Downstream Impacts of Climate Change in the Hindu Kush Himalaya Mountains

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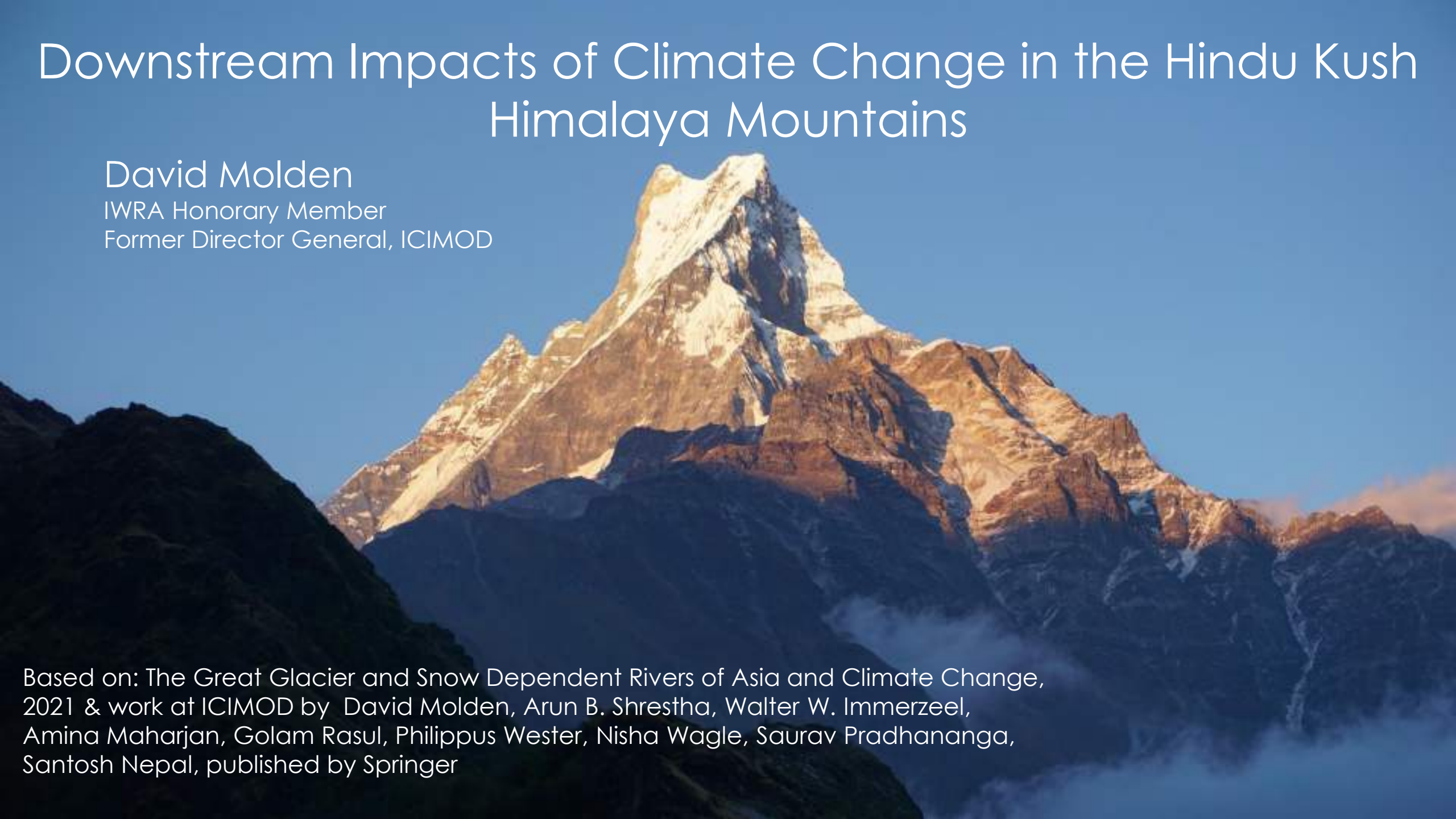
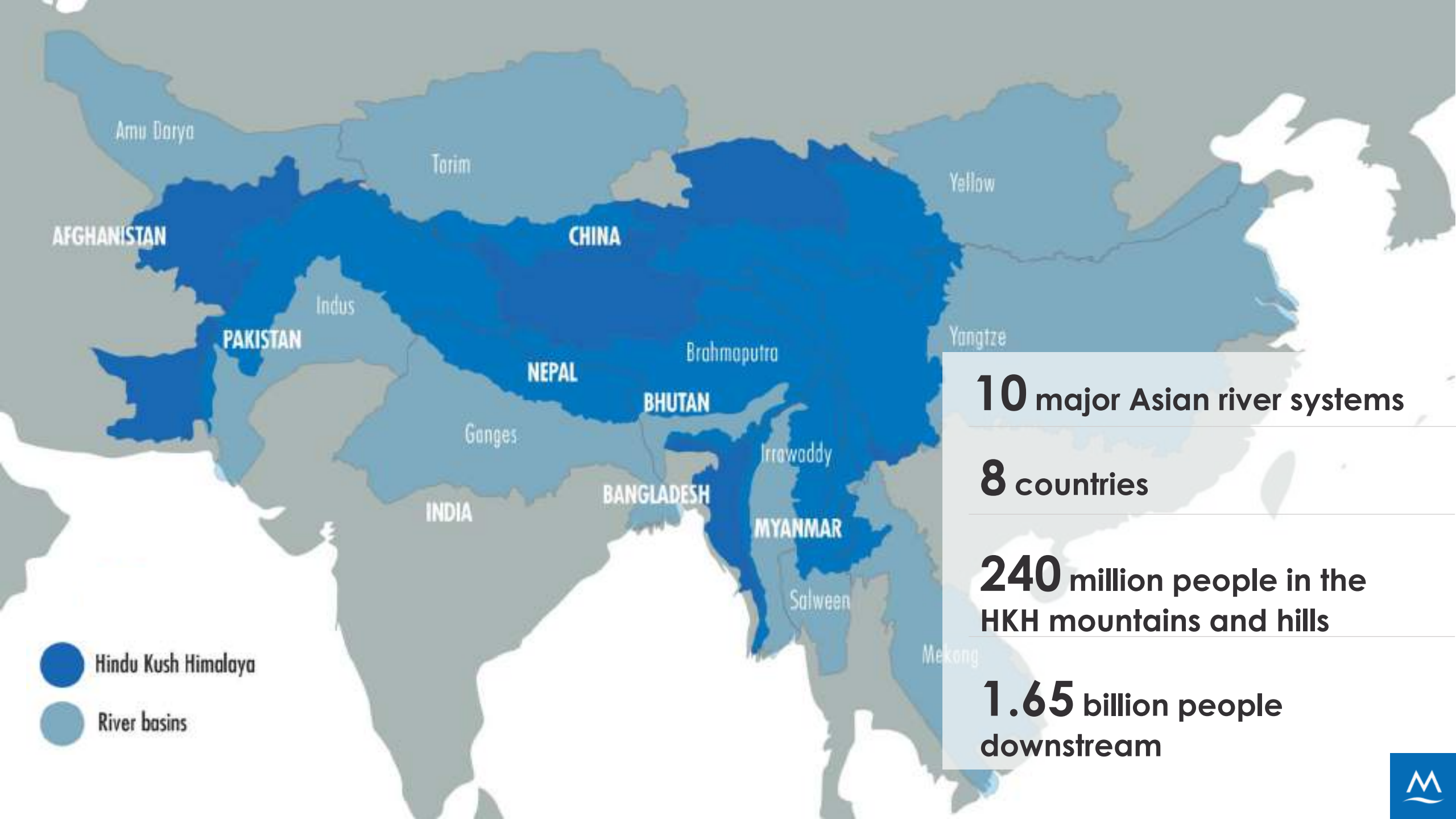


