

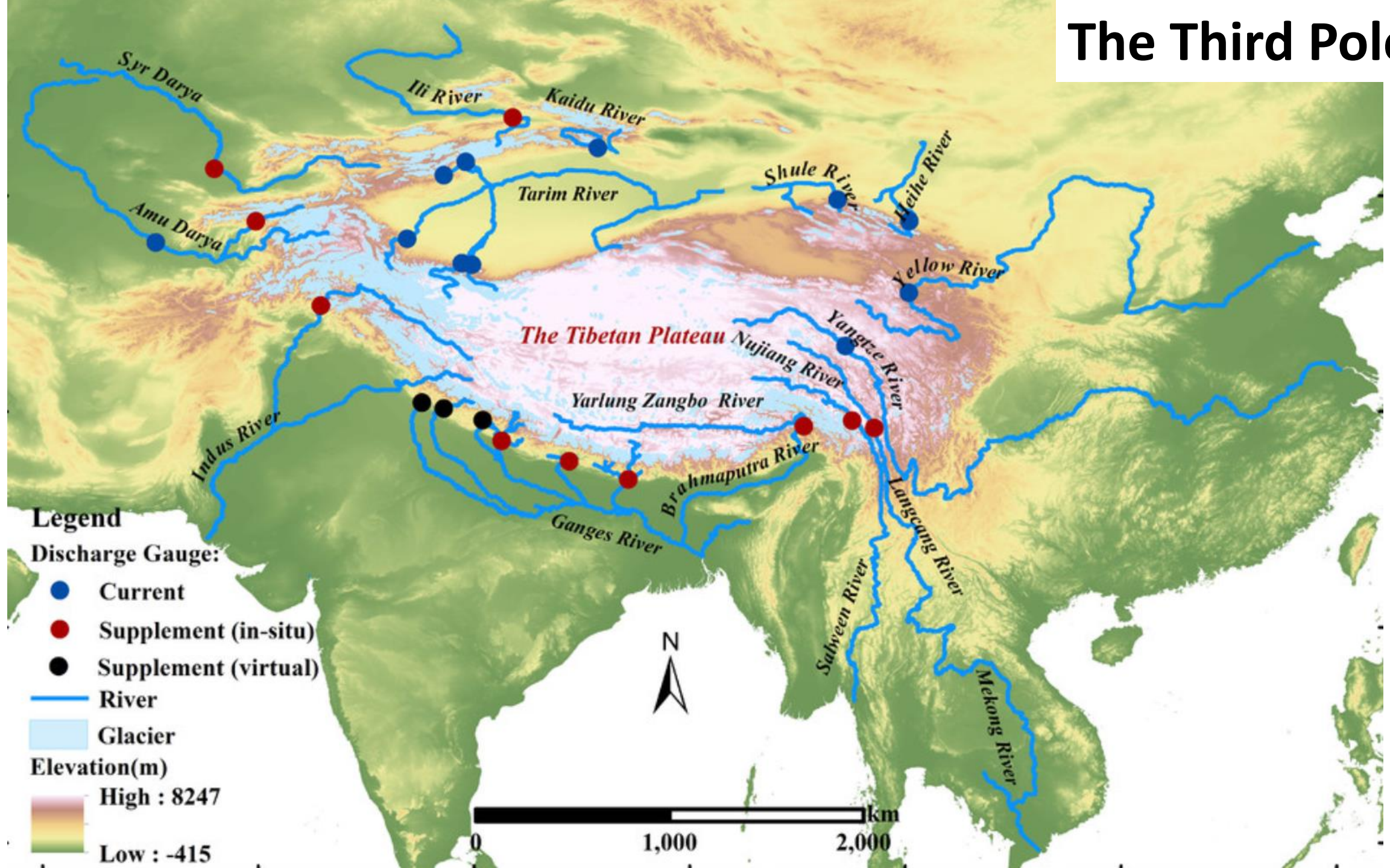
# **QSAIG: Quaker South Asia Interest Group**

*<https://www.qsaig.co.uk/>*

Presentation on the 'Third Pole' and  
climate change implications for South Asia

