

Climate Change in the Himalayas: New Vulnerabilities, new Opportunities

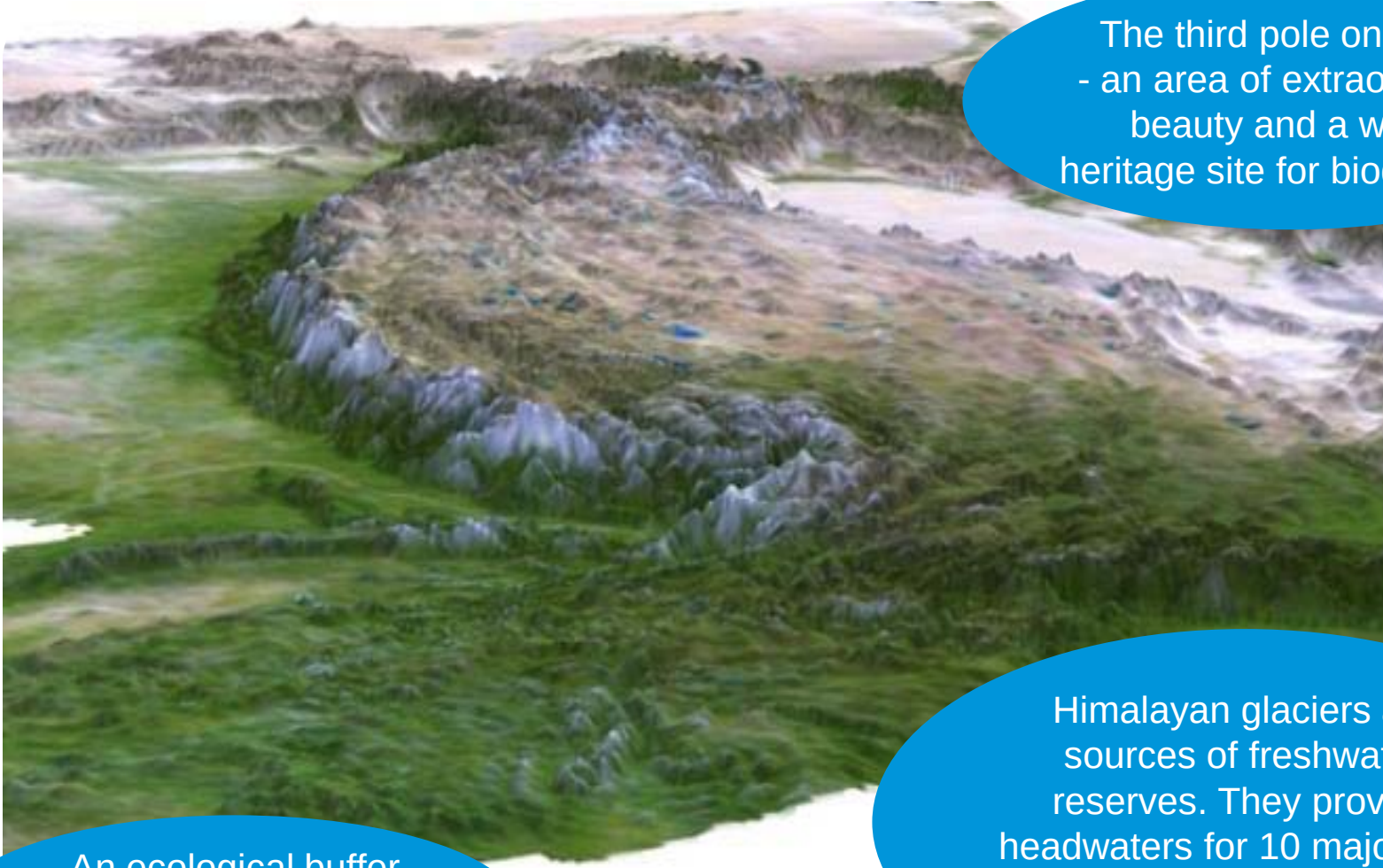
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International Centre for Integrated Mountain Development

Kathmandu, Nepal

- The HKH as a unique mountain system
- A hotspot for climate change
- Need for additional research
- Adaptation now
- The Role of ICIMOD
- Climate Change as an opportunity

The Himalayas, the unique Mountain System



The third pole on earth
- an area of extraordinary
beauty and a world
heritage site for biodiversity

An ecological buffer
between the North and
South Asia

Himalayan glaciers are
sources of freshwater
reserves. They provide
headwaters for 10 major river
systems in Asia – a lifeline for
almost one-third of humanity

