Climate Change in the Himalayas: Challenges and Opportunities

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Outline of presentation

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- Global significance of the Himalayas
- ICIMOD – a brief introduction
- Multiple challenges facing Himalayan countries
- Key issues and opportunities for collaborative work with academia
- Conclusions

Himalayan Region: Source of ten river basins – the water tower of Asia

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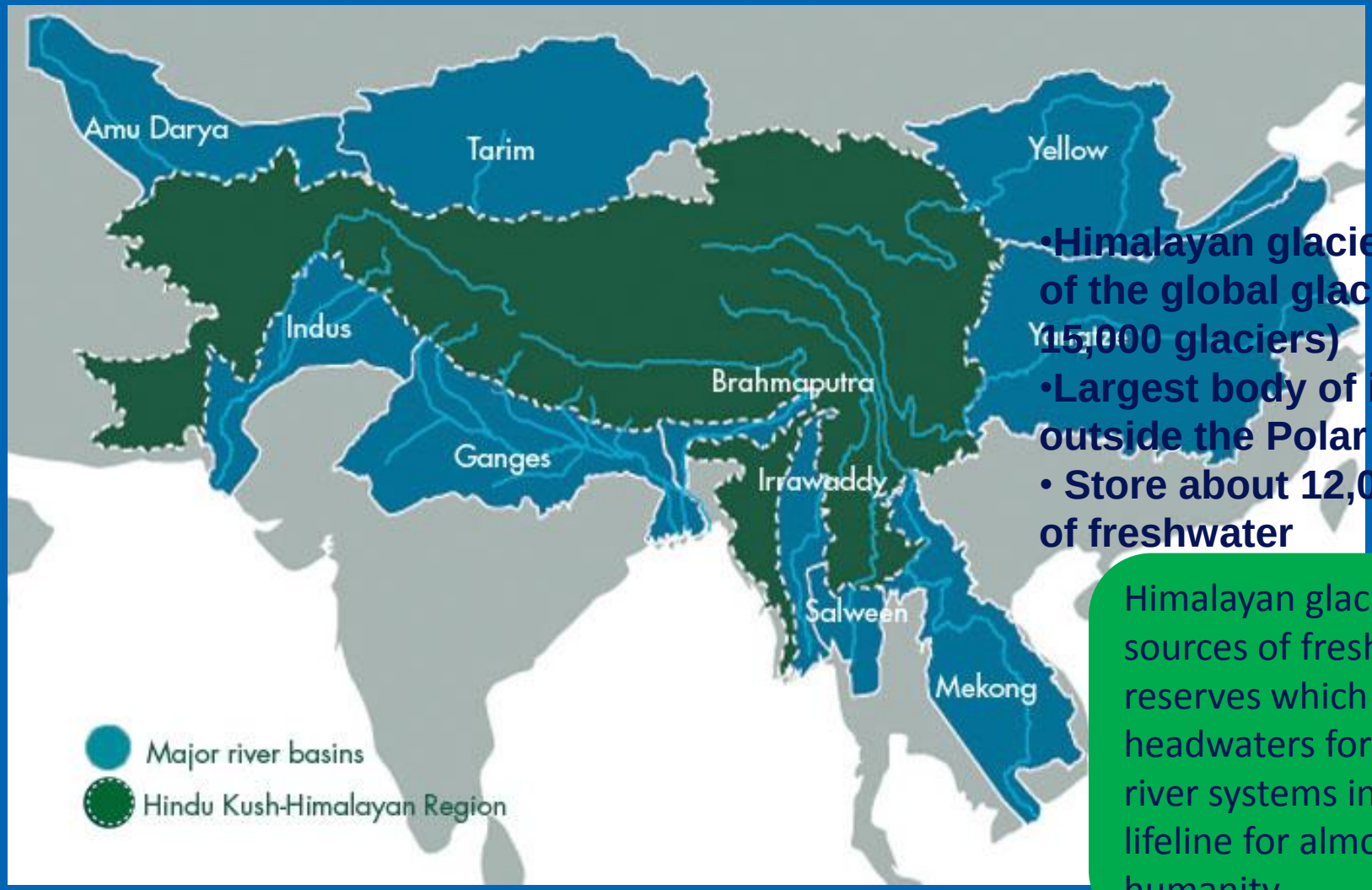
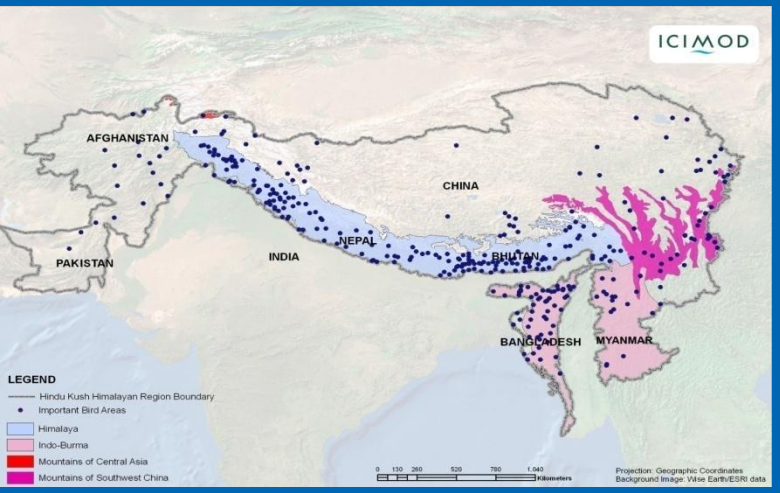


- **Himalayan glaciers: 17% of the global glacial area (> 15,000 glaciers)**
- **Largest body of ice outside the Polar caps;**
- **Store about 12,000 km3 of freshwater**

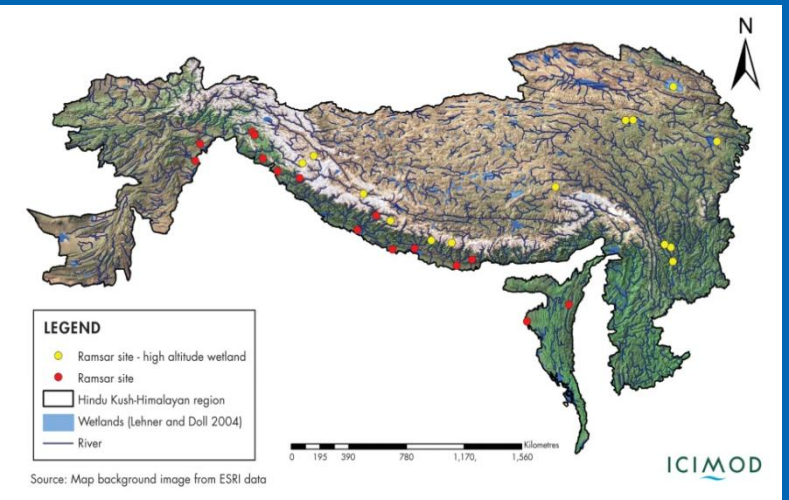
Himalayan glaciers are sources of freshwater reserves which provide headwaters for major river systems in Asia – a lifeline for almost half of humanity.