Based on: The Great Glacier and Snow Dependent Rivers of Asia and Climate Change, 2021 & work at ICIMOD by David Molden, Arun B. Shrestha, Walter W. Immerzeel, Amina Maharjan, Golam Rasul, Philippus Wester, Nisha Wagle, Saurav Pradhananga, Santosh Nepal, published by Springer



10 major Asian river systems

8 countries

240 million people in the HKH mountains and hills

1.65 billion people downstream


What happens here
affects one-fourth
of humanity

Food Insecurity

30% **of HKH population suffers from food insecurity**

50% **malnutrition, and one-fifth to one-half of children >5 suffer from stunting**

Energy Poverty

500 GW **hydro potential = energy for half a billion homes**

80% **rural population in HKH countries lacks access to clean energy for cooking**

High Out-Migration

Labor migration contributes significantly to poverty reduction in HKH region, but depends on who is able to move and under what conditions

Poverty

1/3 **in mountains** compared to

1/4 **national average**

HIMAP

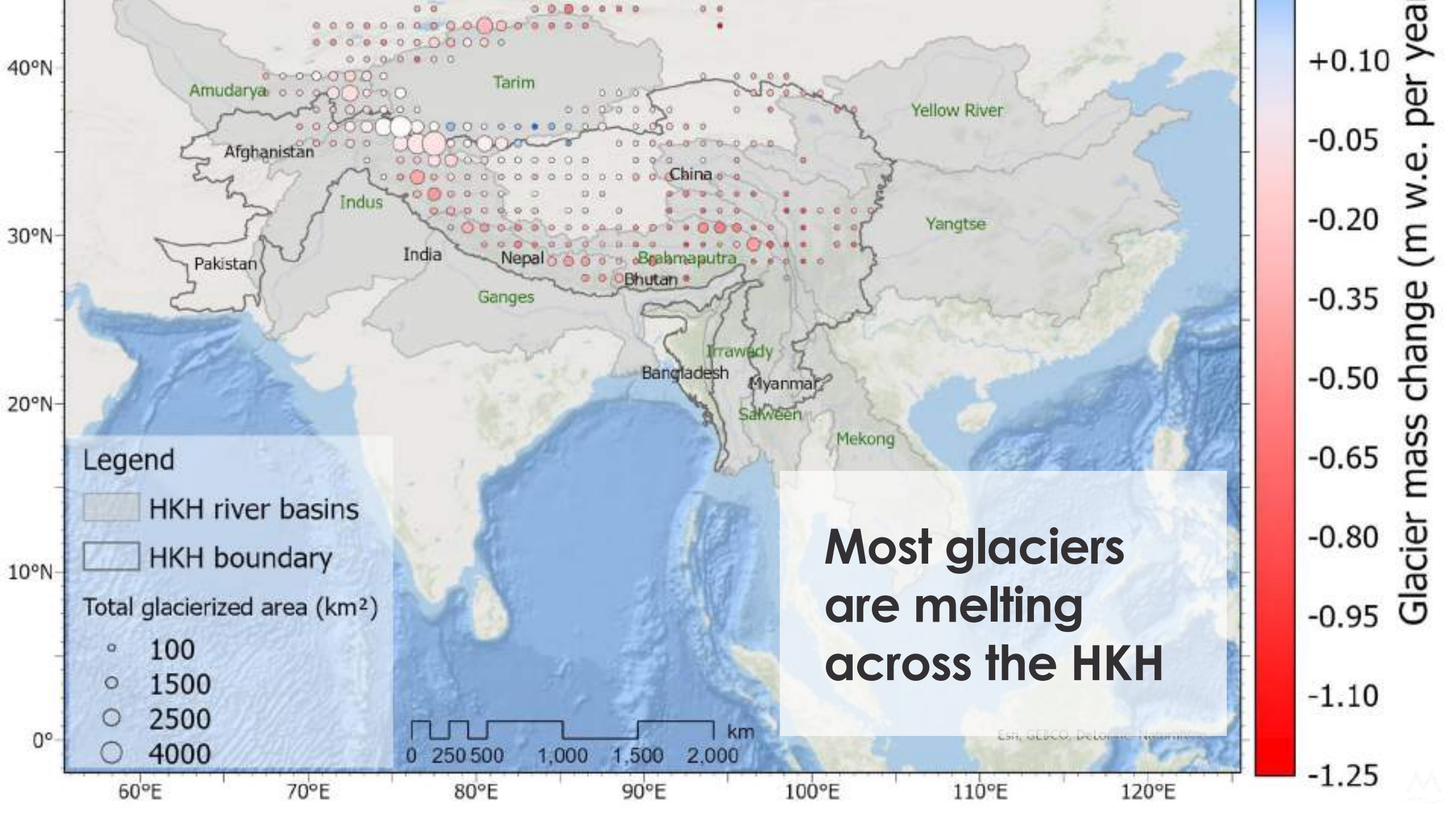
Temperature rise is amplified at altitude and latitude