Ten major river basins of Asia

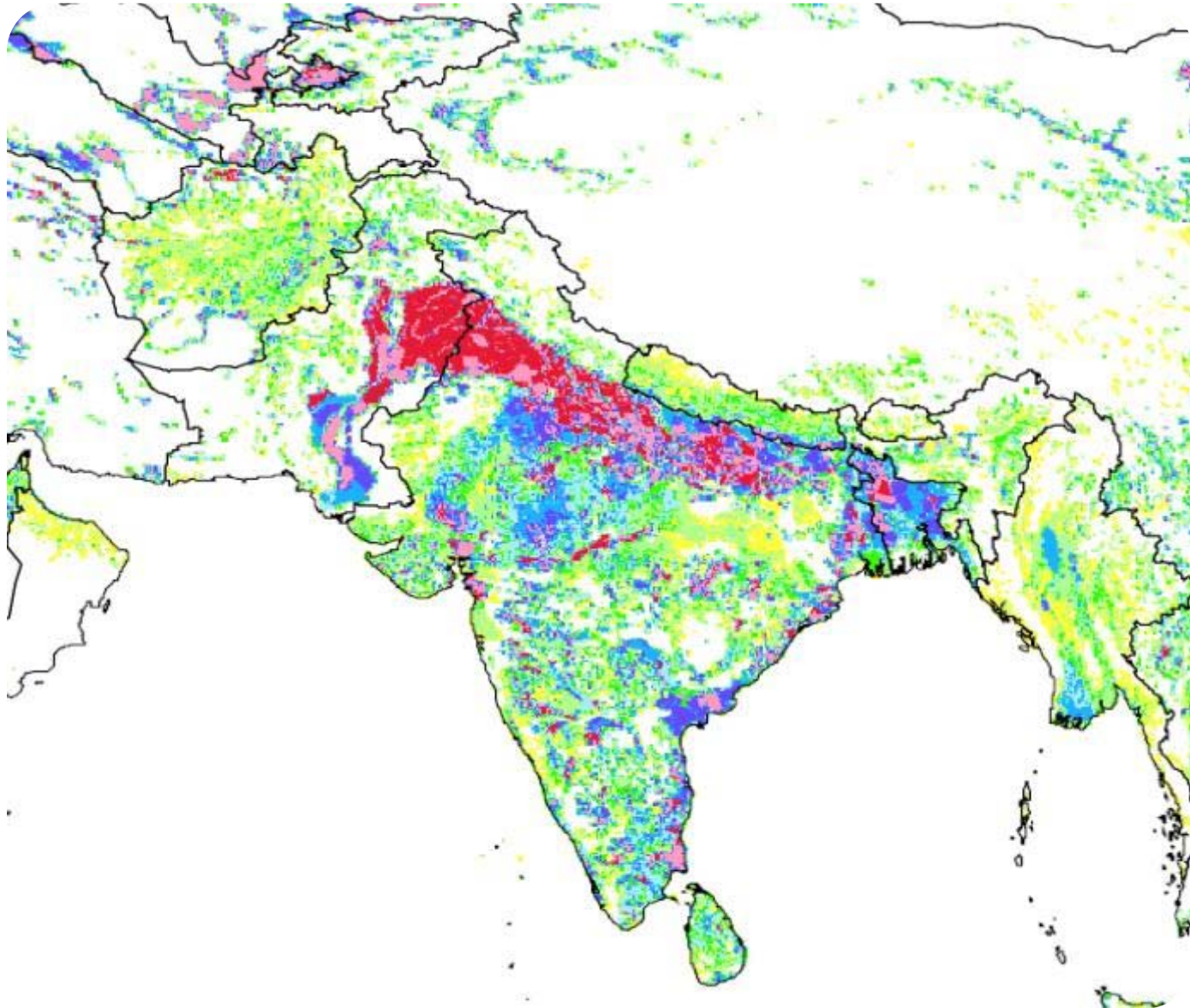


Tibetan Plateau as world water tower

The Tibetan Plateau water tower



The most intensive irrigation system globally



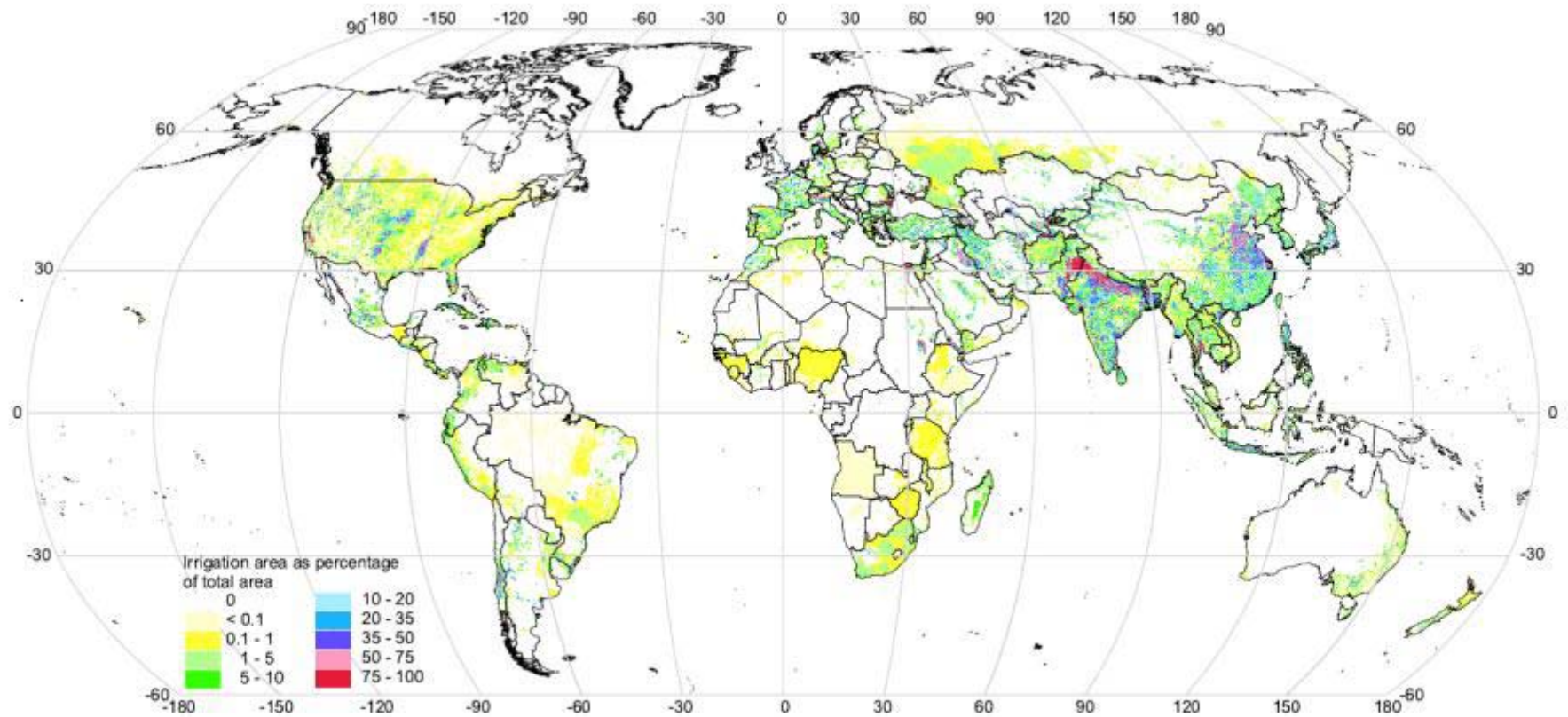
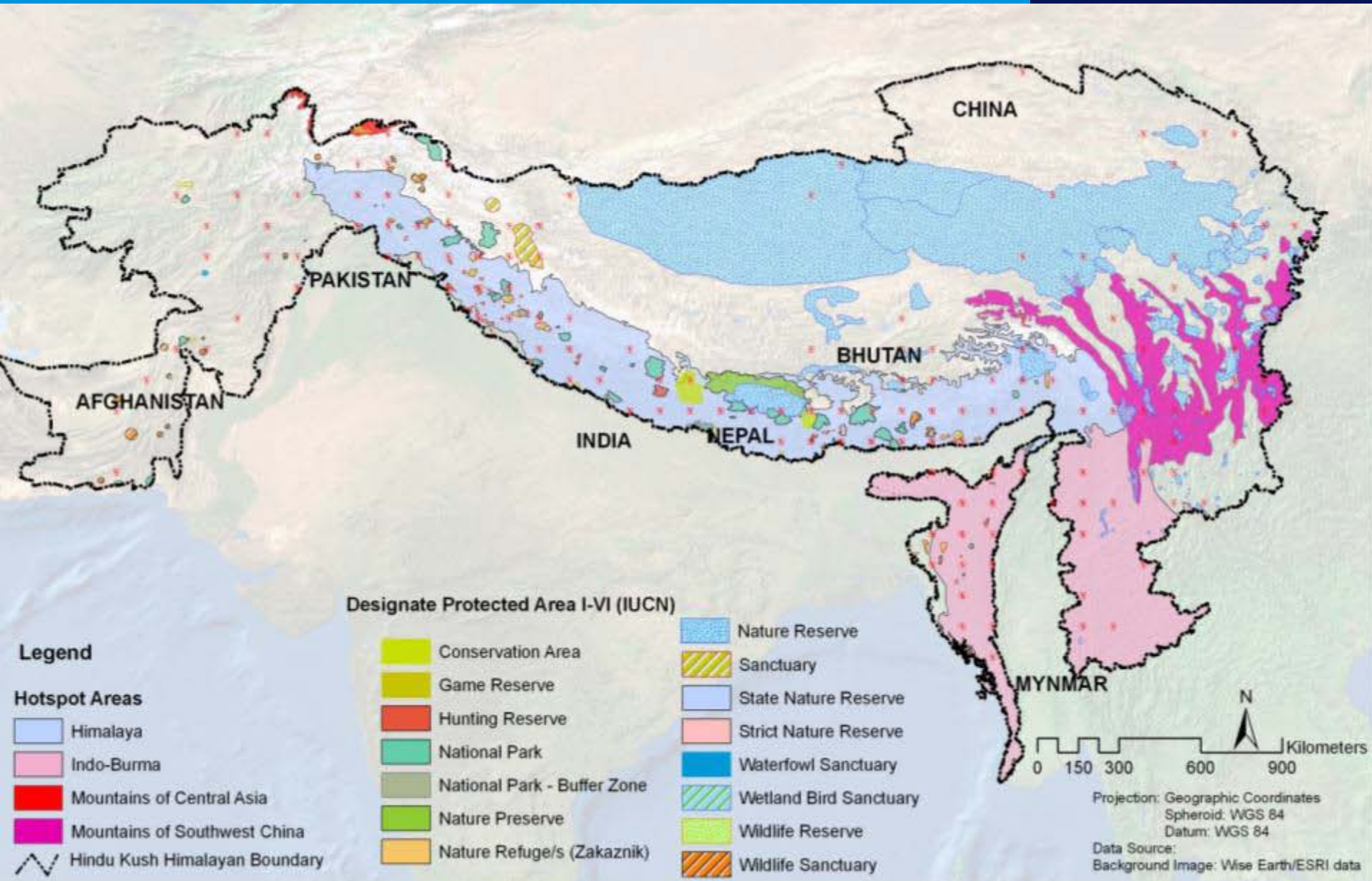