The region is rich in biodiversity



…Himalayas due to high altitudinal variations…are rich in biodiversity

…hosts 4 of the 34 Global Biodiversity Hotspots; 488 protected areas and 330 Important Bird Areas



…has a large number of water retaining wetlands, 28 of them are Ramsar sites

WHO IS ICIMOD?

VISION OF ICIMOD: The mountain people of the greater Himalayas enjoy improved well-being in a sustainable global environment.

Strategic goals of ICIMOD

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1. **Build regional institutional capacity** of member countries to reduce poverty;
2. Mobilise **research and analytical capacity** to deal with climate and global changes;
3. Build strategic regional and global **knowledge partnerships**;
4. Promote dialogue, networking and the **exchange of information** and experiences; and
5. Provide **professional services**, technical advice and management expertise.

ICIMOD's Capacity

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- State-of-art Geo-based solutions; Platform for collaboration, capturing- and exchanging information & knowledge,
- Common regional database
- Mountain knowledge centre and a virtual Learning Centre

Strategic Programs, Action Areas and expected Impacts

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Strategic Programs

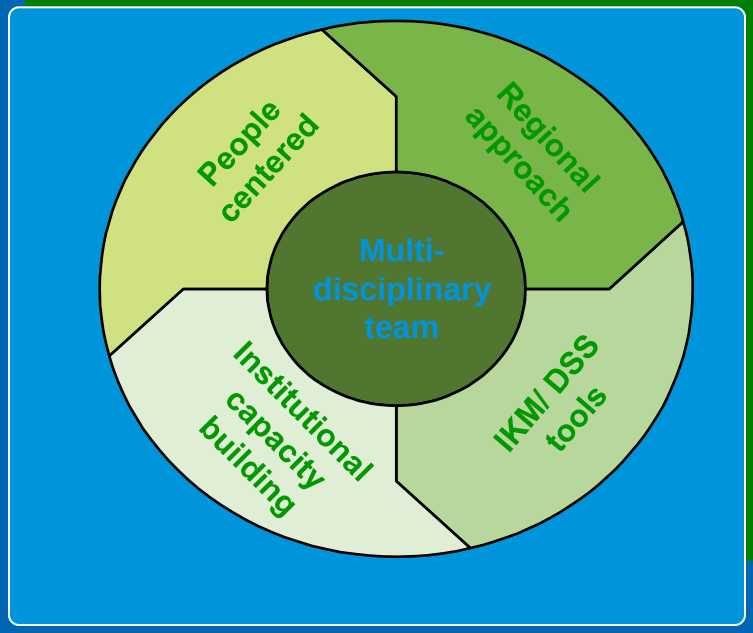
Implementation through Action Areas

Impacts

- Livelihoods
- Ecosystem services
- Water and hazards

Information and knowledge management

- Participatory watershed management
- Biodiversity conservation
- Glaciers, climate change
- Rangeland management, community forestry



Monitoring and impact assessment

- Livelihoods more sustainable
- Stable ecosystem services
- Equitable, sustainable water mgmt.

Research and development thrusts

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Environment Change & Ecosystem Services:

- Transboundary landscape conservation and management
- Monitoring of land use changes and sustainable management of natural resources
- Community and livelihood forestry

Sustainable Livelihood & Poverty Reduction:

- Rewarding poor for eco-system services
- Value chain development of high value products
- Community adaptation and resilience

Integrated Water & Hazards Management:

- Monitoring of snow, ice and water for long-term water management
- Regional flood information and management

ICIMOD Research Sites

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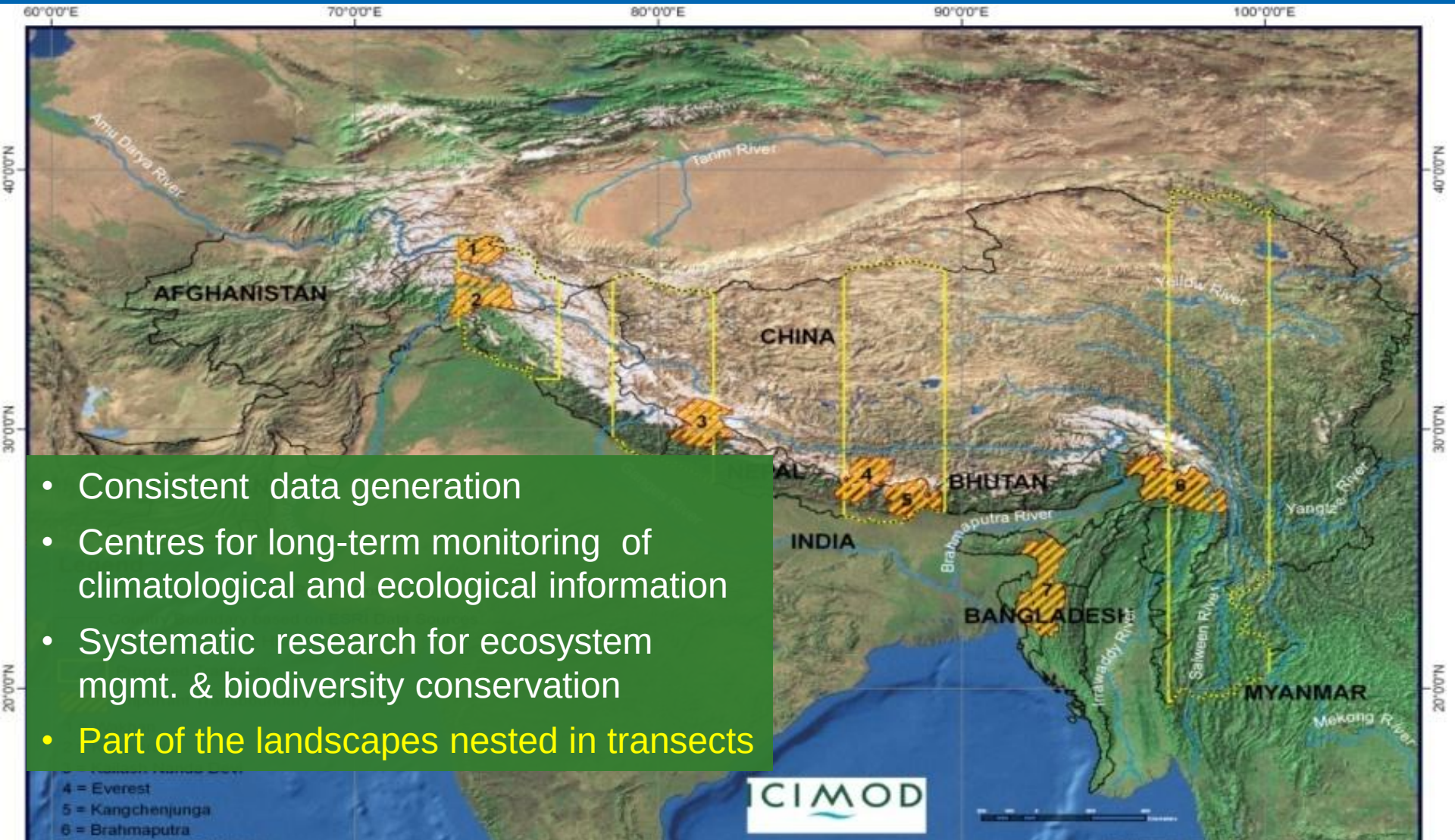