***Saturday 22<sup>nd</sup> April 2023***

# The Third Pole

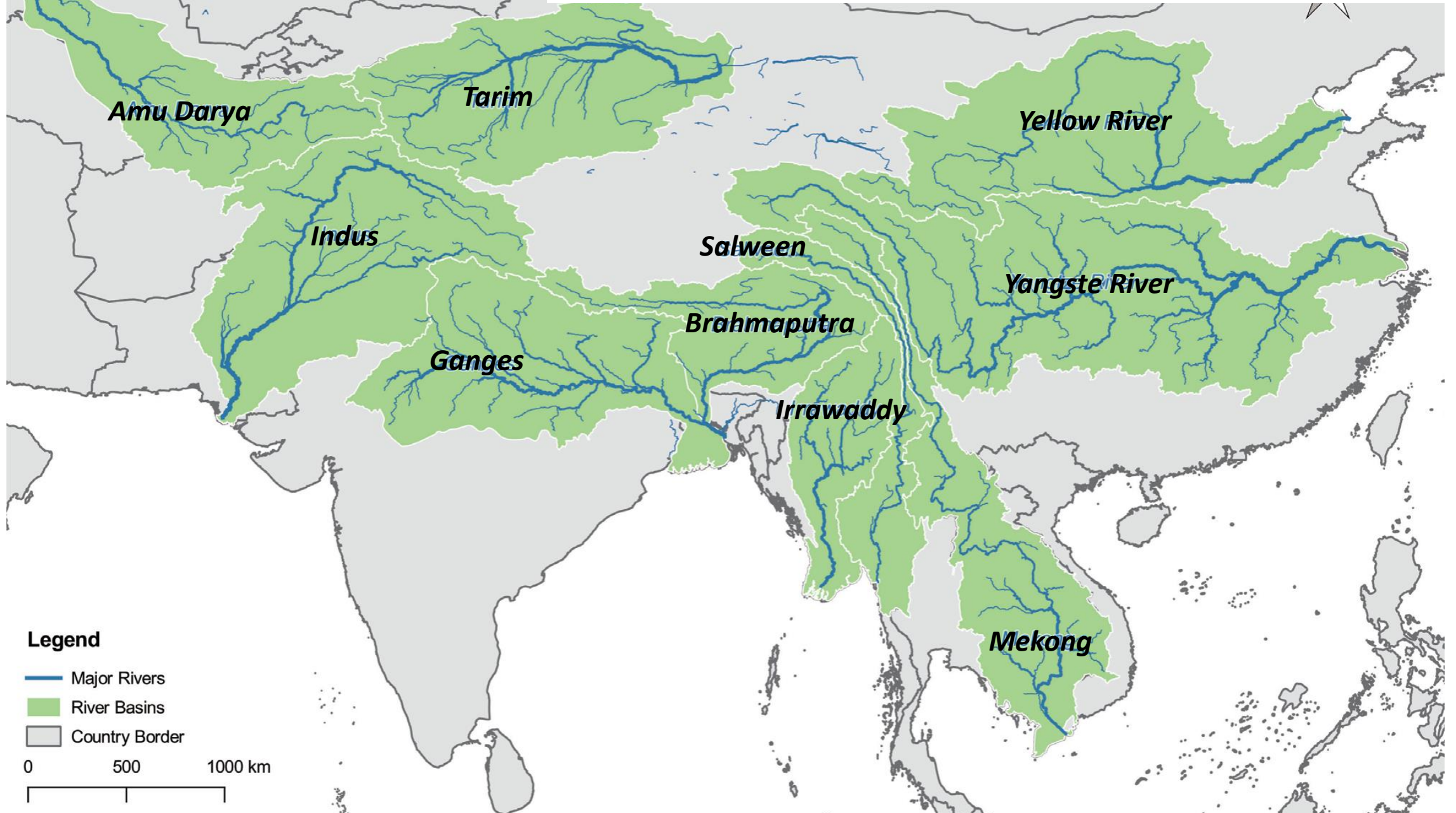


# What is the 'Third Pole'?

- The Himalayas and the Tibetan Plateau are the third largest area of frozen water on the planet
- 100,000 square kilometres, 46,000 glaciers
- Ice volume is about 7,500 km<sup>3</sup> (*this sounds a lot, but is only a tiny fraction of the ice at the North and South Poles*)
- Feeds 10 major river systems in 16 countries
- Directly serves 2 billion people in Asia – roughly one-quarter of the world's population



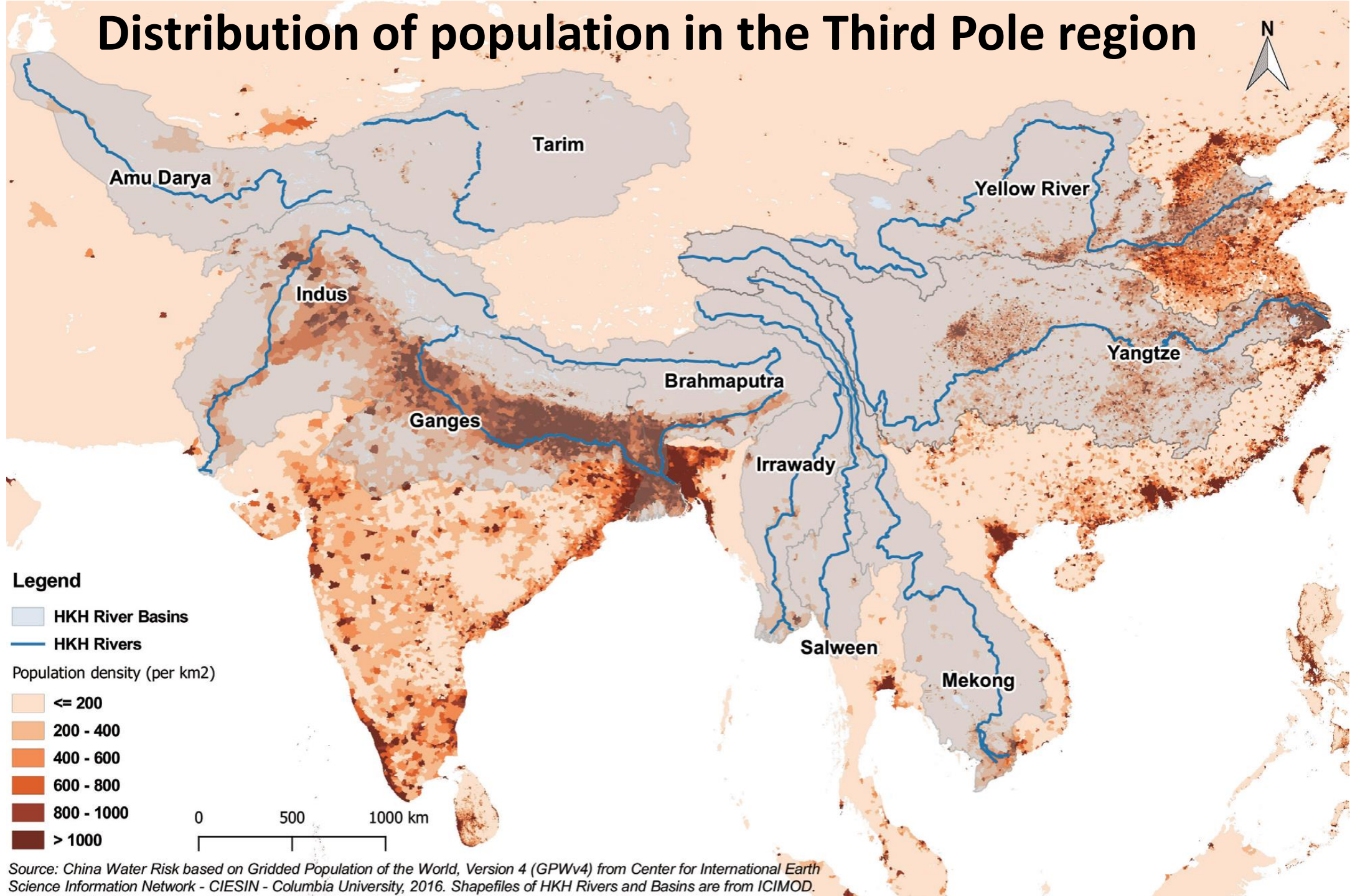
# 10 major rivers originate at the Third Pole