Even 1.5 degrees is too hot for the HKH

- 5.5 ± 1.5˚C by 2100 relative to 1976-2005 at current emission trends
- 2.5 ± 1.5˚C by 2100 relative to 1976-2005 (RCP 4.5)
- 2.1 ± 0.1˚C (PI) in a 1.5 degree world

HIMAP

What is happening to the glaciers?


Amudarya
Tarim
Yellow River
Afghanistan
China
Indus
Yangtse
Pakistan
India
Nepal
Brahmaputra
Bhutan
Ganges
Irrawady
Bangladesh
Myanmar
Salween
Mekong
40°N
30°N
20°N
10°N
0°
60°E
70°E
80°E
90°E
100°E
110°E
120°E
Legend
HKH river basins
HKH boundary
Total glacierized area (km²)
100
1500
2500
4000
0 250 500 1,000 1,500 2,000
km
+0.10
-0.05
-0.20
-0.35
-0.50
-0.65
-0.80
-0.95
-1.10
-1.25
Glacier mass change (m w.e. per year)
Most glaciers are melting across the HKH

In a 1.5˚C world, glaciers in the HKH will lose 1/3 of their volume by 2100

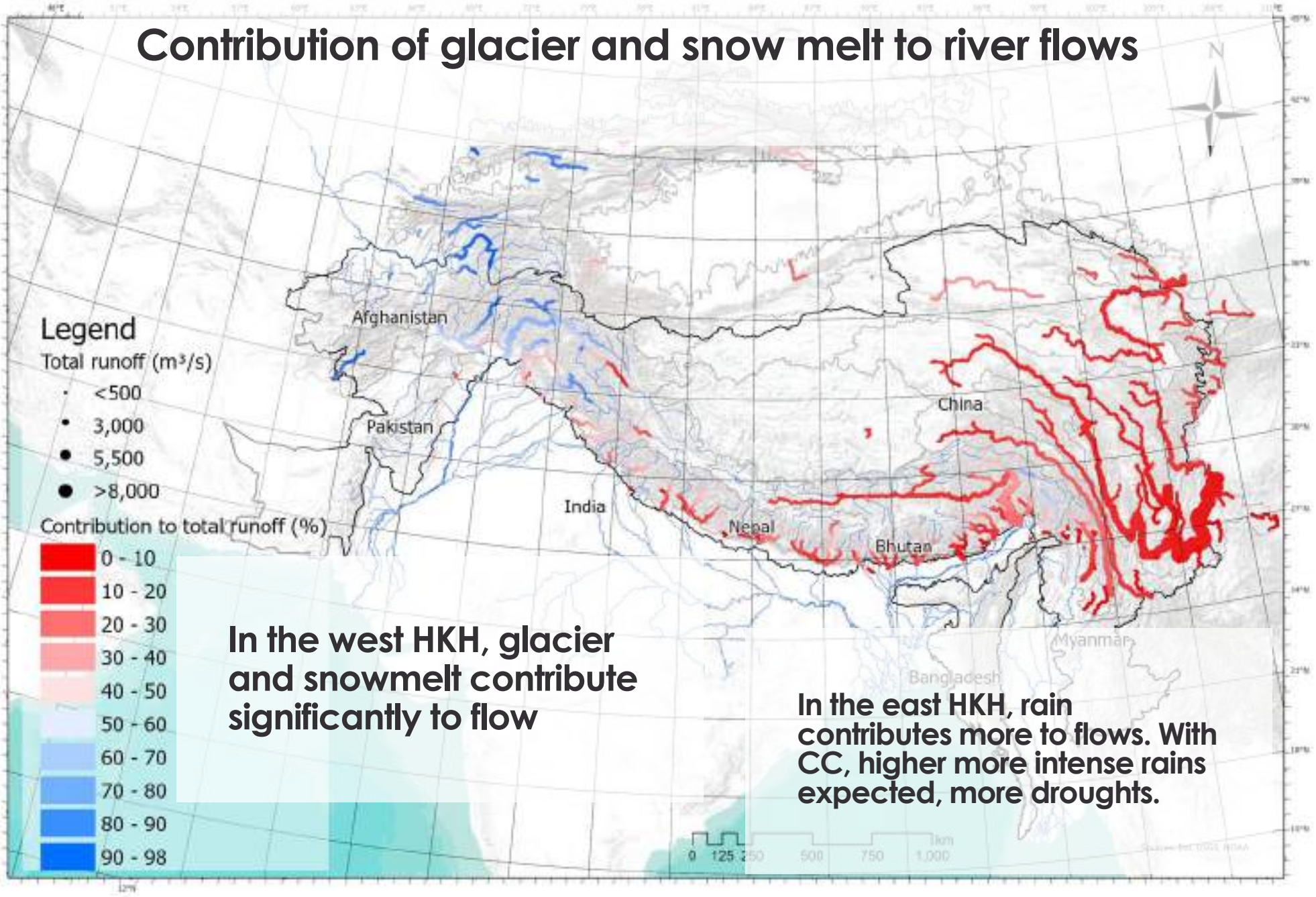
And 2/3 of their volume under current emission trends