- Consistent data generation
- Centres for long-term monitoring of climatological and ecological information
- Systematic research for ecosystem mgmt. & biodiversity conservation
- Part of the landscapes nested in transects

Example : Brahmaputra-Salween Landscape

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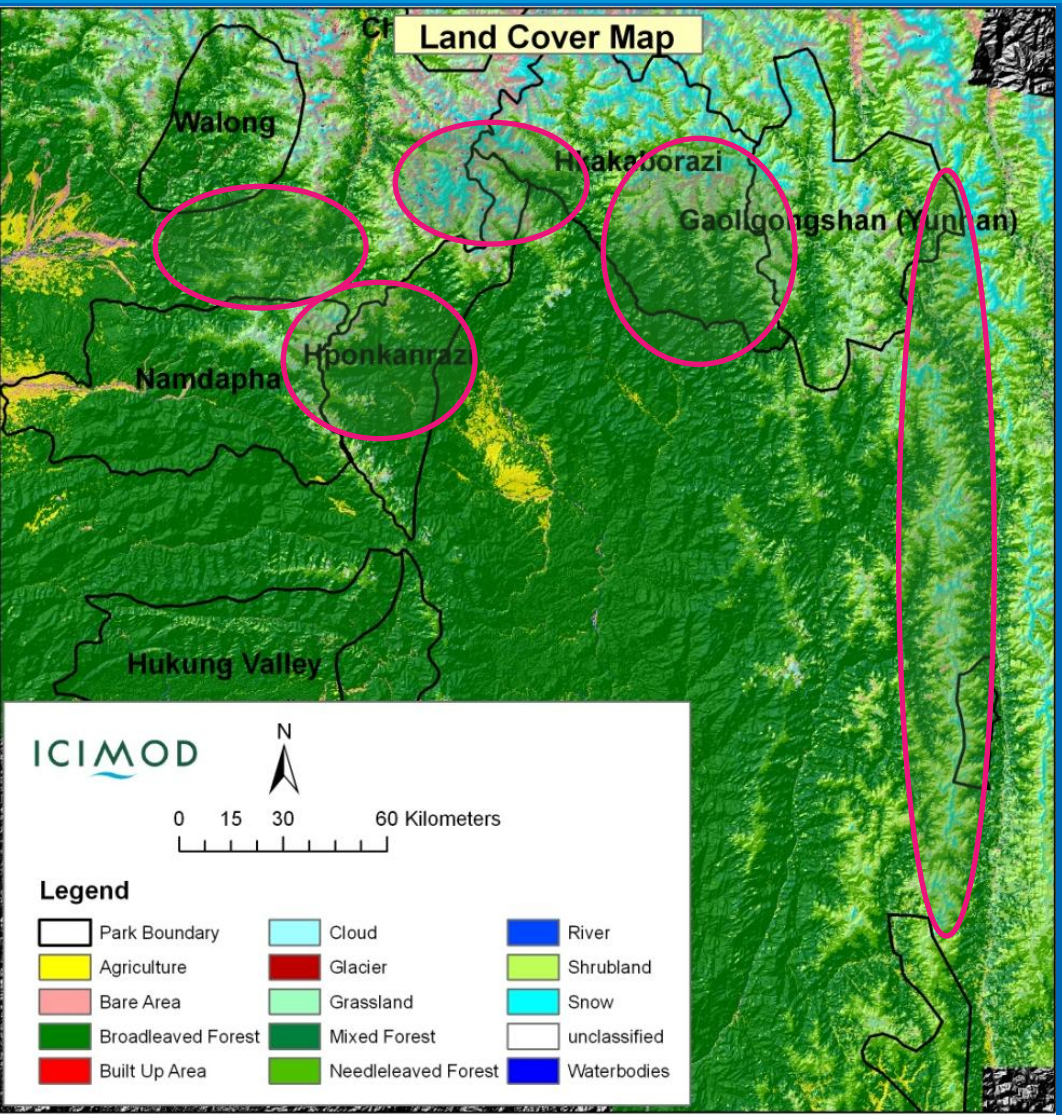

Assessment Areas:

- Natural connectivity
- Biodiversity review and gap analysis
- Land use cover change
- Transboundary issues including illegal trade
- Policy analysis
- Regional Cooperation Framework elements

What can ICIMOD offer?