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

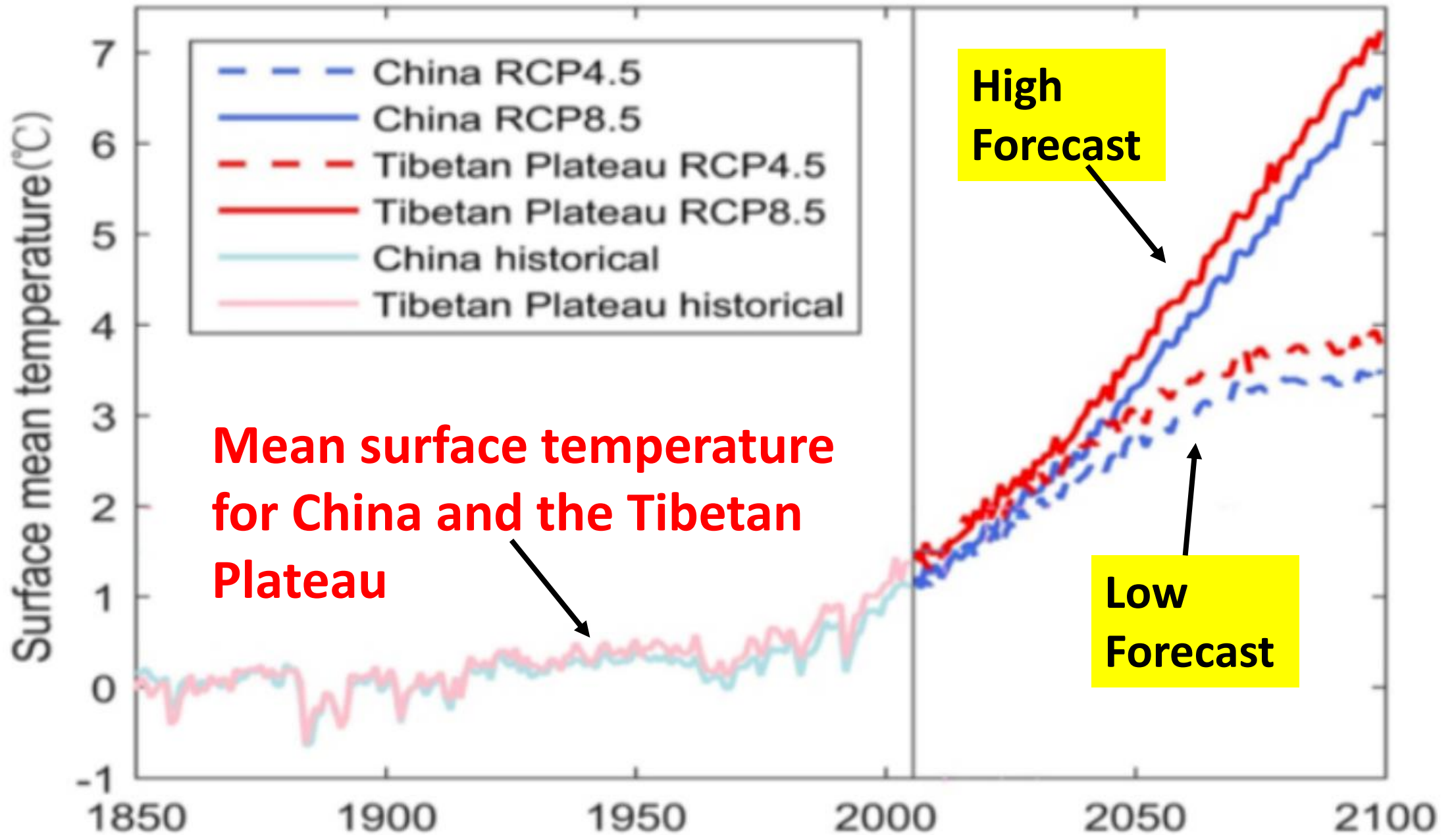


# Distribution of population in the Third Pole region



# The Climate Change Problem

- Mountain regions are especially sensitive to climate change because of absorbing energy from rising, warm, moisture-laden air
- Rate of warming in the Third Pole region is considerably greater – up to three times faster – than the global average
- The region has warmed by about 1.8 °C over the past half century
- Even with ‘best case’ scenario ( < 1.5 °C global increase), the region will experience more than 2 °C of warming
- If we fail to reduce emissions, the rise may be more than 5 °C



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

# The Third Pole is melting fast

- ICIMOD\*\* predicts 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
- Already a significant decline/thinning of the snowpack
- This 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



# Shrinking Glaciers

Kyetrak  
Glacier on the  
Tibetan  
Plateau



# Origins of the black soot

- Black soot on the Himalayan glaciers comes primarily from the west and south
- The northern and north-western plateau is under the westerly jet stream all year, so the up-wind sources are principally from **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 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*

# Impacts on the region of Third Pole melting

- (1) General global warming impacts
- (2) Specific impacts due to Third Pole warming/melting

## (1) General global warming impacts:

- **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 global warming 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 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:

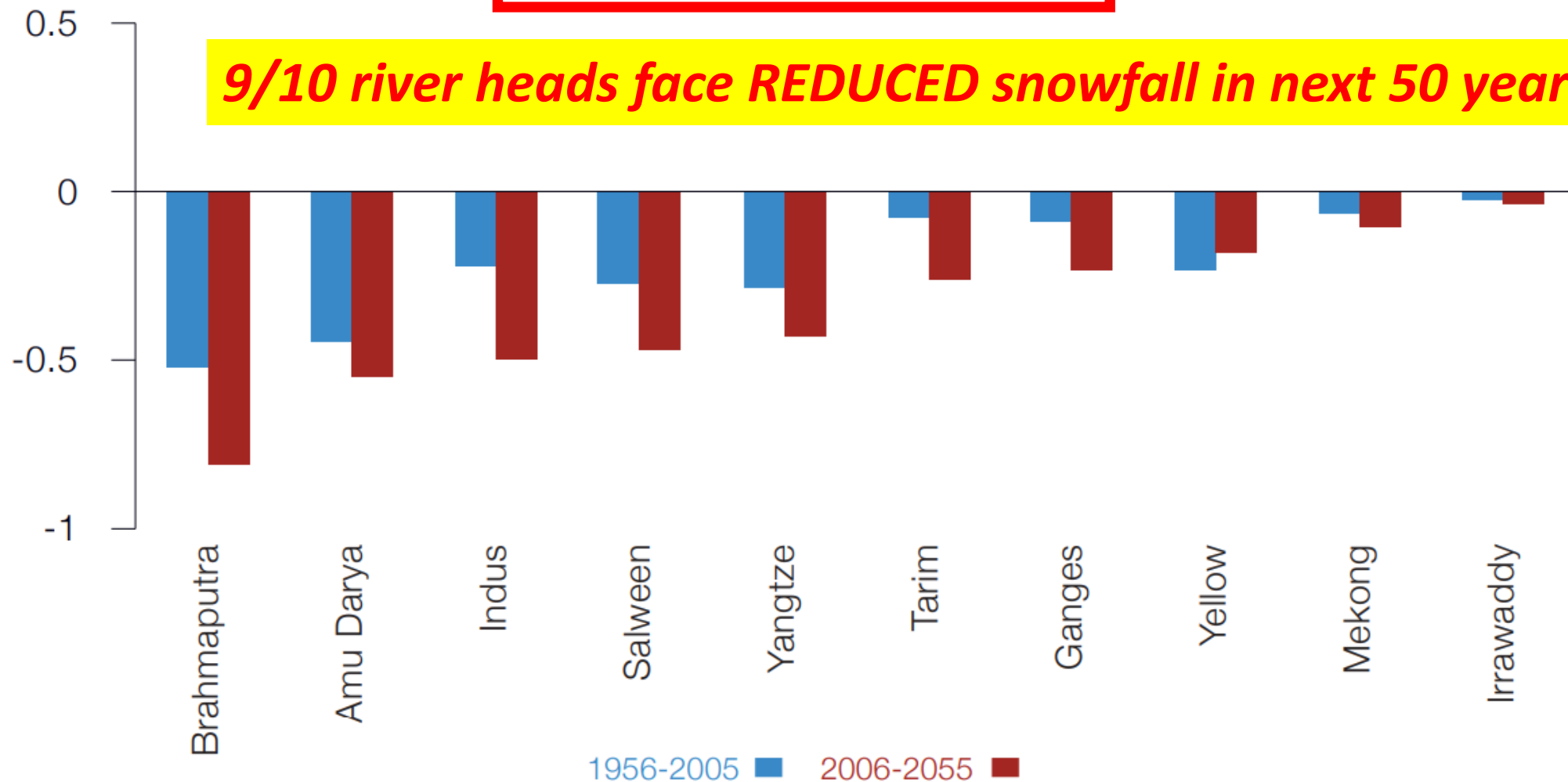
- **Increased glacial hazards:** e.g.
  - Glacial lake outbursts
  - Flash floods
  - Landslides, debris falls
- **Reduced river flows (especially in rivers dependent on meltwater):**
  - Indus River and Tarim River are particularly at risk, due to high dependency on snow and glacier melt
- **Strengthening 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