Fig. 3. Global Map of Irrigation Areas Version 3: Percentage of 5-min grid cell area that was equipped for irrigation around the year 2000 (Robinson projection).





Unique Landscapes

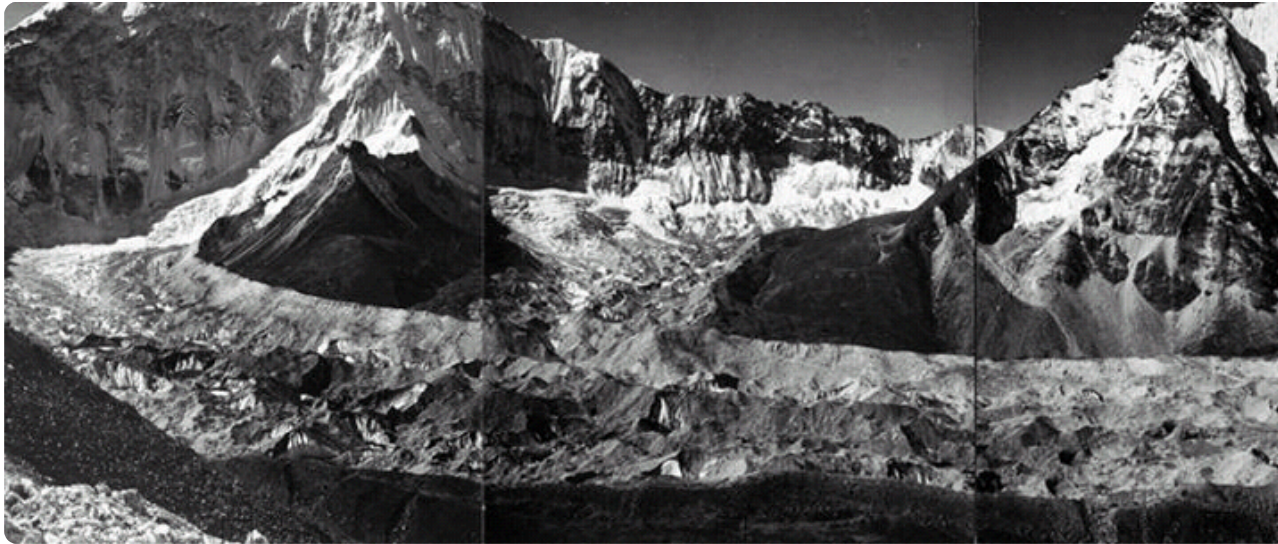
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- Economic Development (India and China)
- Infrastructural Development, Government Policies
- Globalisation (Communication, Transport, Migration)
- Rural urban linkages (urban- rural continuum)
- **HKH as a Hotspot for Climate Change**

Retreating Imja glacier (near Mt. Everest)