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- Regional, facilitator and knowledge broker with a mountain perspective
- Promoting application of knowledge to solve local, national and trans-boundary approaches
- Customising international knowledge
- Regional capacity development, regional database management, monitoring, and quality control

Climate change challenges & Issues:

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1. Rapid rate of glacier melting & its impact on region's water resources

Snow-cover in the Himalayas (1975)

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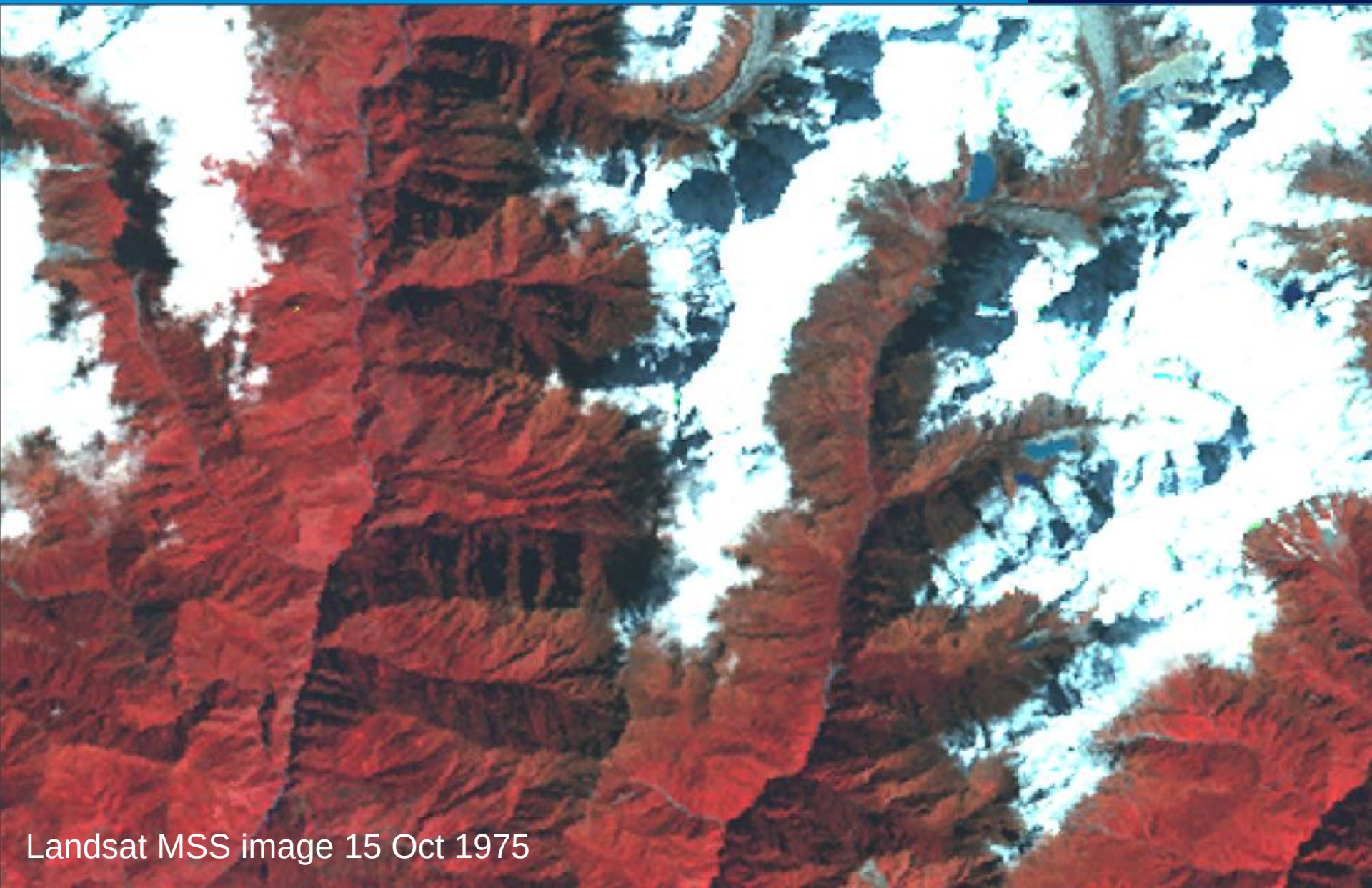