Snowfall Change (mm/year)

**9/10 river heads face REDUCED snowfall in next 50 years**



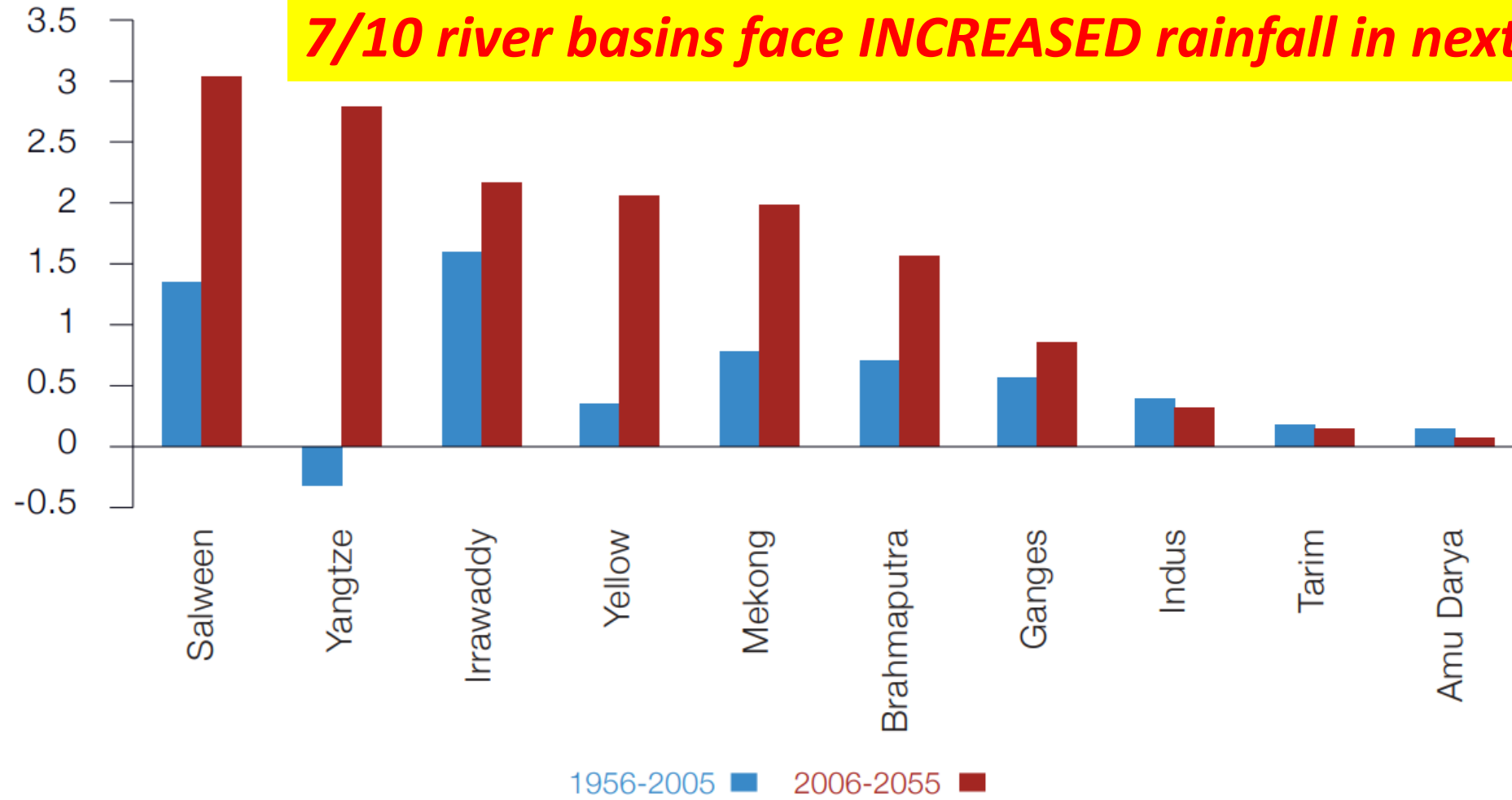
Source: China Water Risk based on data from Center for Water Resources Research, Chinese Academy of Sciences. Rainfall, snowfall and runoff change are expressed in equivalent water height. All data are calculated from five ensemble model (BCC-CSM1.1, CanESM2, CCSM4, MIROC5, MPI-ESM-LR) in IPCC AR5.



# Predicted Impacts on Third Pole Rivers

Rainfall Change (mm/year)

