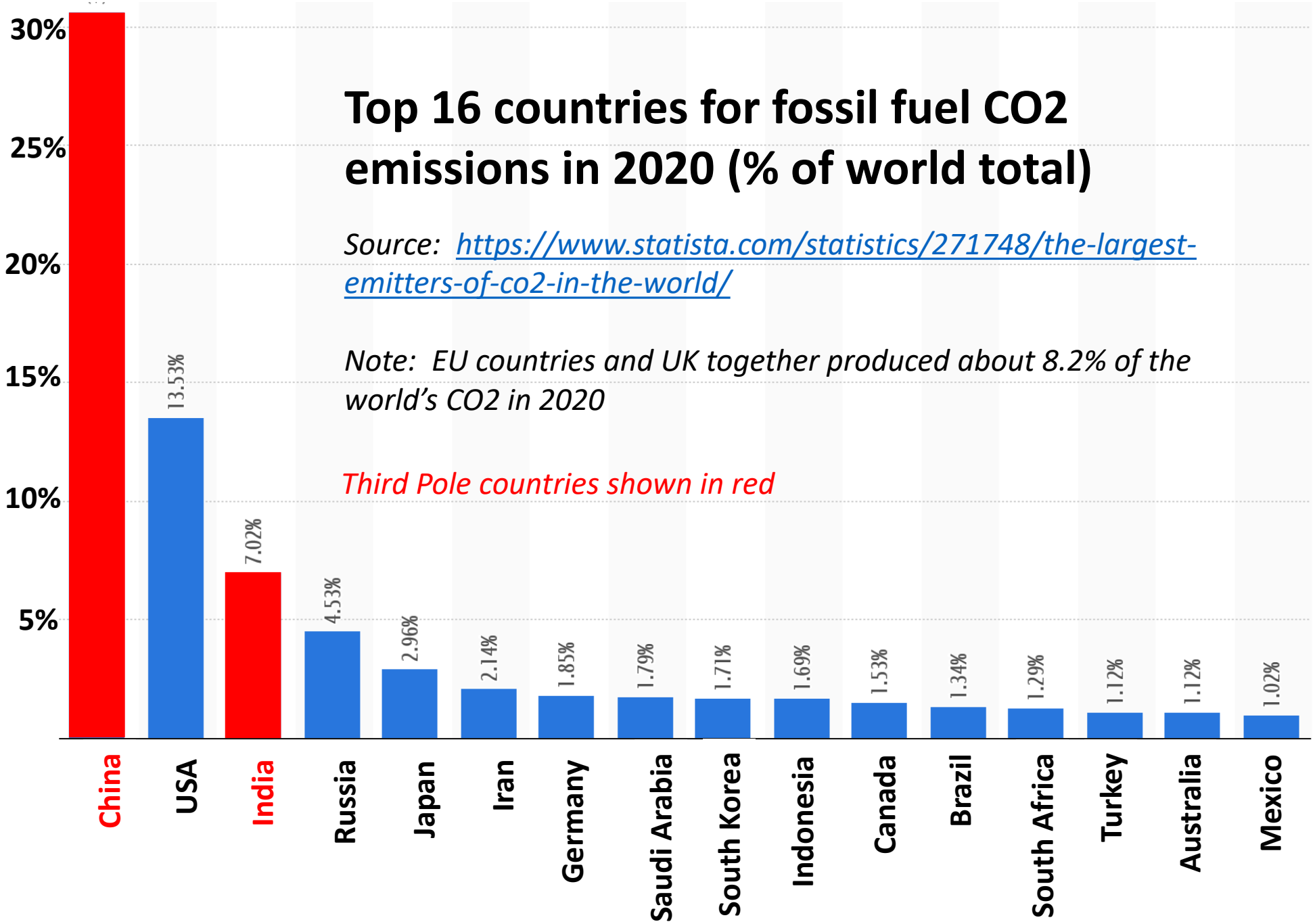


Top 16 countries for fossil fuel CO2 emissions in 2020 (% of world total)