Landsat MSS image 15 Oct 1975

Snow-cover in 2006

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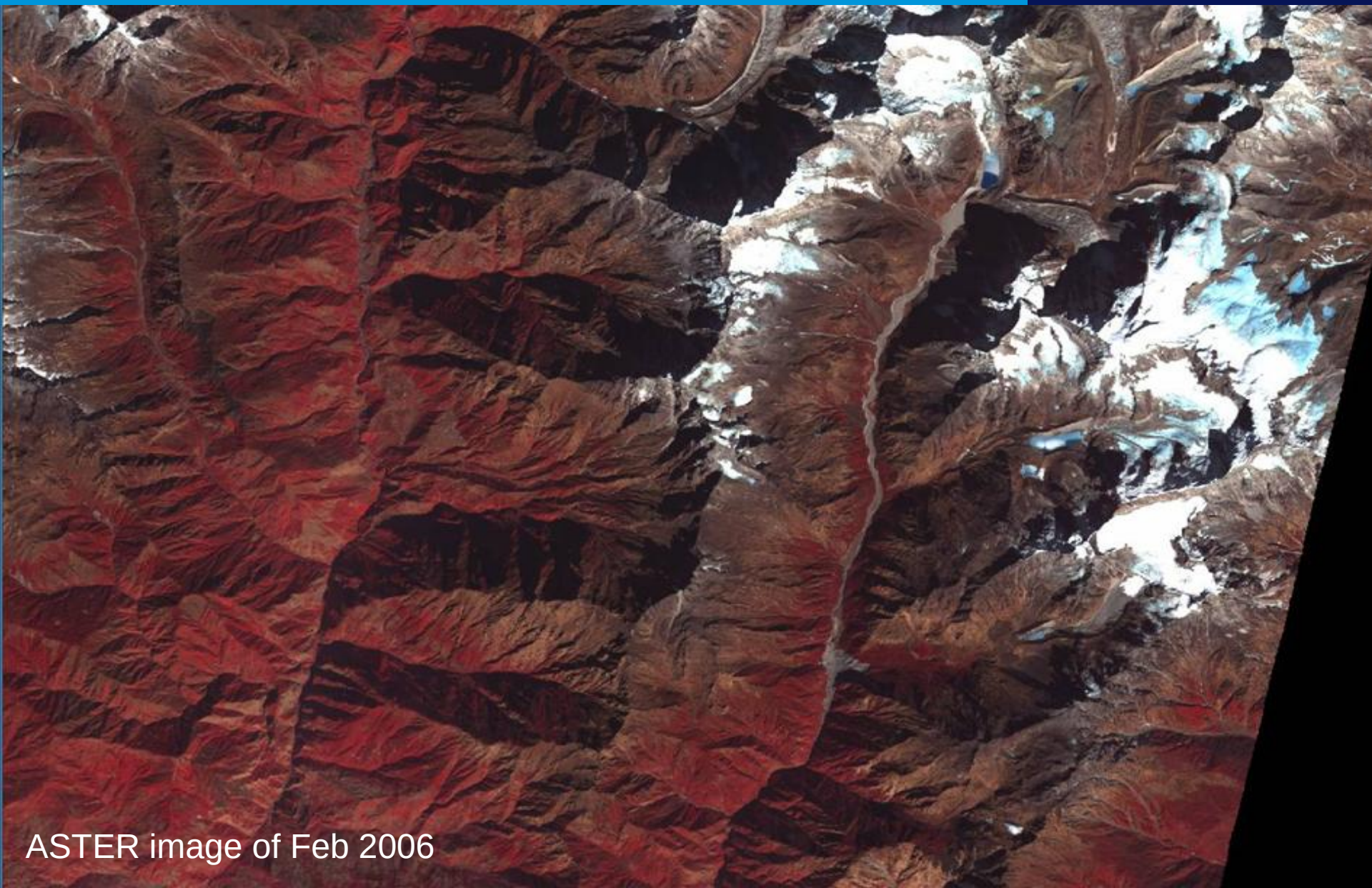
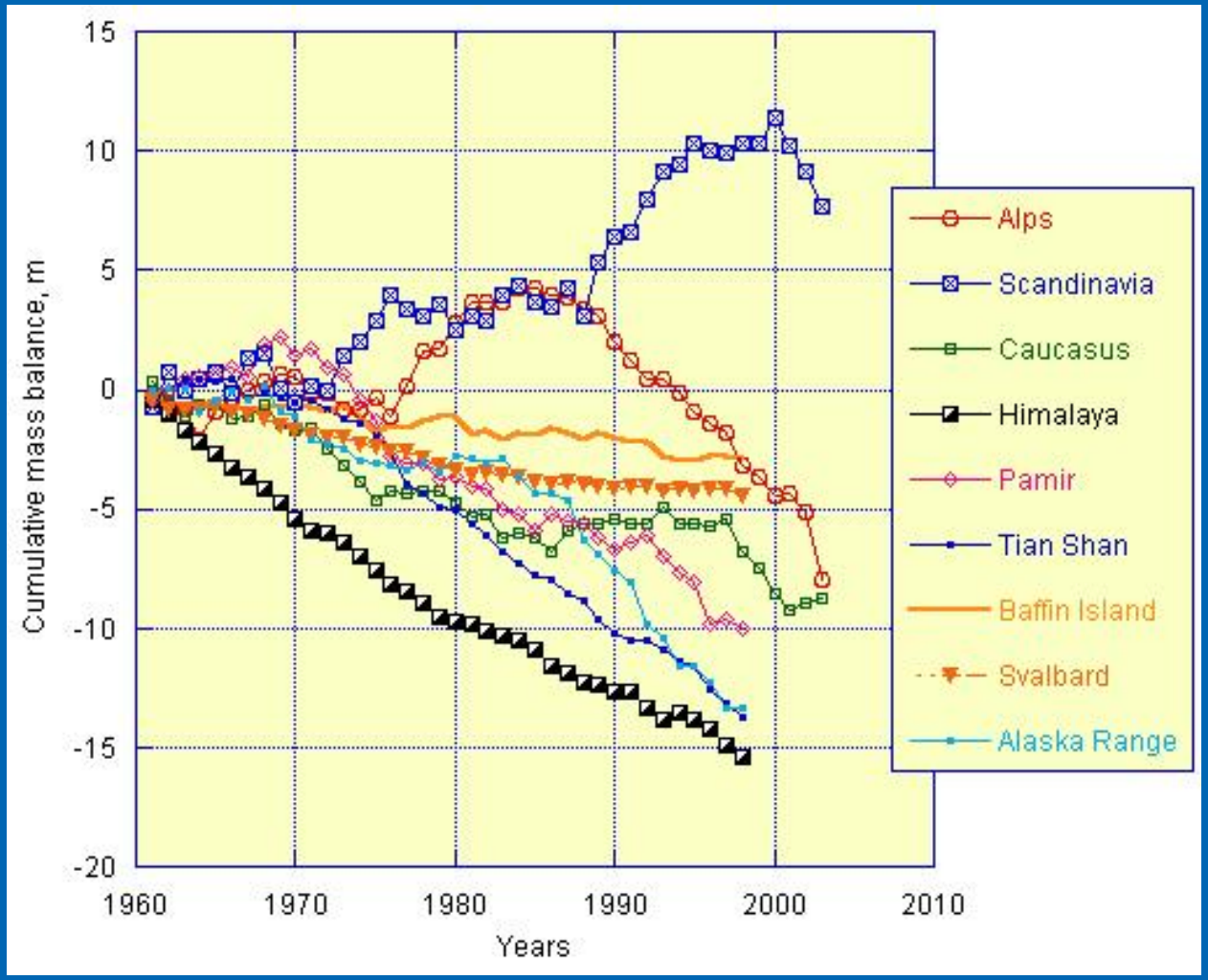