**7/10 river basins face INCREASED rainfall in next 50 years**

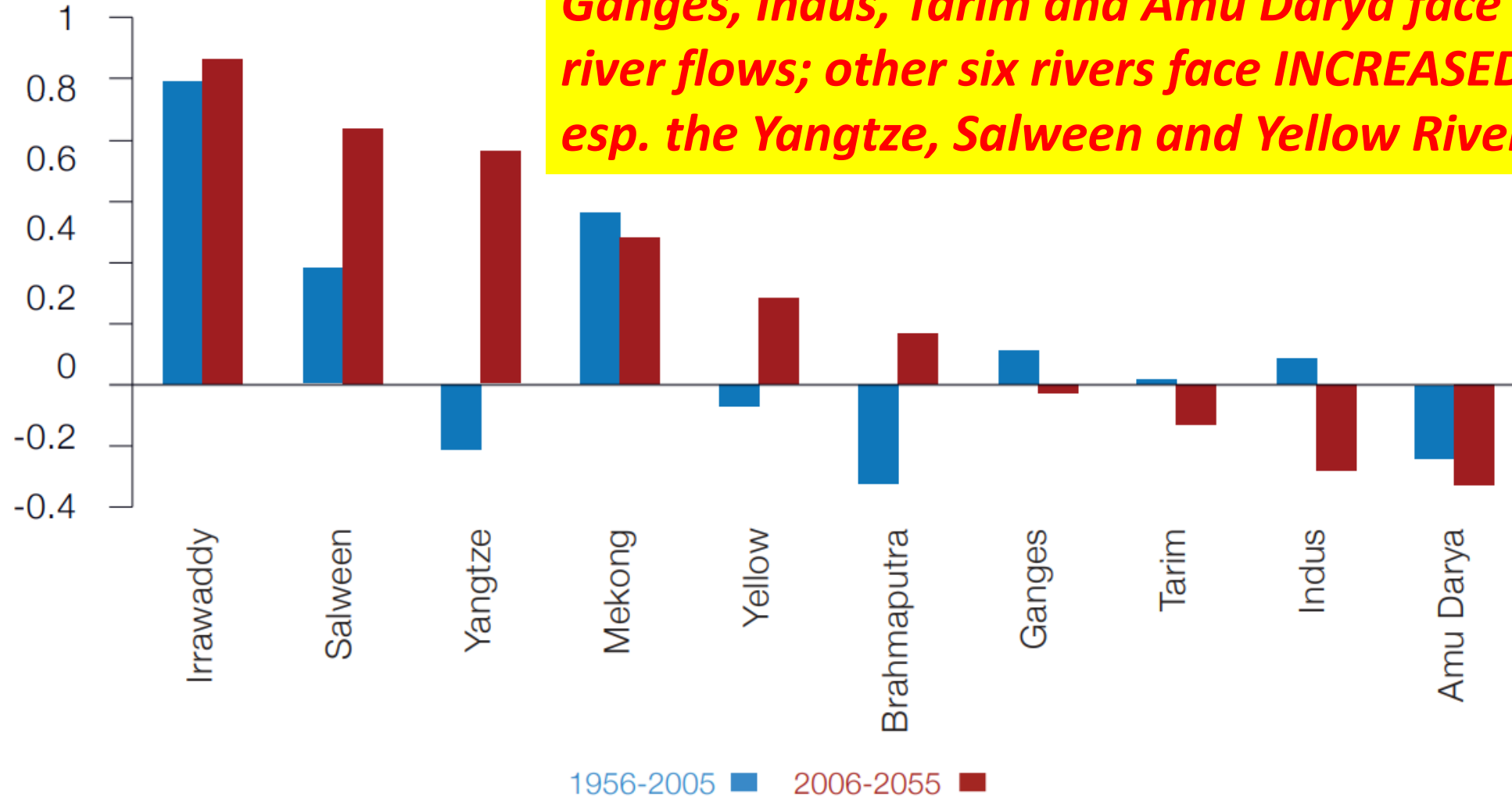


Source: China Water Risk based on data from Center for Water Resources Research, Chinese Academy of Sciences. Rainfall, snowfall and runoff change are expressed in equivalent water height. All data are calculated from five ensemble model (BCC-CSM1.1, CanESM2, CCSM4, MIROC5, MPI-ESM-LR) in IPCC AR5.

# Predicted Impacts on Third Pole Rivers

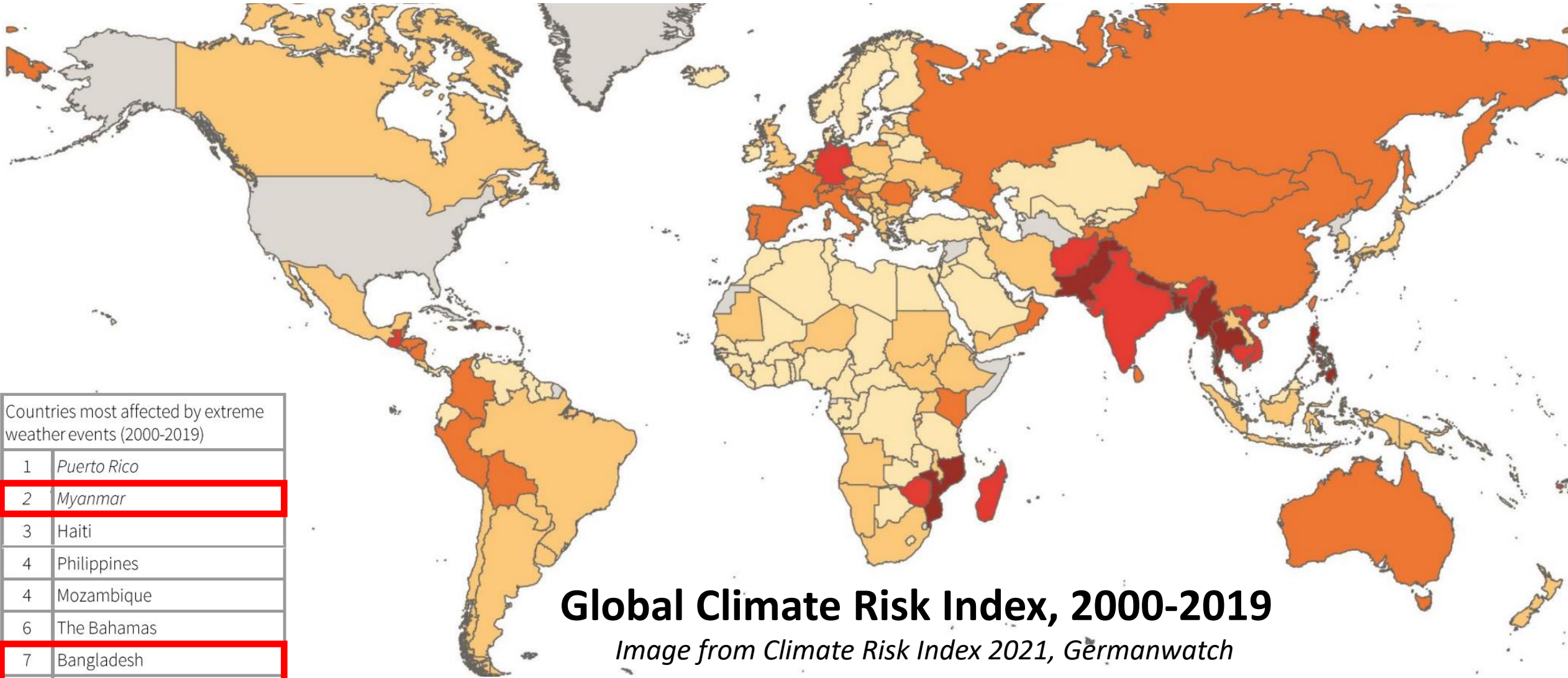
Runoff Change (mm/year)

**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.

# South Asia is one of the most vulnerable areas in the world



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

Climate Risk Index: Ranking 2000 - 2019





# **Trans-boundary Issues**

**Co-operation between the countries in the Third Pole region will be essential**

- Eight out of the 10 HKH rivers are trans-boundary
- In South Asia, 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

# Rivers Most at Risk

- The 2018 China Water Risk (CWR) report\*\* identified four priority rivers as 'greatest risk':
  1. Ganges
  2. Indus
  3. Yangtze
  4. 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

**Rainfall:** Rainfall more variable and erratic: e.g. increased pre-monsoon/monsoon rainfall in most regions, but some reductions in southern parts and eastern hills by 2050

**Floods:** Increased flood extent for all areas by mid-century (2050)

**Droughts:** The droughts in Bangladesh are not meteorological droughts but agricultural droughts (i.e. severe moisture stress). Drought risk will increase due to (i) reduced surface water from diversion of river water upstream in India, and (ii) inadequate rainfall in the dry season lowering the water table.