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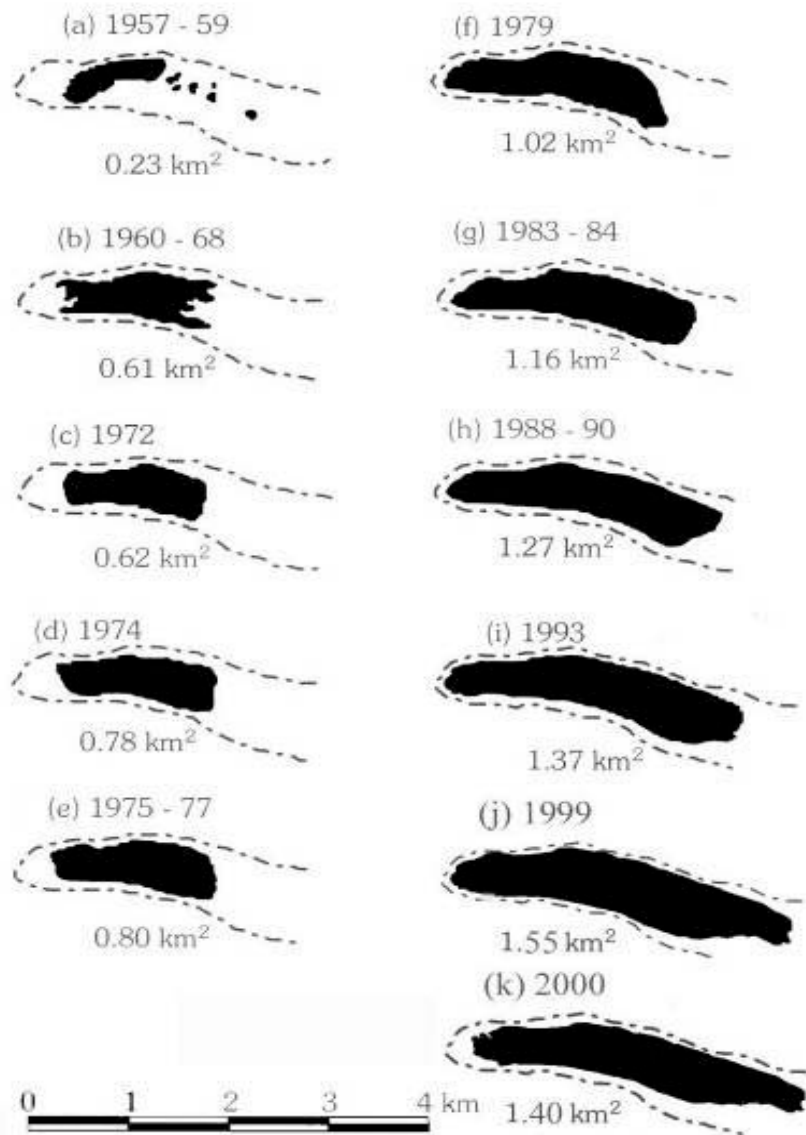


In 1956
(Erwin Schneider, Khumbu,
Nepal, 1956 – 1961
Courtesy of the Association
for Comparative Alpine
Research, Munich
Archives of Alton Byers, The
Mountain Institute)



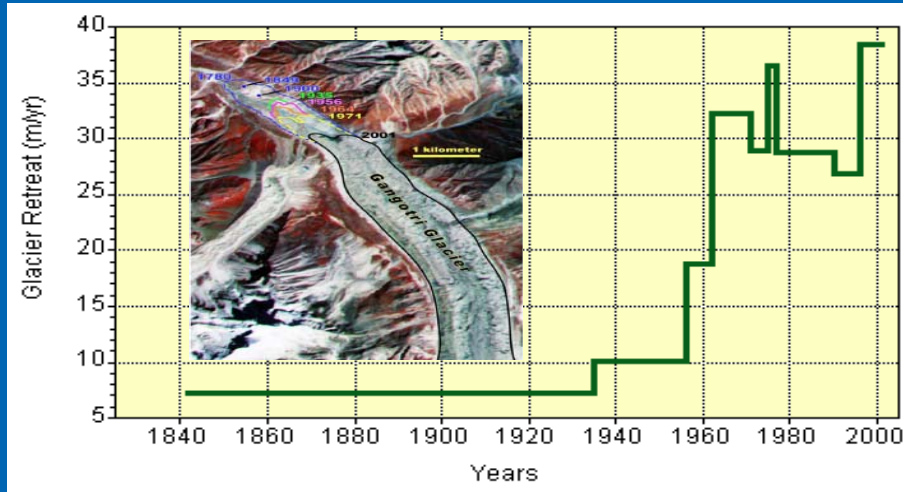
In 2007
(photo: Alton Byers,
The Mountain Institute)