ASTER image of Feb 2006

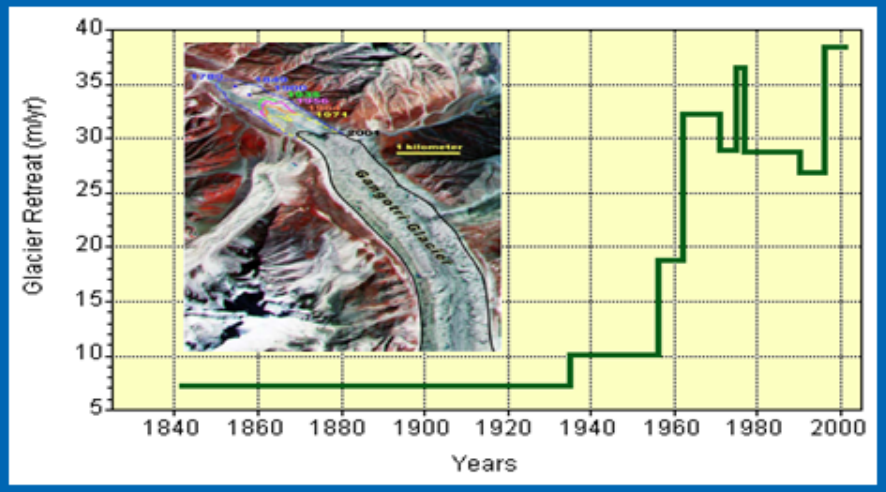
Glacier Mass Balance



- Himalayan glaciers are shrinking more rapidly than elsewhere

Source: Dyurgerov and Meier, 2005

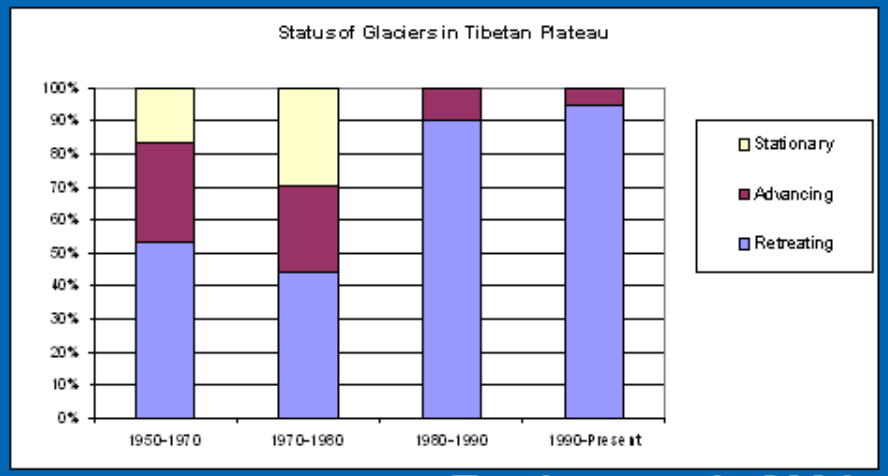
Glacial melting in the Himalayas



India

J. Kargel, USGS

- Deglaciation is widespread in HKH
- Some advances in Hindu Kush and Karakorum

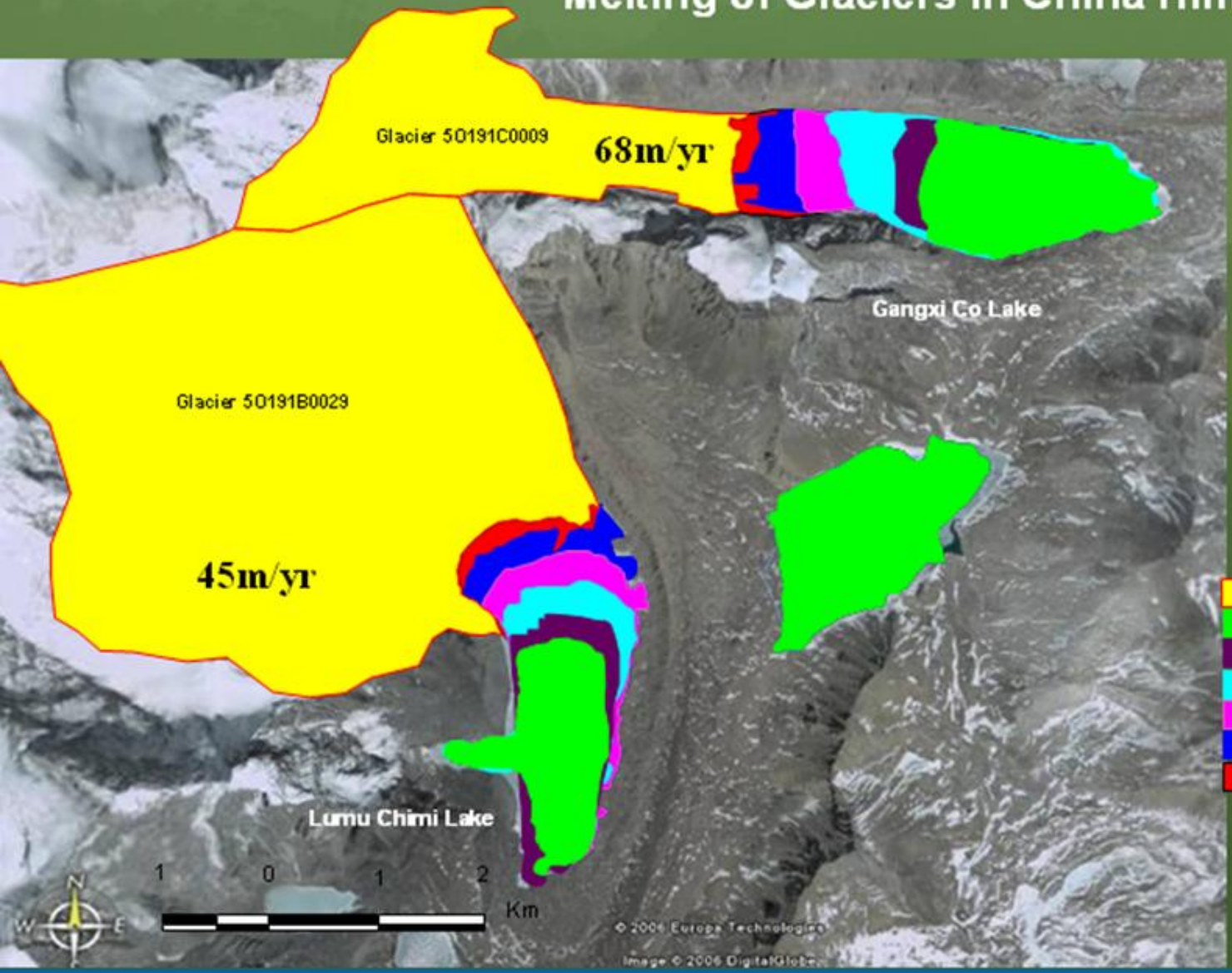


Tibet

Tandong et al., 2004

Data mostly on terminus fluctuation or areal change– no data on mass change

Melting of Glaciers in China Himalaya



Glacier retreat and growth of lakes in Poiqu Basin, Tibet Autonomous Region of Peoples' Republic of China