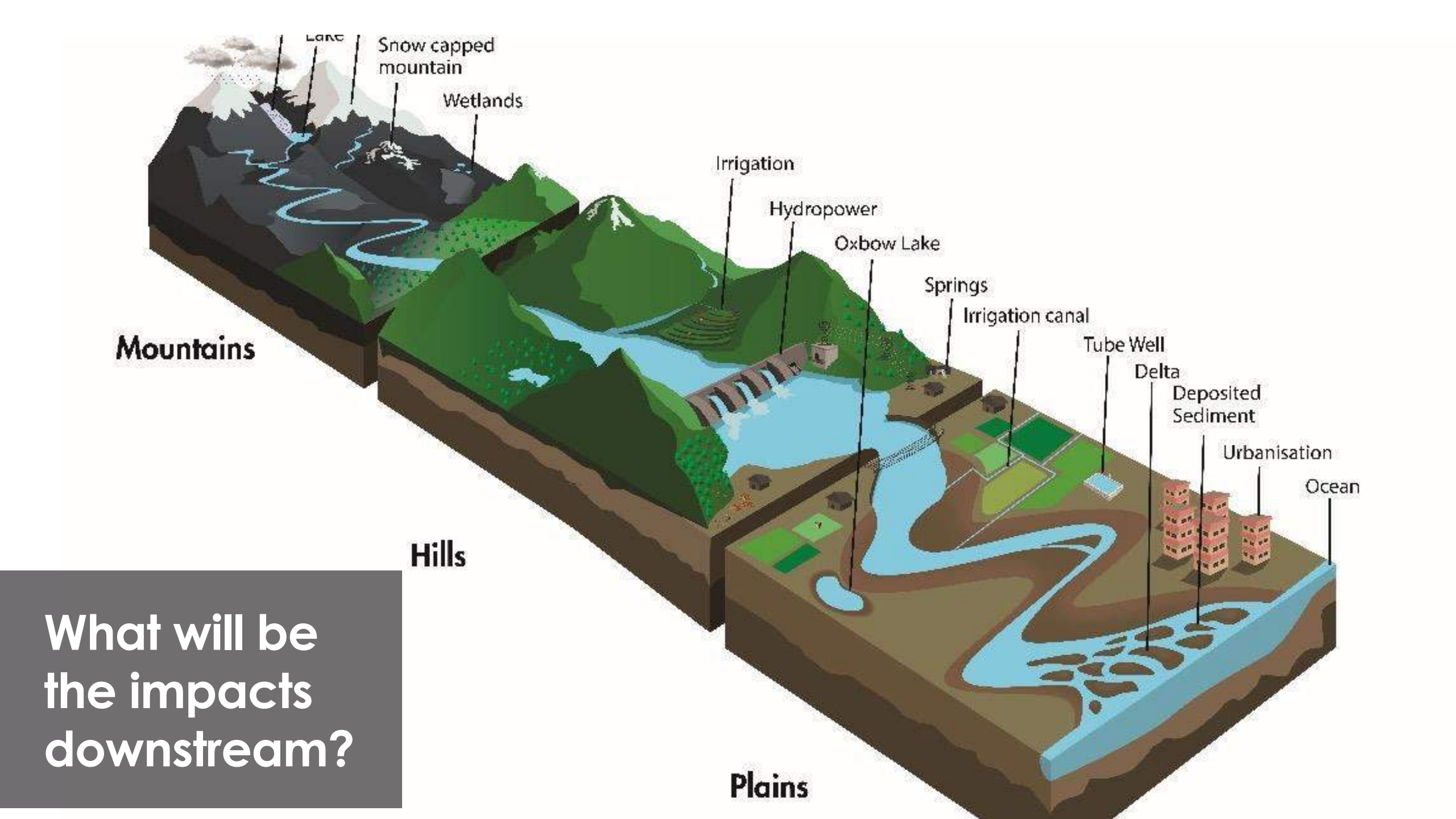
Snow covered areas and snow volumes will decrease and snowline elevations will rise;