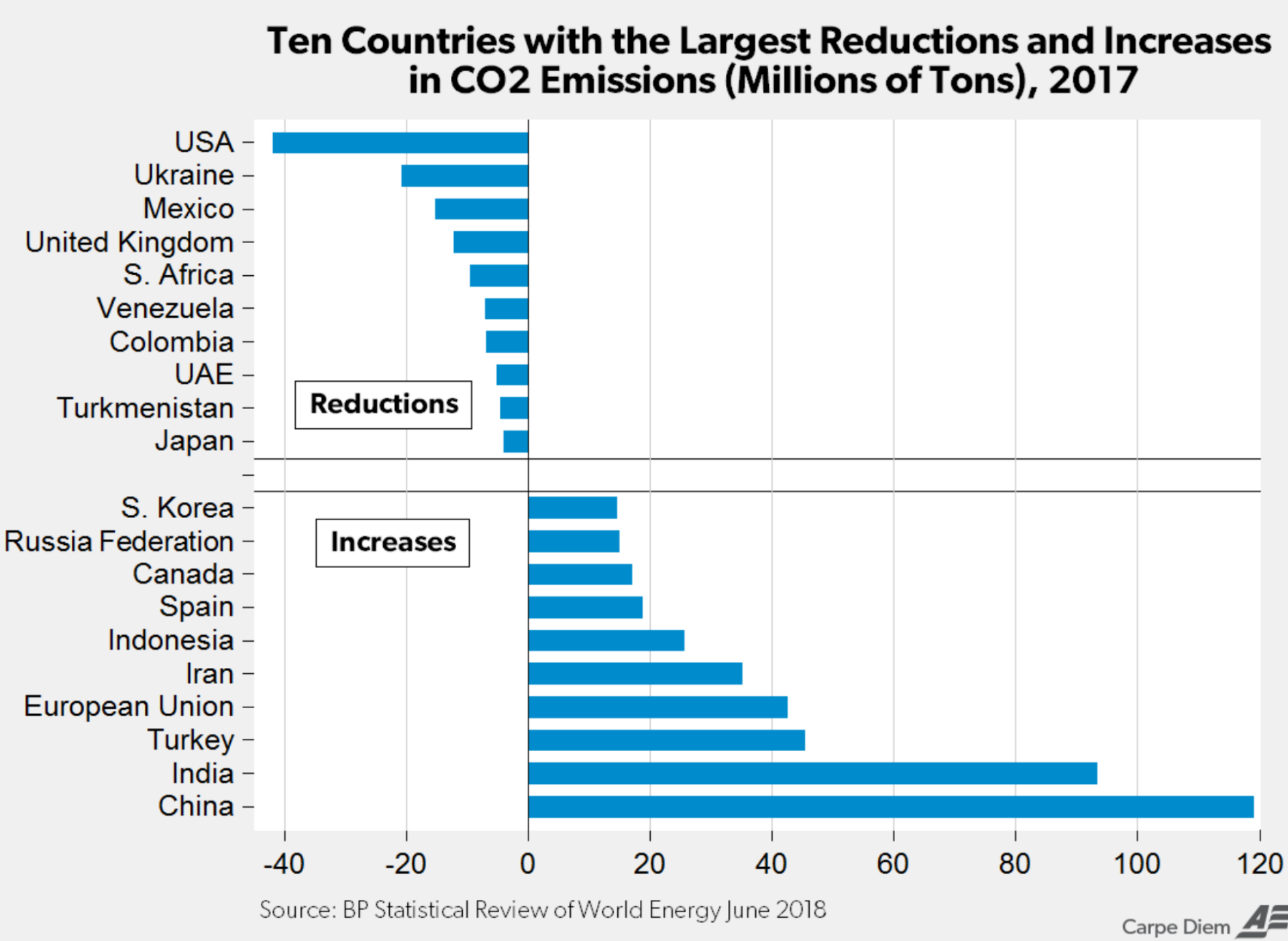
Source: https://www.statista.com/statistics/271748/the-largest-emitters-of-co2-in-the-world/

Note: EU countries and UK together produced about 8.2% of the world's CO2 in 2020