- Glacier on 5 Dec, 2003
- Glacial Lake on 1 Jan 1977
- Glacial Lake on 9 April, 1984
- Glacial Lake on 21 Dec, 1990
- Glacial Lake on 18 Oct, 1996
- Glacial Lake on 22 Nov, 2000
- Glacial Lake on 5 Dec, 2003

Estimated contribution of glaciers in water resources of the HKH rivers

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River basin	Mean discharge (m^3/s)	Contribution of glacial melt in river flow (%)	Water availability per person (m^3/person/year)
Indus	5,553	44.8	978
Ganges	18,691	9.1	1,447
Brahmaputra	19,824	12.3	5,274
Irrawaddy	13,565	Unknown	13,089
Salween	1,494	8.8	7,876
Mekong	11,048	6.6	6,091
Yangtze	34,000	18.5	2,909
Yellow	1,365	1.3	292
Tarim	146	40.2	571

(Source: Xu *et al.* 2007)

IPCC (2007) forecast:

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- Glaciers in the Himalayas are receding faster than in any other parts of the world;
- At the current trends, 80% of Himalayan glaciers will be gone in 30 years (although this is questioned?);
- In Northwest China, 27% of the glacier area will decline by 2050;
- Likely water shortages for downstream agriculture in dry season
- Up to 750 million people in the region are vulnerable

Key issues and research gaps

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- IPCC has termed Himalayan region as a `data deficit' region; how to gather long-term scientific data and reduce the knowledge gap?
- How to build regional climatic models and scenarios to help prepare robust water management plans?
- What would be the global impact of the cryospheric changes in the Himalayas?.

Climate Change Challenges & Issues

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2. Flood disaster due high intensity rainfall, land slide and glacial lake outburst floods (GLOF)

Impacts on temperature and rainfall patterns

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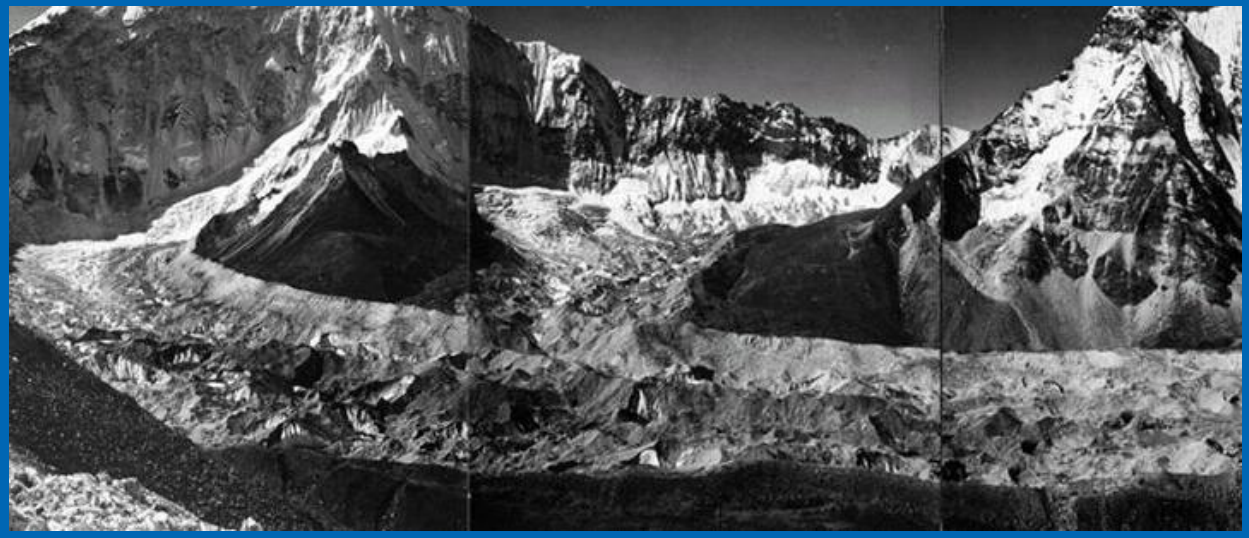
- 0.15 - 0.34 °C/decade warming trend is found over the HHK with maximum warming over areas in the western Himalayas of ~1°C since 1979 which *significantly exceed the global rate*.

- Higher temperature shifting Asian monsoon's path towards the foothills of the Himalayas resulting extreme rainfall patterns (Lau et al, 2006).

Increased risk of flash flood (Imja Glacier, Everest area Nepal)



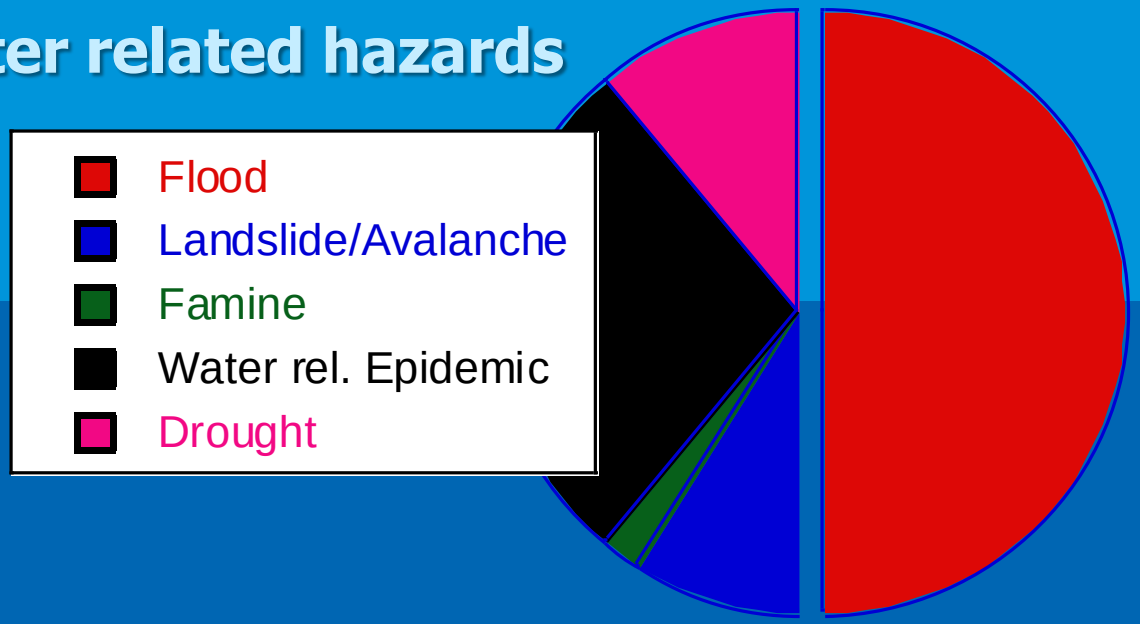
1956

photograph of Imja glacier (Photo: Fritz Muller; courtesy of Jack Ives)