Snow melt induced run-off peak will be stronger and occur earlier in the year

Source: HIMAP climate change and cryosphere chapters and Kraaijenbrink et al. 2017, Nature

Contribution of glacier and snow melt to river flows





What will be the impacts downstream?

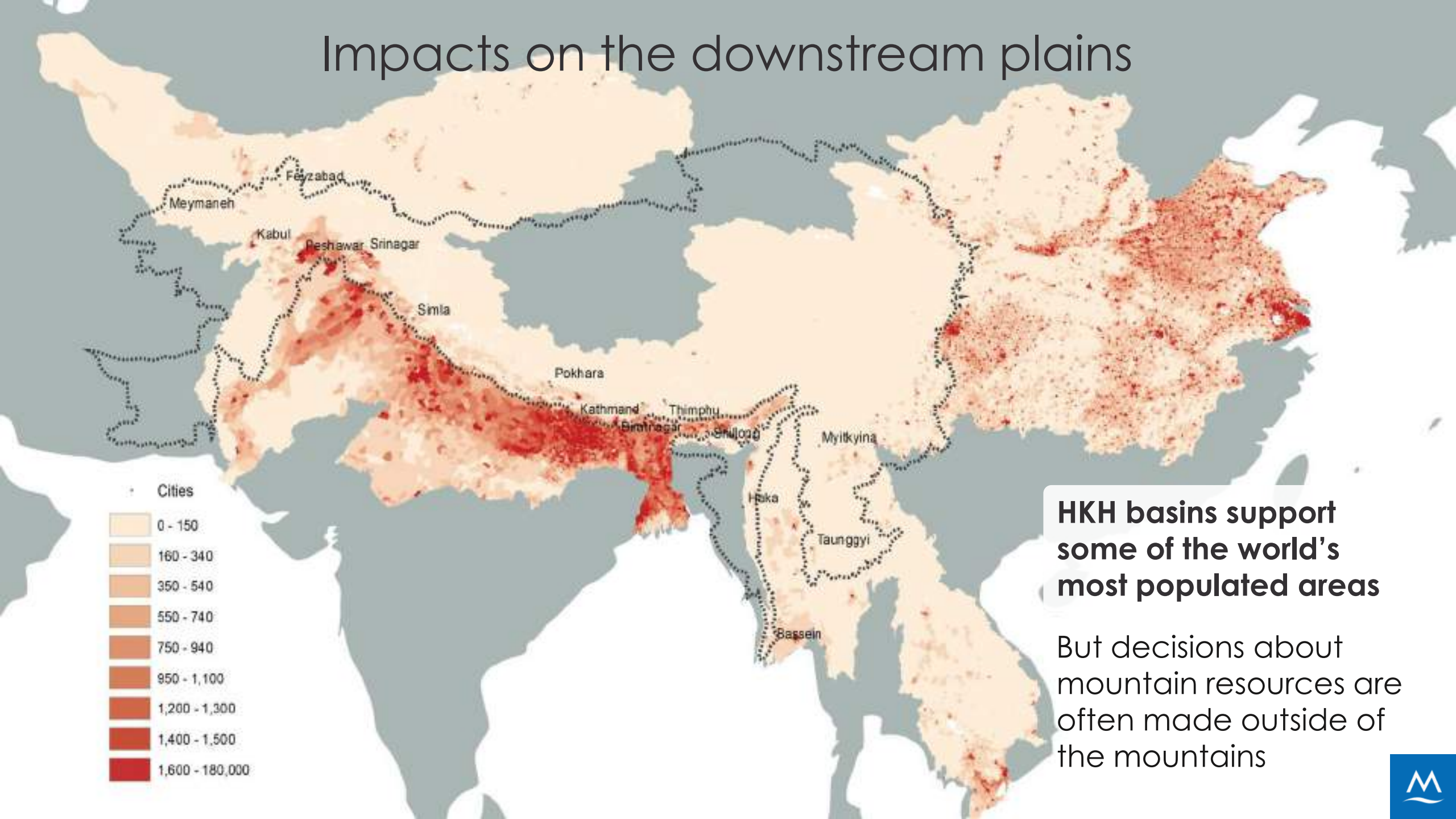
Communities dependent on glaciers and snow melt are highly vulnerable