Third Pole countries shown in red



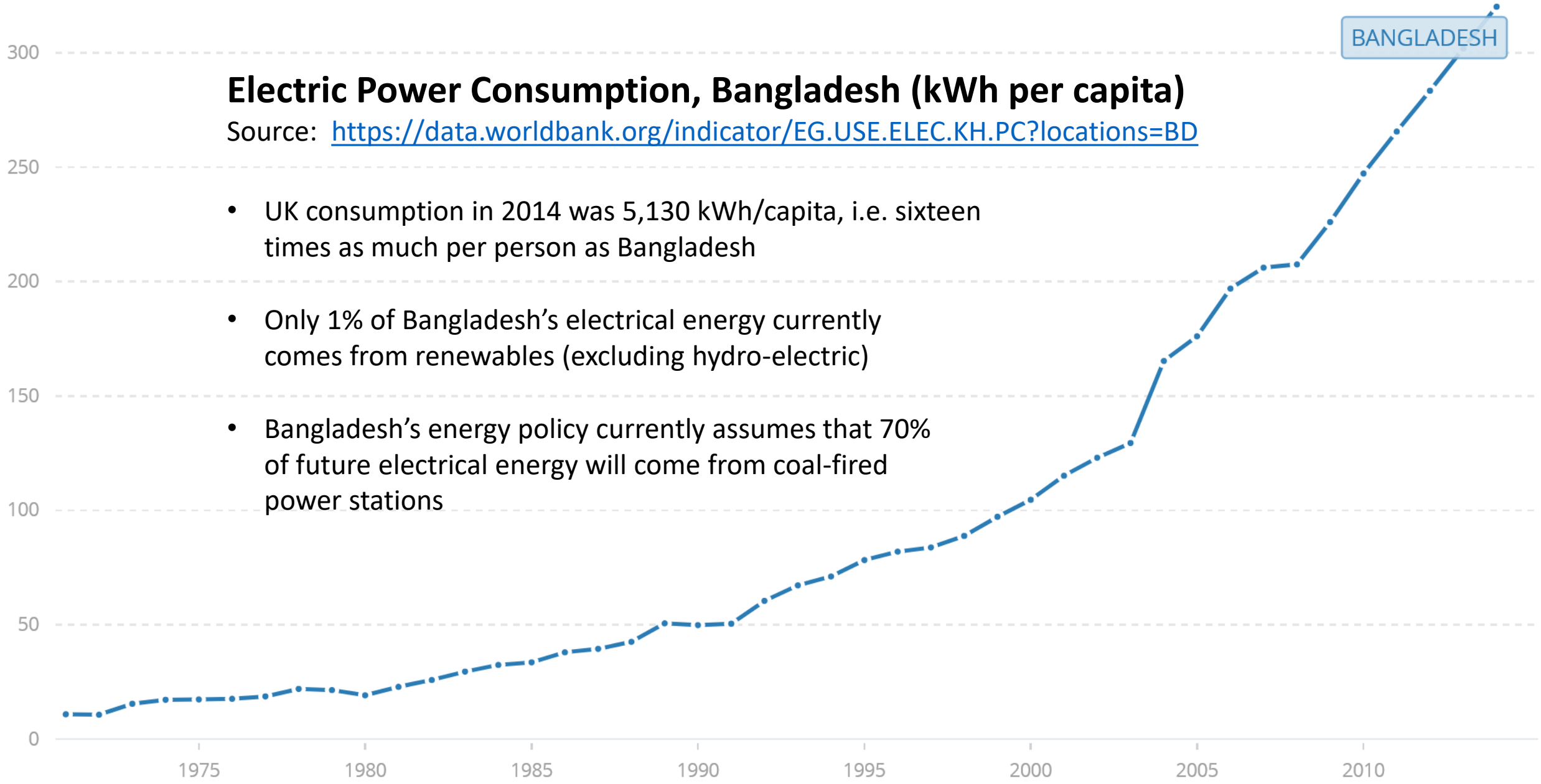
Source: https://www.aei.org/carpe-diem/chart-of-the-day-in-2017



Electric Power Consumption, Bangladesh (kWh per capita)

Source: https://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC?locations=BD

- UK consumption in 2014 was 5,130 kWh/capita, i.e. sixteen times as much per person as Bangladesh
- Only 1% of Bangladesh's electrical energy currently comes from renewables (excluding hydro-electric)
- Bangladesh's energy policy currently assumes that 70% of future electrical energy will come from coal-fired power stations



What can we do about it?

1. Richer nations must drastically reduce their greenhouse gas emissions (and show the way for other nations)
2. The Third Pole countries (and other emerging regions) must rapidly change to sustainable models of development
3. Co-operation between the Third Pole countries is essential to share the scarce water resources

Sharing Water Resources

- Two major bilateral treaties on river water in South Asia:
    i. Indus Waters Treaty between India and Pakistan (1960)
    ii. Ganges Water Treaty between India and Bangladesh (1996)
- Also, various water cooperation agreements between India and Nepal
- The **Indus Waters Treaty** was a landmark of cooperation between the two countries – it resolved a 12-year dispute over the waters of the Indus Basin and has survived three wars between India and Pakistan
- The **Ganges Treaty** was also the outcome of a longstanding dispute over sharing of river water, especially after the Farakka Barrage commenced operation in 1975 around 16 km upstream of the Bangladesh border. The Treaty assumes equitable sharing of river waters, subject to an impact review by either party. However, when the flow at Farakka was found to be far less than anticipated, further negotiations were required to enable a compromise beyond the treaty's initial agreement. Despite agreements being reached by state representatives, various groups on both sides of the border still dispute the 'fairness' of the arrangements

What can individual QSAIG members do?

- The average UK person produces about **6.03 tonnes of CO_2 equivalent per year** ***(Note: CO_2 equivalent takes account of other greenhouse gases besides Carbon Dioxide)***
- The global average is about **3.4 tonnes per person per year**
- To live sustainably, we should reduce our individual CO_2 equivalent output to about **2.1 tonnes/ person/ year**
- i.e. We need to make all of the changes on the right and more!