This could affect agriculture particularly in the Barind Tract (the land area between the Ganges and Brahmaputra)

*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)*

## Climate change impacts specifically in Bangladesh *(continued)*

**River Erosion:** Increased peak discharges will increase the river erosion. While land accretion also occurs, on balance this may be significantly **lower** than land erosion for all three major rivers

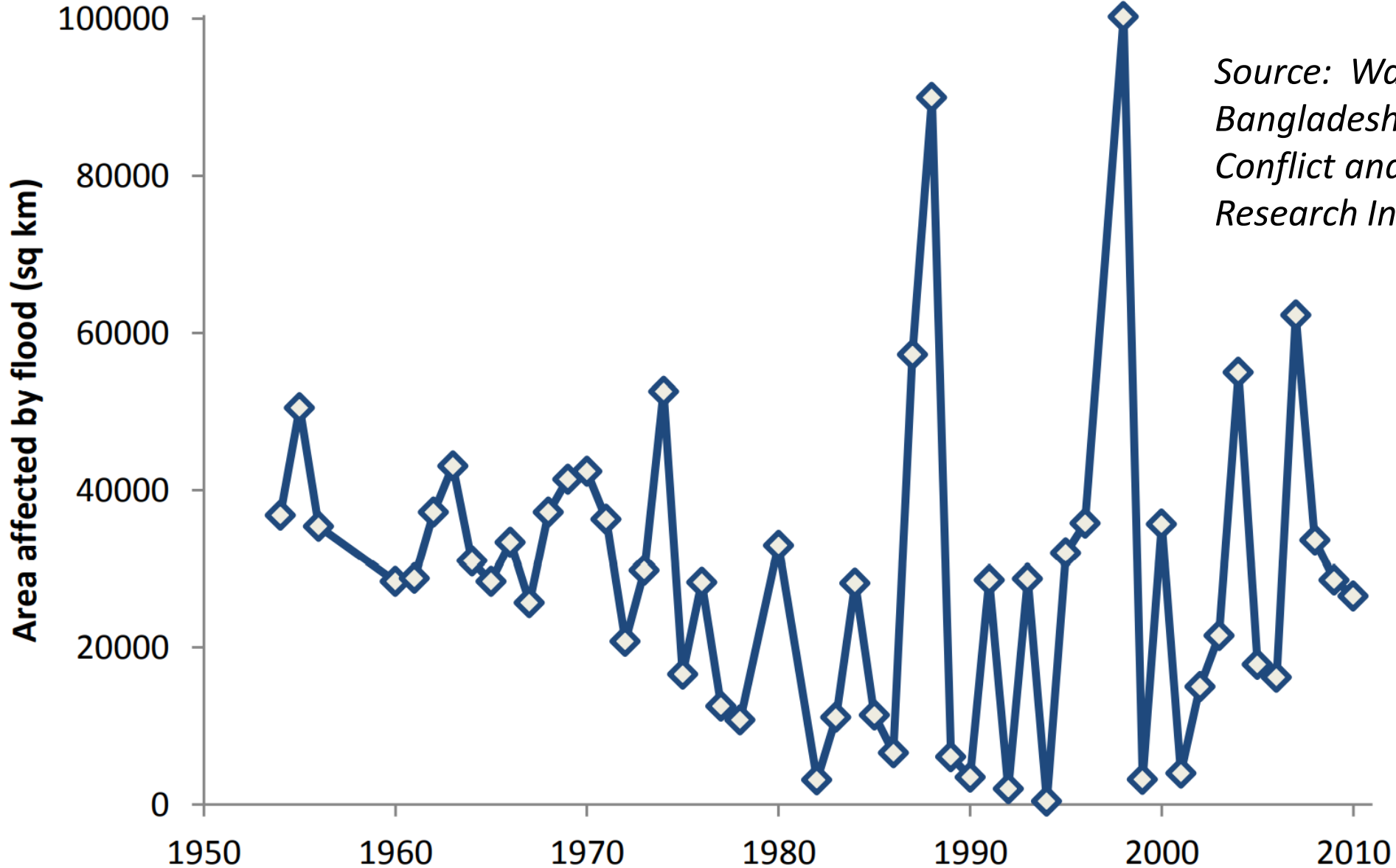
**Sea Level Rise (SLR) and Salinity Intrusion:** This is already causing problems in the Bangladesh delta. Future sea level rises of between 0.2m to 1m are predicted by 2100 (IPCC, 2013). This will impede fresh water availability, and the area of high salinity (5 ppt) may increase from 16% (2005) to 24% by 2025

**Cyclones and Storm Surges:** A severe cyclone currently strikes Bangladesh every three years, on average. The intensity of cyclonic storm surges as well as the depth and extent of induced coastal inundation are likely to increase due to rising sea level and sea surface temperature