Retreat of Trakarding glacier and growth of Tsho Rolpa lake



Deglaciation in the Himalayas

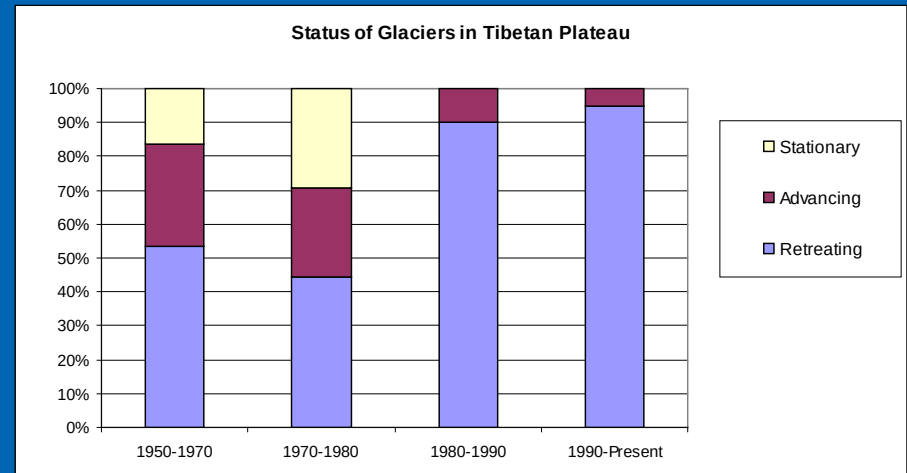
India



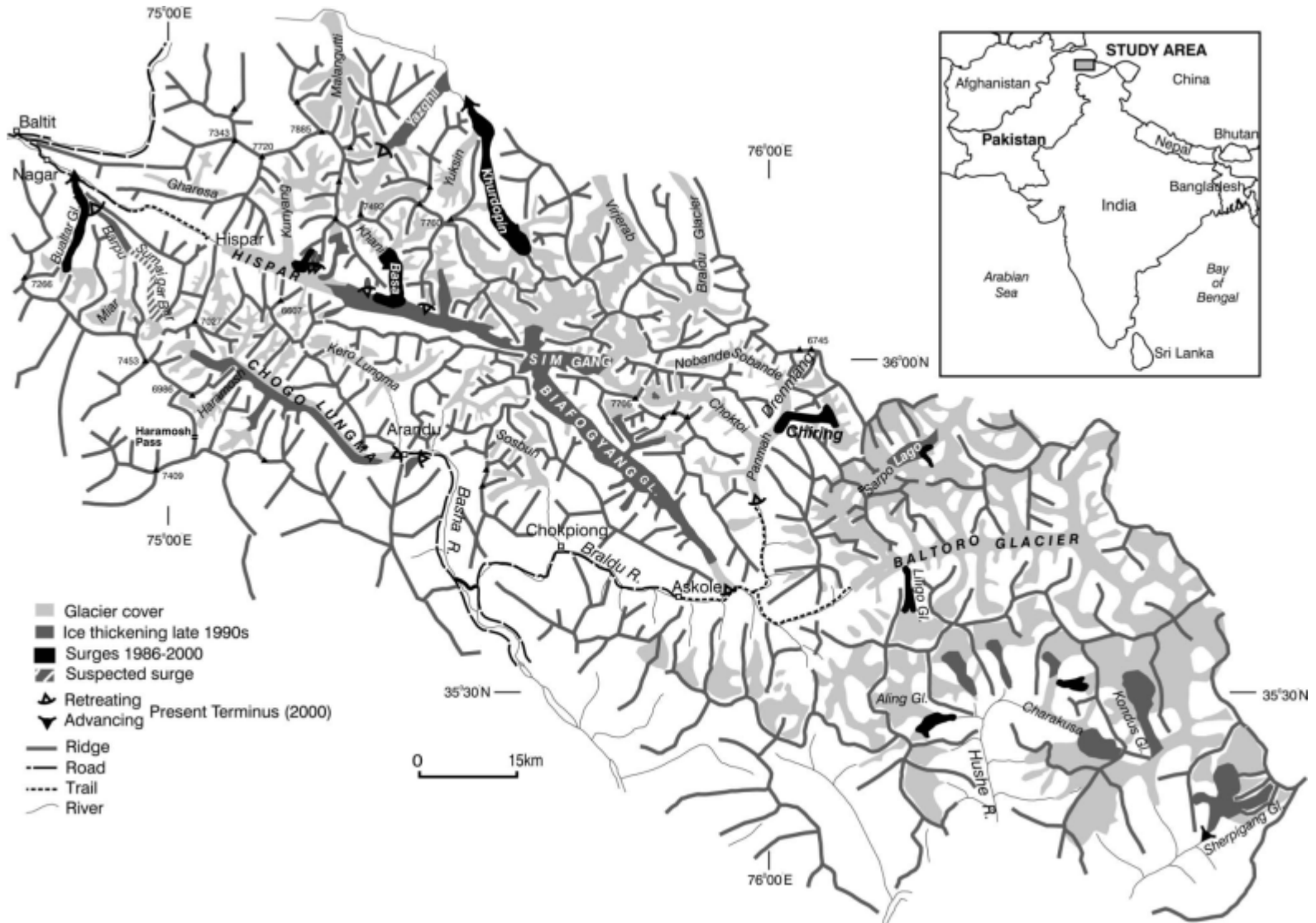
USGS

- Deglaciation is widespread in the Himalayas
- Data mostly on terminus fluctuation or areal change – no data on mass change

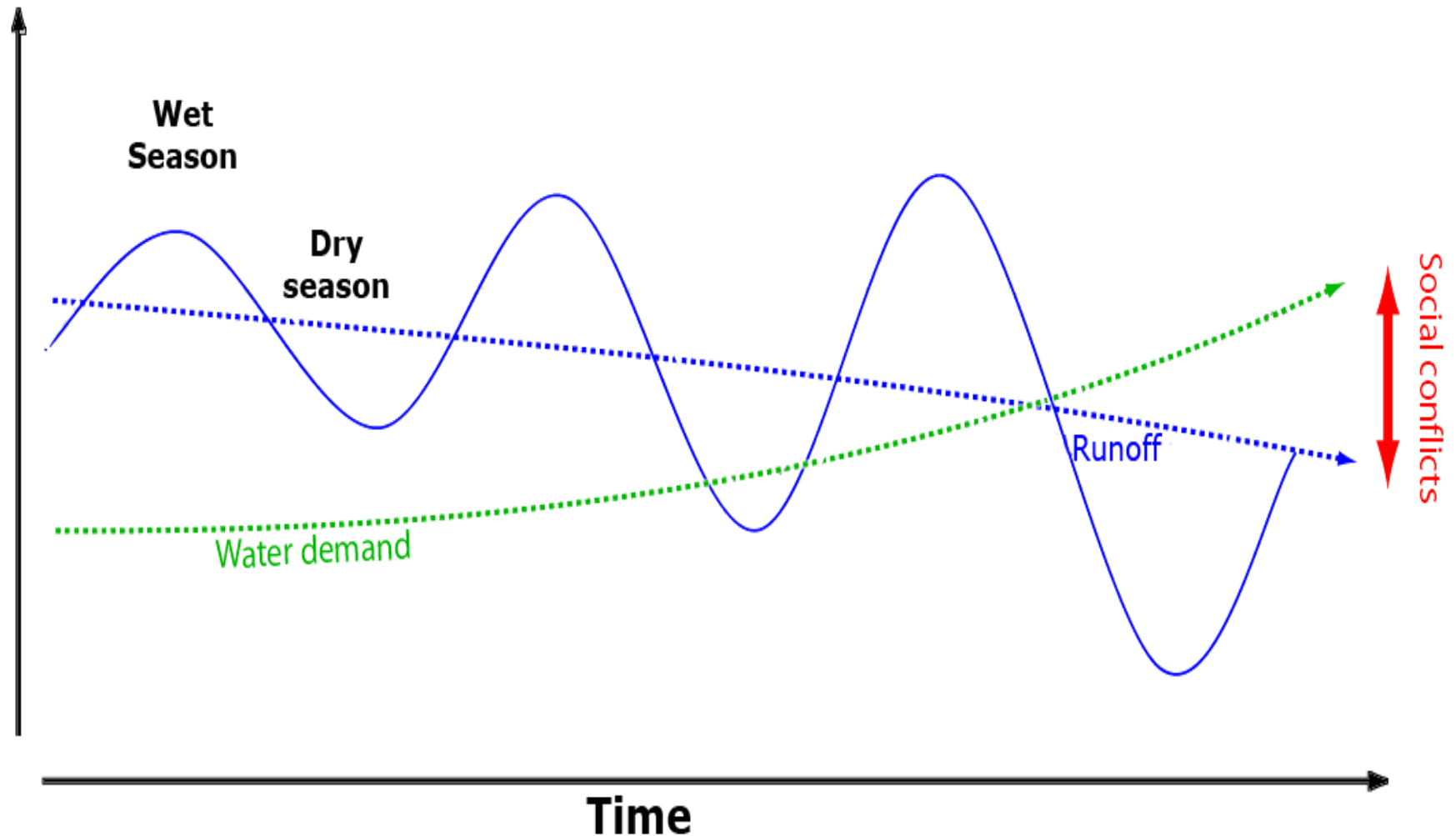
Tibet (Tandong et al., 2004)

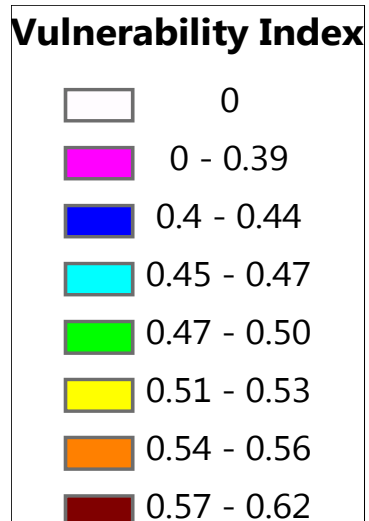


What about Pakistan?