Nang, Ladakh, India
Photo Karen Conniff


Mountain Communities are already feeling the impact, and more literature points to climate change as a factor of outmigration due to water shortage or disasters


High potential
for
hydropower,
but
vulnerabilities
to floods
increasing

Impacts on the downstream plains



HKH basins support some of the world's most populated areas

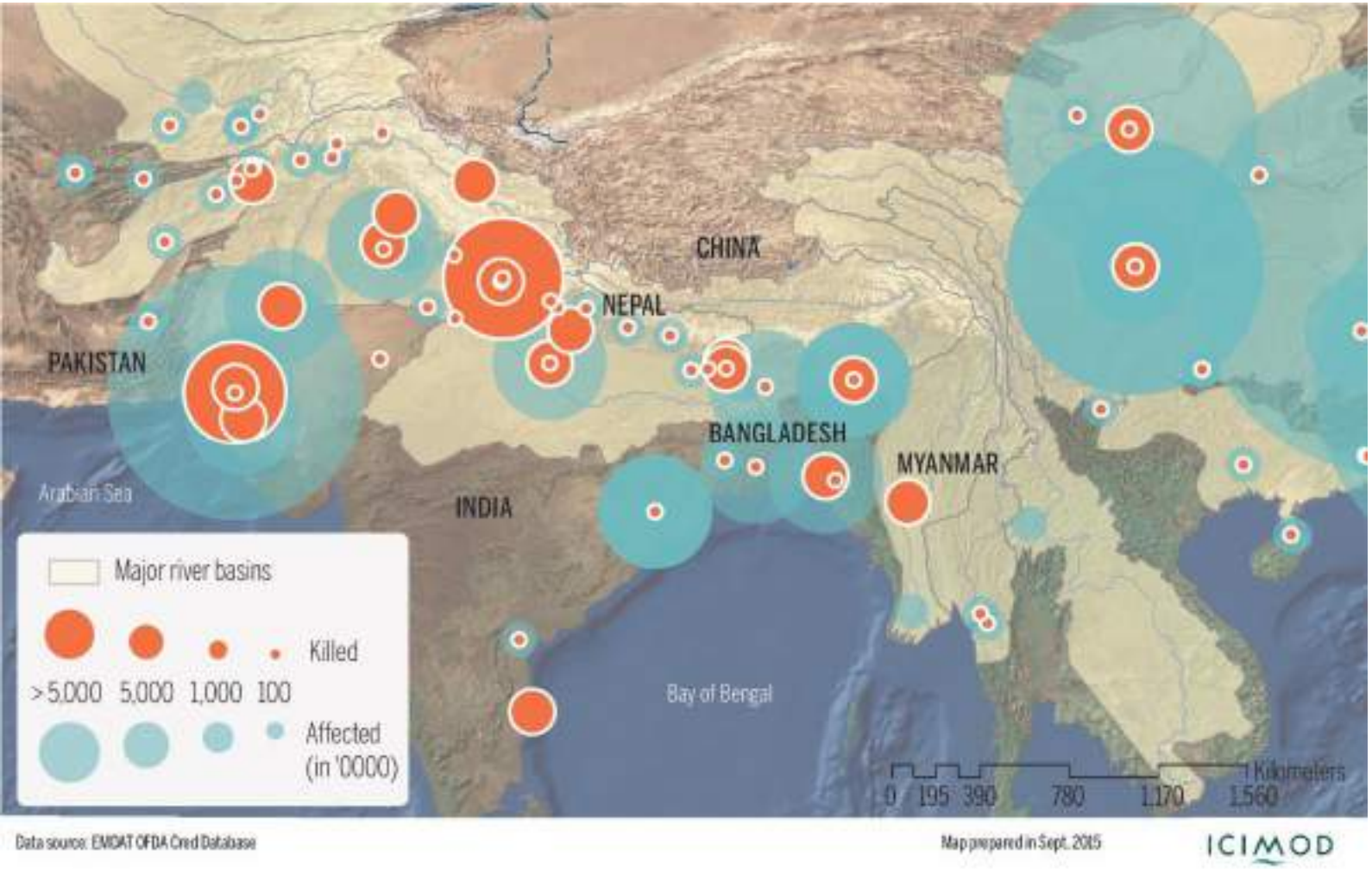
But decisions about mountain resources are often made outside of the mountains

Growing megacities downstream already under water stress

Irrigated agriculture, important for food security, will need to adapt

In Indus 90% of crops are irrigated, 60% of withdrawals from glacier and snow melt , Biemens et al 2019

Disaster risk is increasing

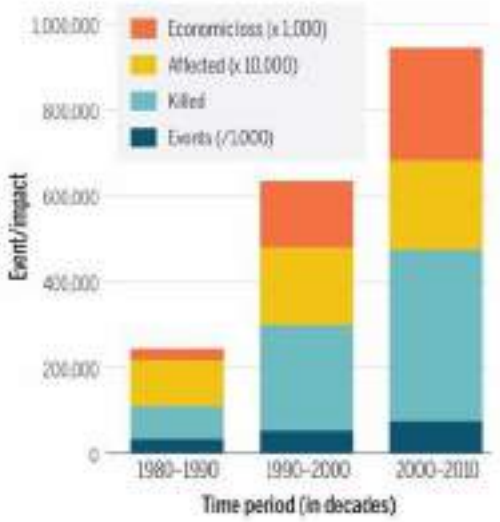


Floods, droughts, landslides, glacial lake outburst floods

One-third of disasters are floods, many crossing national borders

More than 1 billion people at risk of exposure to increasing frequency and intensity of natural hazards

Women more susceptible to natural disasters then men



Oct 20, 2021

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At least 150 dead in flooding and landslides in India and Nepal

Himalayan state of Uttarakhand suffers heaviest rain in more than 100 years, with Nepal also badly affected

Key Actions

Photo: Karen Conniff

Community Level: Investments needed to adapt and build resilience

Regional Cooperation is required

Improved shared science base

Flood early warning

Link upstream and downstream activities

Coordinate water supply, energy, transport

United voice for mountains and water

Thank you

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Photo: Karen Conniff