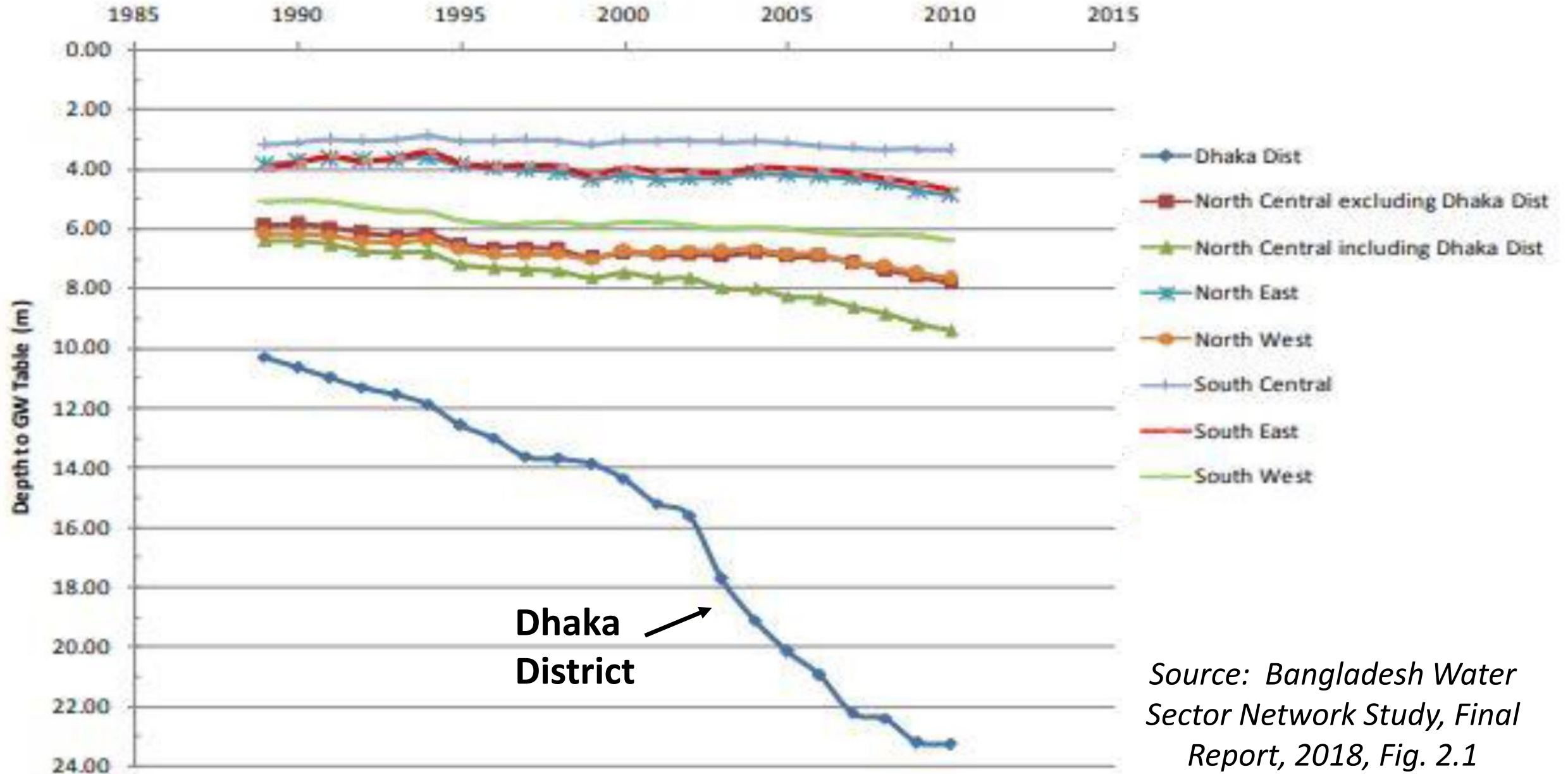
# Floods in Bangladesh 1954-2010

**- 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

# Bangladesh – Potential Impacts on Foodgrain and Infrastructure

*Bangladesh Delta Plan 2100, page 12*

- Agriculture is the most vulnerable sector :
  - Yields of high-yielding varieties of Aus, Aman, and Boro rice likely to be reduced due to higher temperatures
  - Increased incidence of insect pests, diseases, and micro-organisms
  - Predicted decline of about 17% in overall rice production and up to 61% in wheat production, compared with the baseline situation
  - Agriculture will also suffer from increased soil salinity in coastal areas. 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
- Other adverse effects include loss of land and physical assets from inundation:
  - At 1m sea level rise, a significant part of dryland in Bangladesh will be permanently inundated

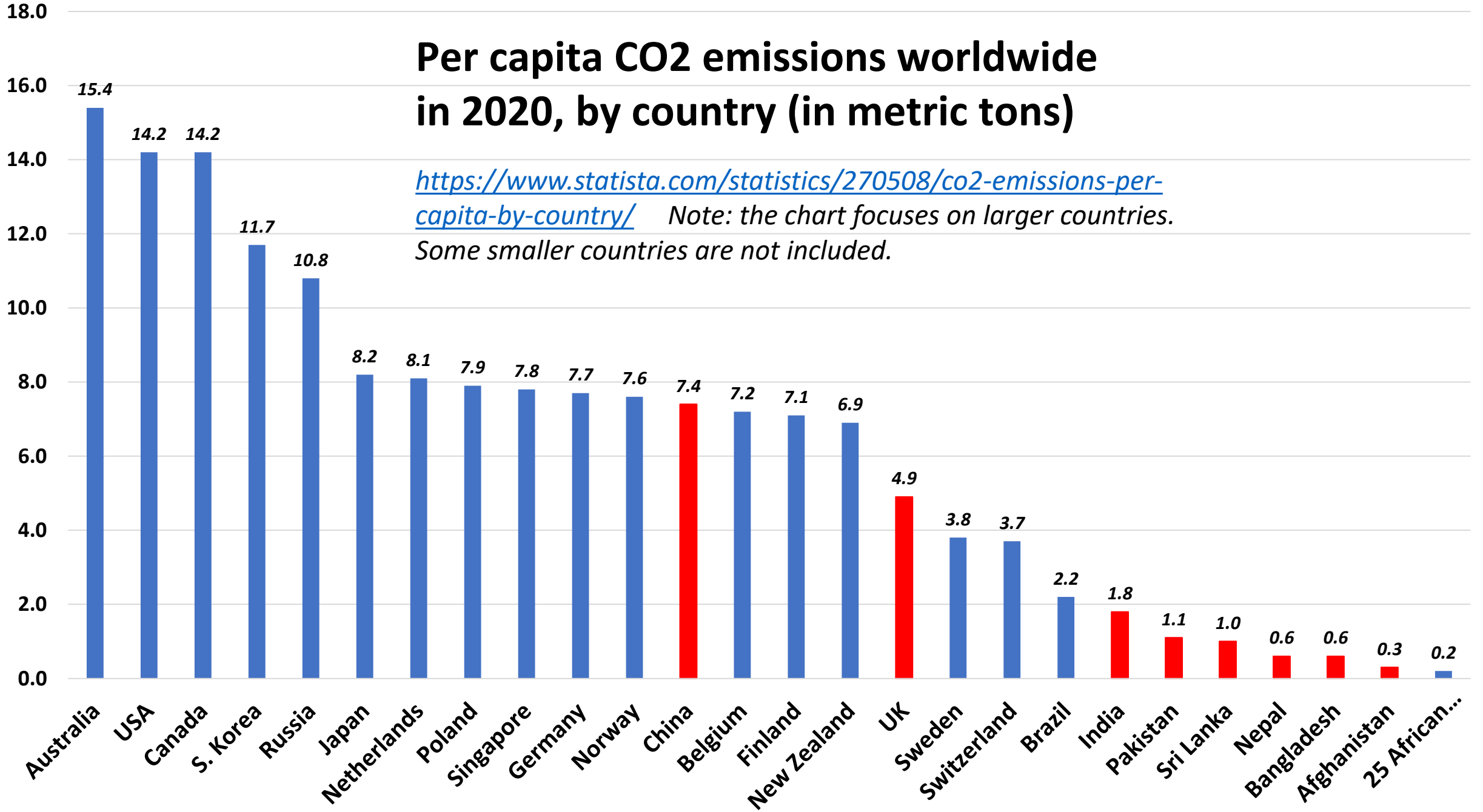
# Who is responsible for Global Warming?

- 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<sub>2</sub> 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.