Changes in runoff over time: seasonal and long term





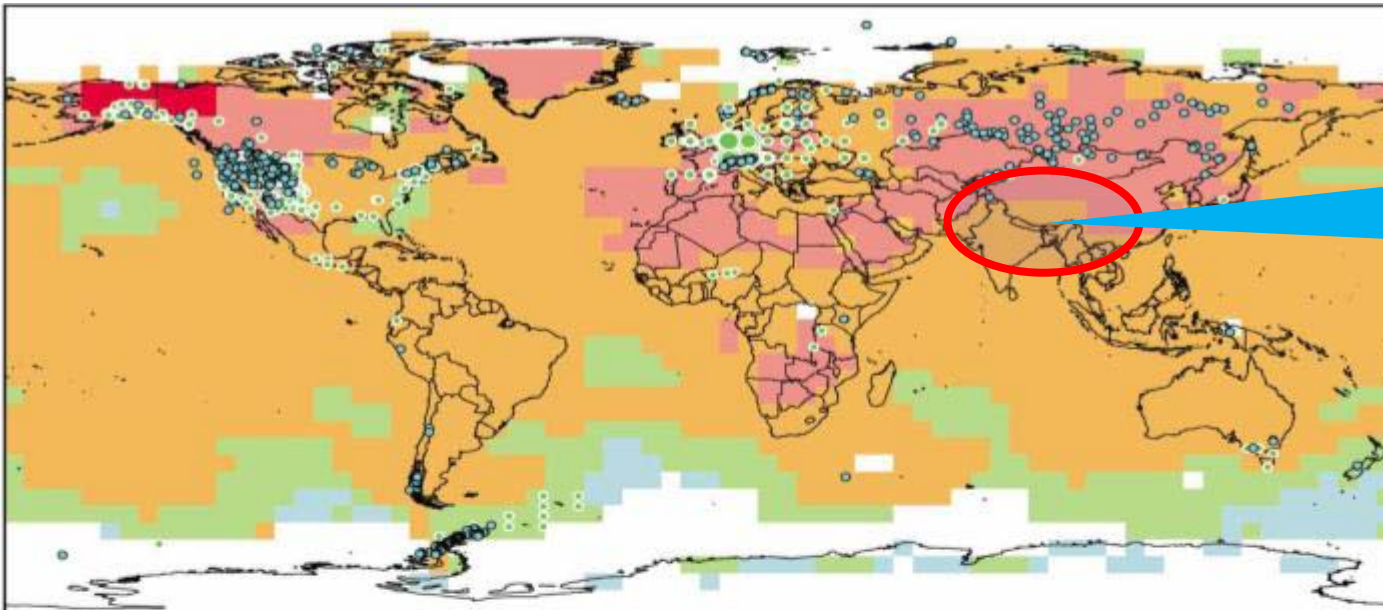
Challenges for the region: Climate change

	1990-2080 (% change)
World	-0.6 to -0.9
Developed Countries	2.7 to 9.0
Developing Countries	-3.3 to -7.2
Southeast Asia	-2.5 to -7.8
South Asia	-18.2 to -22.1
Sub-Saharan Africa	-3.9 to -7.5
Latin America	5.2 to 12.5

Expected impacts
of climate change
on global cereal
production:

Threat to food
security in the
HKH countries

HKH as a blank Spot



Himalayas: A blank spot in IPCC AR4

NAM		LA		EUR ^{28,115}		AFR		AS		ANZ		PR*		TER ^{28,586}		MFW**		GLO ^{28,671}	
355	455	53	5	119		5	2	106	8	6	0	120	24	764		1	85	765	
94%	92%	98%	100%	94%	89%	100%	100%	96%	100%	100%	—	91%	100%	94%	90%	100%	99%	94%	90%

Observations

- Physical systems (snow, ice and frozen ground; hydrology; coastal processes)
- Biological systems (terrestrial, marine, and freshwater)

Europe ***

- 1-30
- 31-100
- 101-800
- 801-1200
- 1201-7500

Temperature change °C
1970-2004



Physical

Number of significant observed changes

Percentage of significant changes consistent with warming

Biological

Number of significant observed changes

Percentage of significant changes consistent with warming

* Polar regions include also observed changes in marine and freshwater biological systems.

** Marine and freshwater includes observed changes at sites and large areas in oceans, small islands and continents.

*** Circles in Europe represent 1 to 7,500 data series.

Glaciers several thousands of years old are rapidly receding

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Glaciated area (approx):

HKH: 100,000 km²

Himalayas: 33,000 km²

Stored water in Himalayan
glaciers: 12,000 km³

Mt. Everest

Glaciated area (approx):

HKH: 60,411 km²

Stored water in Himalayan
glaciers: (estimated) 6.101
km³

N

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Glaciers in HKH Region

River Basins	Glaciers			
	Number	Area (km ²)	Avg. Area	Ice (km ³)
Afghanistan	3,622	2,677.34	0.74	167.662
Bhutan	787	680.25	0.86	47.935
China/TAR	26,347	29,528.60	1.12	2648.700
India	12,830	12,295.58	0.96	1131.268
Myanmar	87	23.99	0.28	0.929
Nepal	3,808	4,213.03	1.11	346.700
Pakistan	7,339	10,994.06	1.50	1758.666
Total	54,820	60,411.85	1.10	6101.860

The Status of Glaciers in the Hindu Kush-Himalayas. Unpublished report ICIMOD 2011. Bajracharya, SR; Maharjan, SB; Shrestha, F; Khattak, GGA; Wanqin, G; Junfen, W; Shiyin, L; Xiaojun, Y

- Changing behavior of the Monsoon: role of the Westerlies, Role of heating of atmosphere (Tibetan Plateau).
- Mitigation: Black carbon and tropospheric ozone, REDD+, REDD++
- Cryosphere: Mass balancing, Hydrological balancing, Behavior of glaciers (sweep and debris covered), Role of Karakorum glaciers, Glacier lakes as risks and potentials, snow melt and Monsoon discharge
- Water: Hydrological Balance, discharge modeling, water Storage, changing discharge pattern due to climate change and consequences for debris flow.

- Livelihoods: Vulnerabilities, disaster risks, adaptation (herders, below the tree line: Adaptation or SDM, Labor migration and remittances, how to build resilience in a changing social fabric, changing gender patterns and role of women, new forms of livelihoods
- Biodiversity: Changes of Biodiversity due to climate change (biodiversity corridors versus crowding out). Changes in Plant sociology and soil stability, Invading species, management of BD as a source of livelihood, market driven BD management
- Green Economy: Costs for Green to remain green, mechanism to assure sustainability of marginal and fragile areas, payment for environment services, valuation of ecosystem services, use of national resource as part of the national accounts

What Strategies for adaptation?