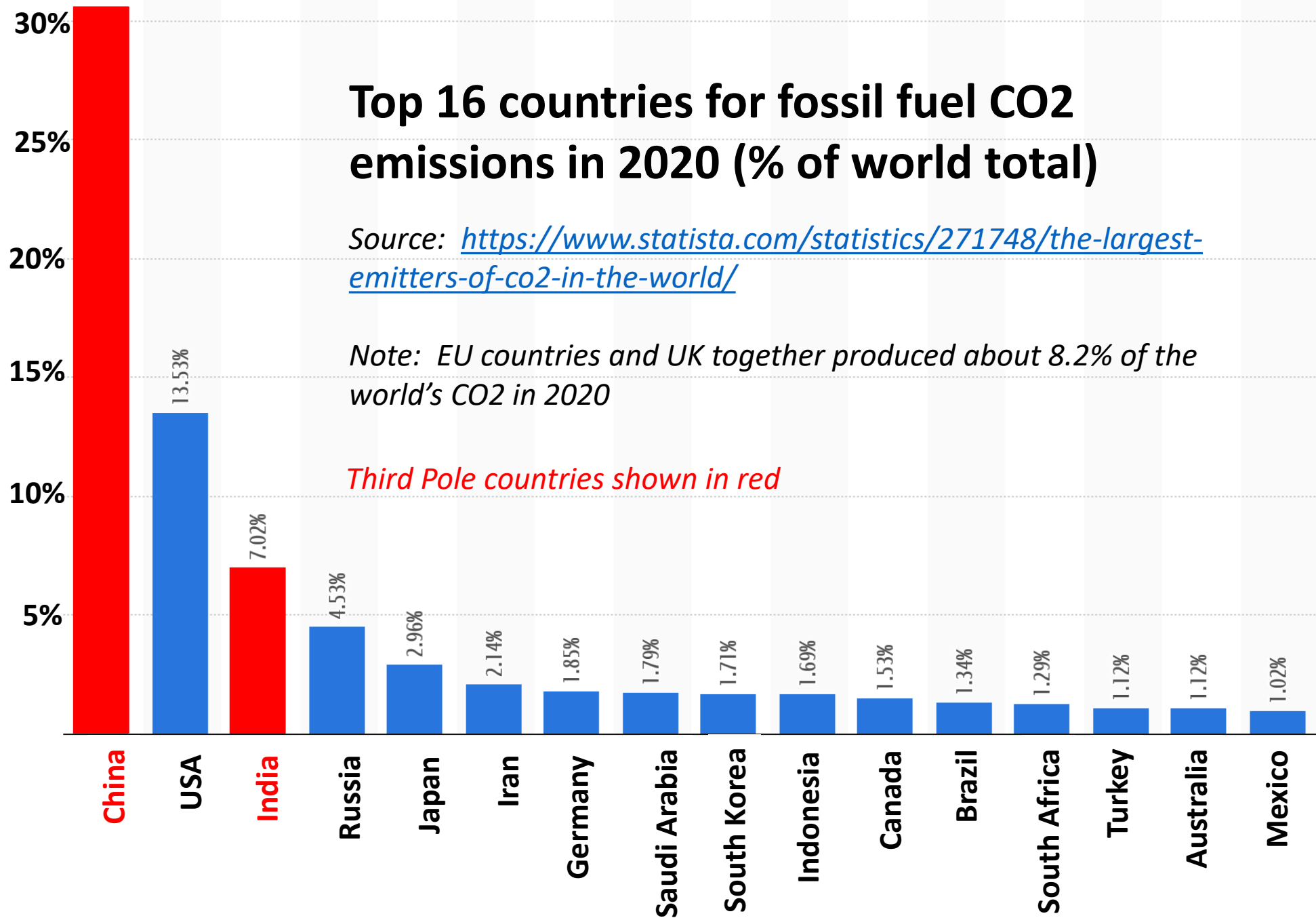


# Top 16 countries for fossil fuel CO2 emissions in 2020 (% of world total)

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

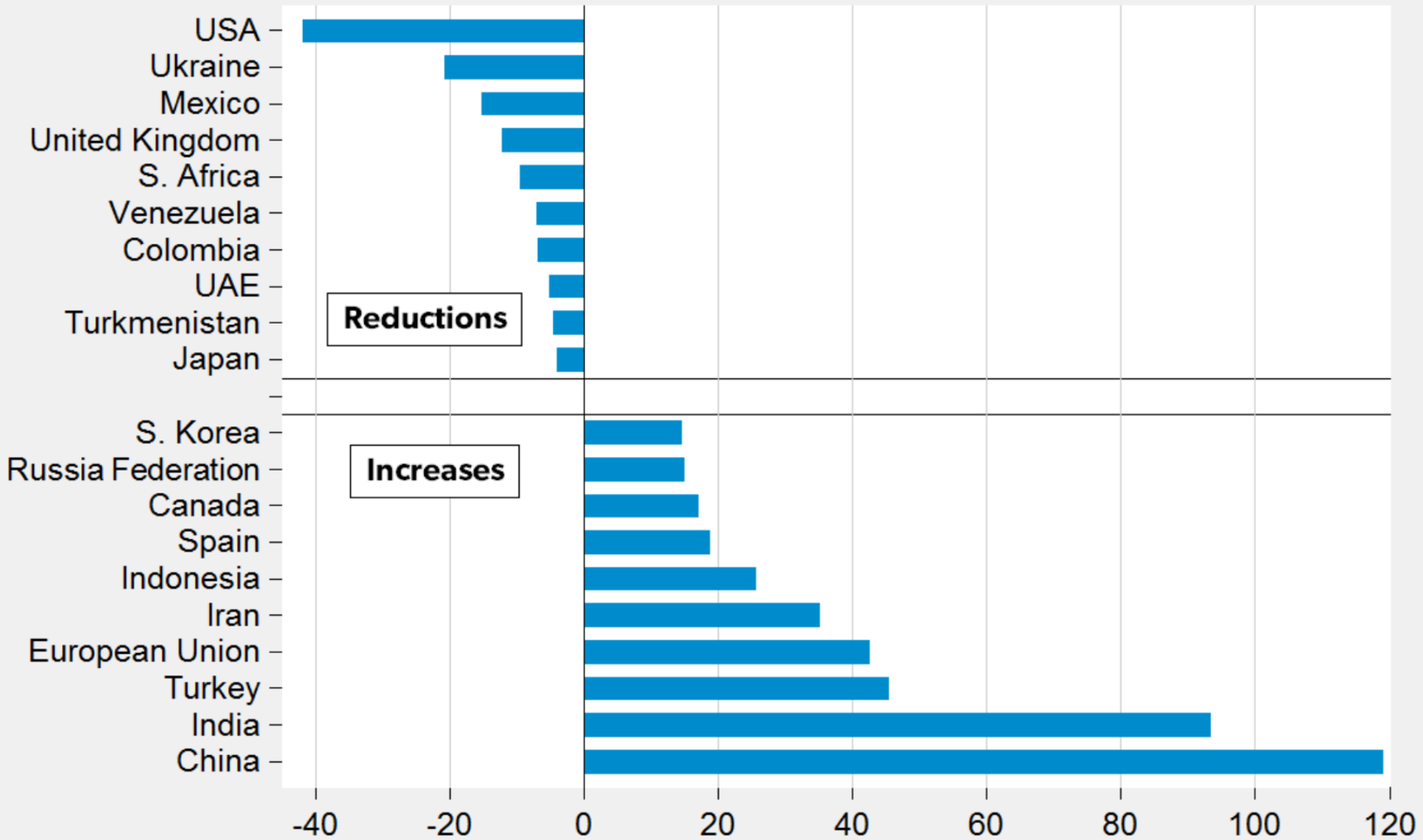
Note: EU countries and UK together produced about 8.2% of the world's CO2 in 2020

Third Pole countries shown in red



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

## Ten Countries with the Largest Reductions and Increases in CO2 Emissions (Millions of Tons), 2017



Source: BP Statistical Review of World Energy June 2018

# 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.

But despite agreements between the 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<sub>2</sub> equivalent per year** *(Note: CO<sub>2</sub> 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<sub>2</sub> equivalent output to about **2.1 tonnes/ person/ year**
- i.e. We need to make all of the changes on the right and more!

## Top options for reducing your carbon footprint

Average reduction per person per year in tonnes of CO<sub>2</sub> equivalent



Live car-free  
**2.04**



Refurbishment /renovation  
**0.895**



Battery electric car  
**1.95**



Vegan diet  
**0.8**



One less long-haul flight per year  
**1.68**



Heat pump  
**0.795**



Renewable energy  
**1.6**



Improved cooking equipment  
**0.65**



Public transport  
**0.98**



Renewable-based heating  
**0.64**