- RDD
- Early warning systems
- Integrated watershed development
- Water storage
- Landscape approach for biodiversity conservation ecosystem management
- New livelihood options
- Regional cooperation

DRR: Risk mapping, capacity development

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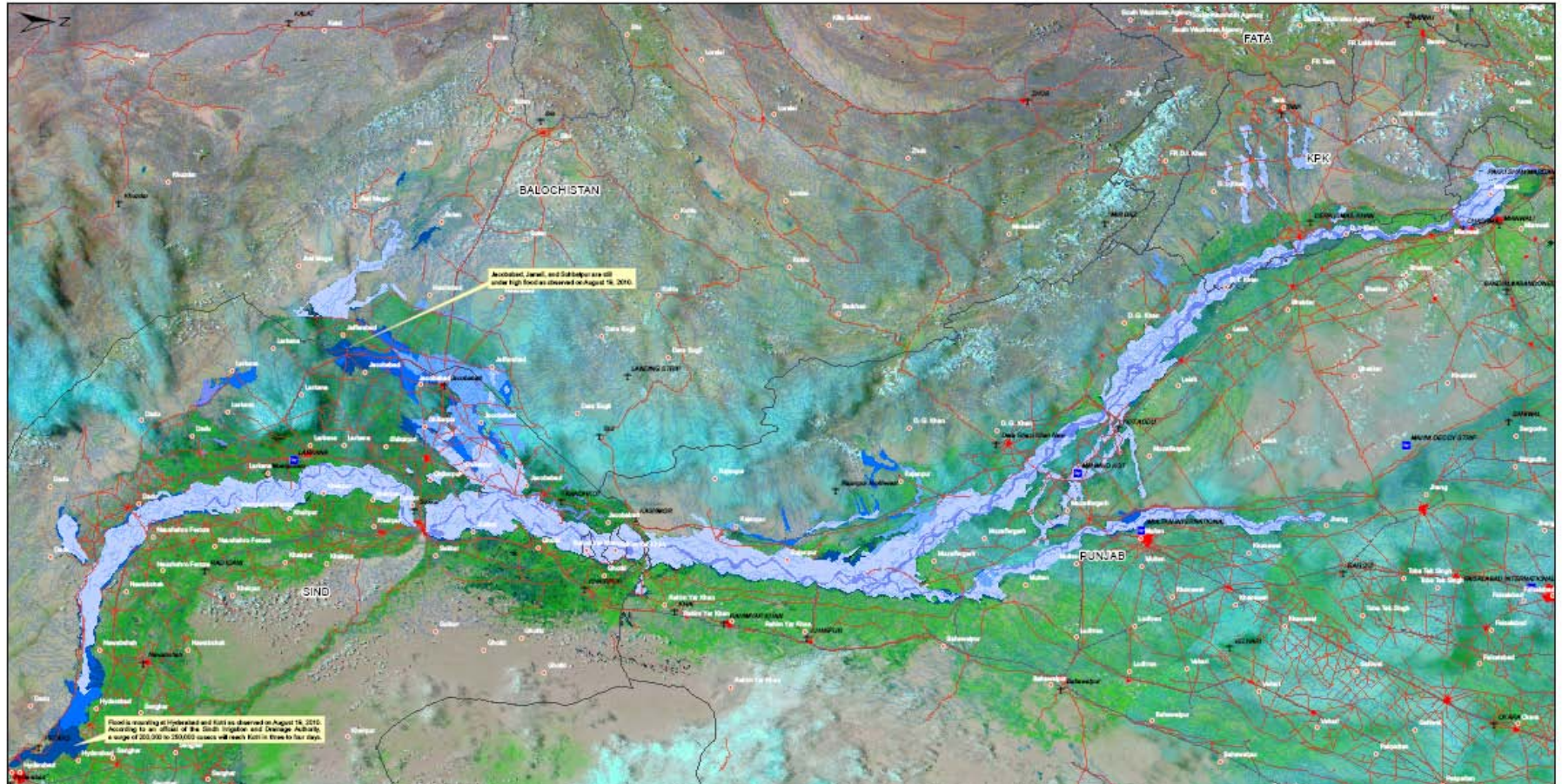
Pakistan Floods

ICIMOD

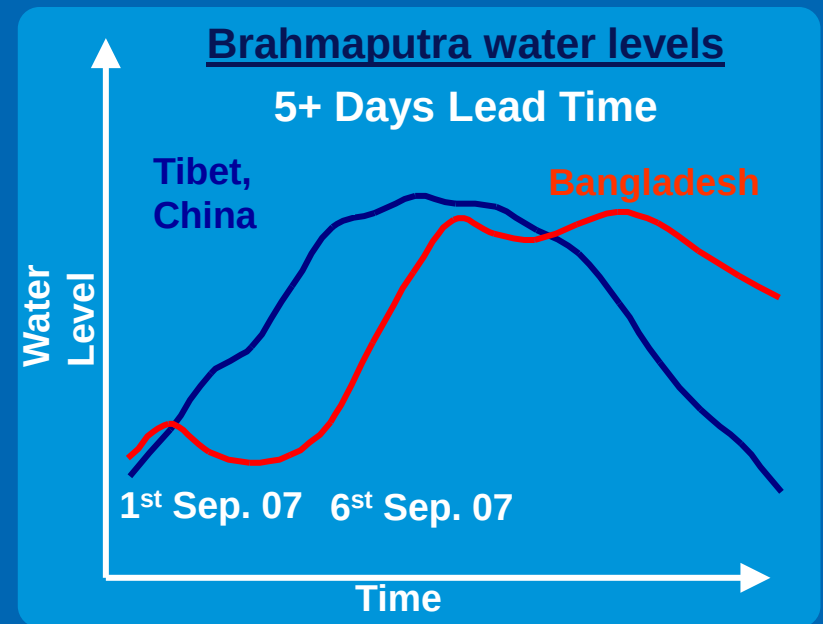
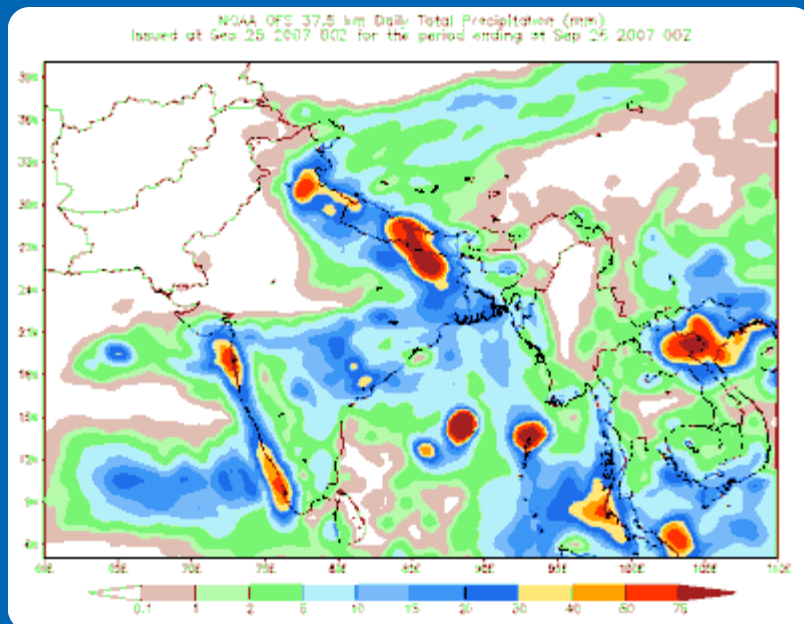
FOR MOUNTAINS AND PEOPLE

Spatio-Temporal Flood Analysis along the Indus River, Sindh, Punjab, KPK and Balochistan Provinces, Pakistan

20 August 2010
FL-2010-00141-PAK
Version 1.0



- Facilitate regional cooperation for flood disaster mitigation
- Facilitate forecasting and early warning systems



- High value products like NTFPs are important sources of livelihoods
- Unique products from mountain areas
- Poor could have access – common land
- Provide cash income and local health care benefits
- High demand for products in emerging markets



Land cover change (Brahmaputra and Koshi basins)

(+) shrubland (90%),
bare areas (7%),
cultivated land (3%)

(-) snow cover (35%),
grassland (17%),
forest (48%)
water bodies (0.1%)



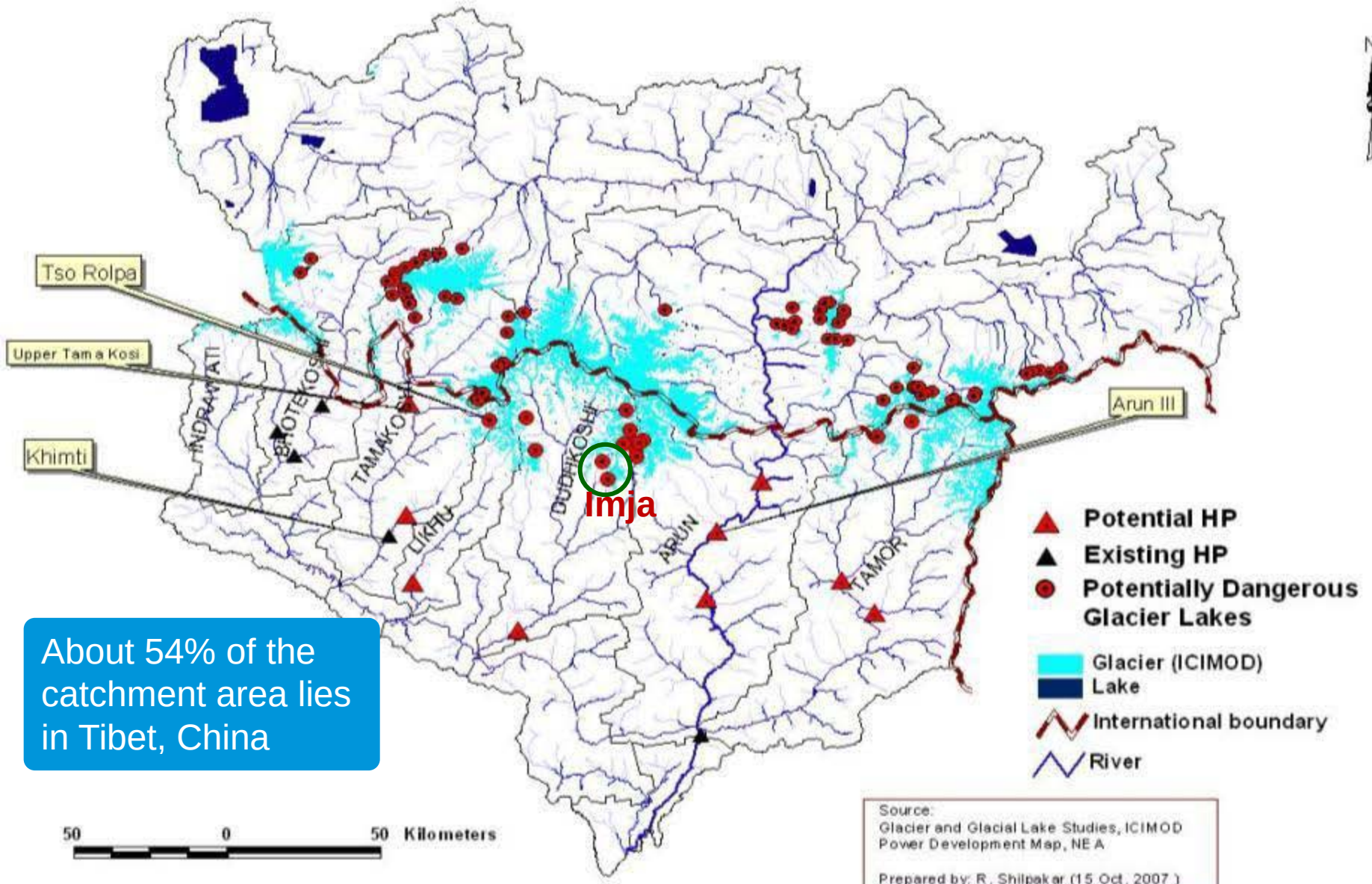
Total Change 3.7% (1970-2000)



Upper Indus Basin Monitoring

- Capacity building
- Learning new tools for monitoring
- Hydrological modeling
- Regional cooperation for improved knowledge on Indus Basin
- Contribution of data for developing basin wide water availability scenarios

Transboundary cooperation: The Koshi basin



ICIMOD as a Regional Knowledge Manager



- Regional, facilitator and broker with a mountain perspective
- Contributing to country-based knowledge becoming regionally accessible
- Promoting the extension from local to transboundary approaches
- Customising international knowledge
- Capacity development, common methodologies, regionally accessible data, monitoring, quality control

Evolution of the ICIMOD Program

ICIMOD

FOR MOUNTAINS AND PEOPLE

- Monitoring of snow and ice: CRYOSPHERE
- Regional flood information system HYCOS
- SERVIR as a technology platform
- Adaptation to climate change (HICAT)
- Livelihood (Niche products, value chain and remittances)
- Ecosystem management and valuation of ecosystem services.

- The Heritage of the first Earth Conference in Rio 1992: **Chapter 13 of the agenda 21**
- **UNFCCC**: Mountain systems as fragile ecosystem of strategic importance
- **CBD**: Valuation of ecosystem services, use of natural resources as part of GDP
- **Rio+20**: What means green Economy for the Mountains?

Thank you

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