2006

photograph of Imja glacier (Photo: Giovanni Kappenberger courtesy of Alton C Byers)

Water related hazards



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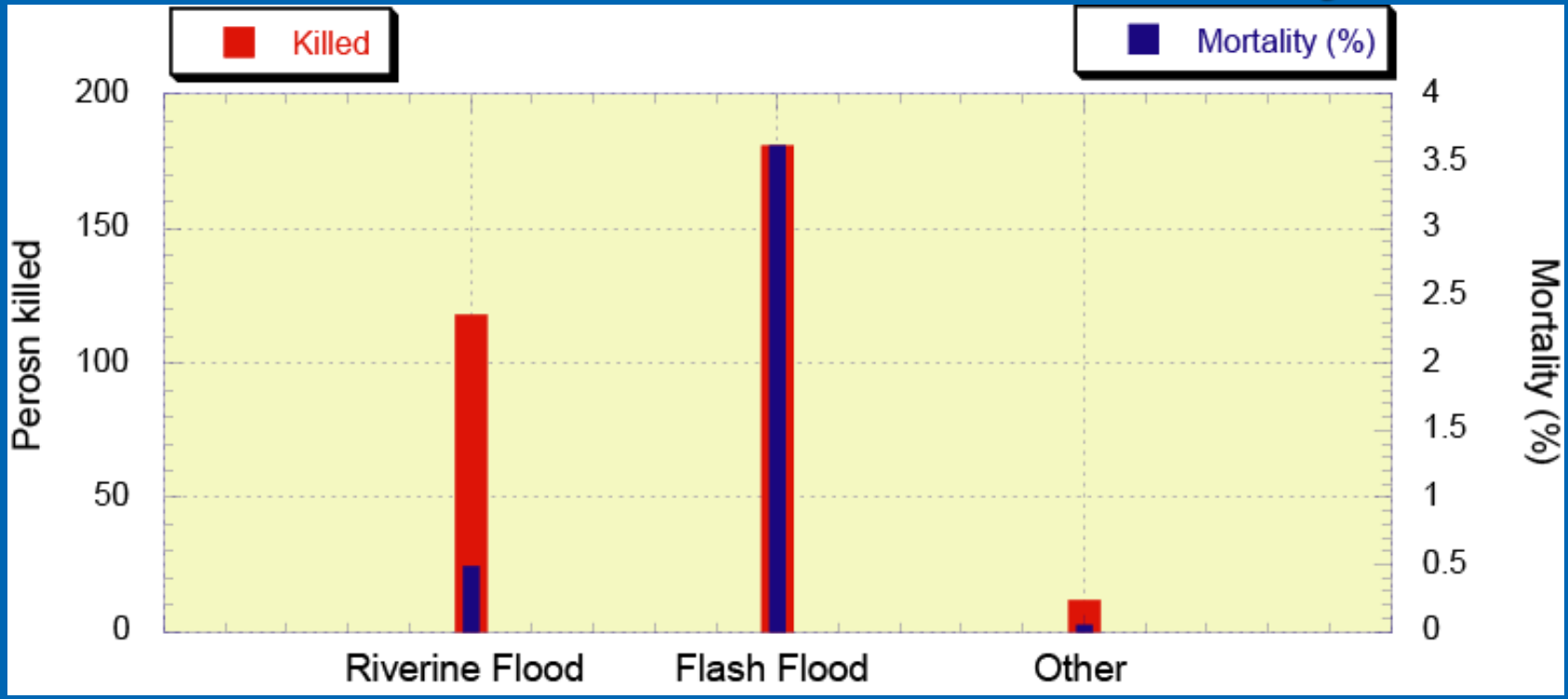
- Flash flood has the highest mortality rates



Jonkman, 2005

Increasing trend of flood disasters

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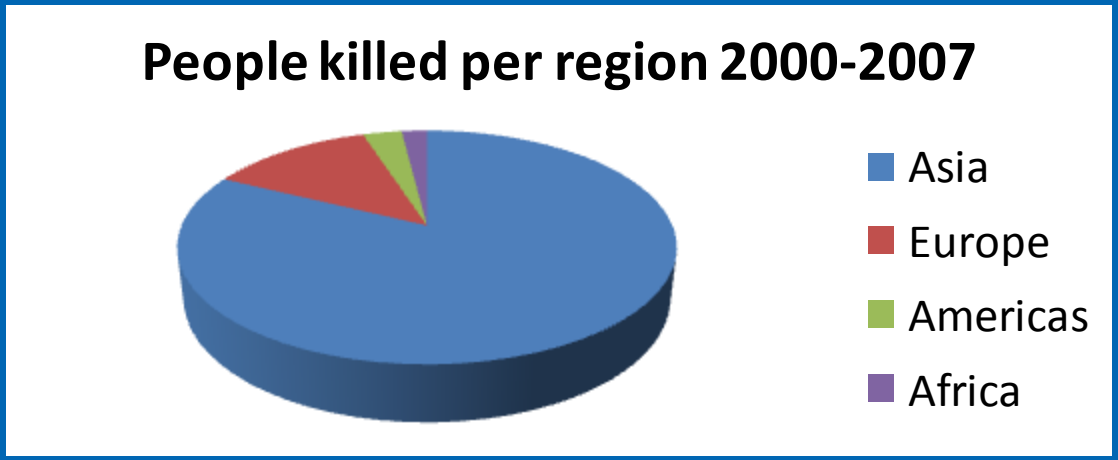
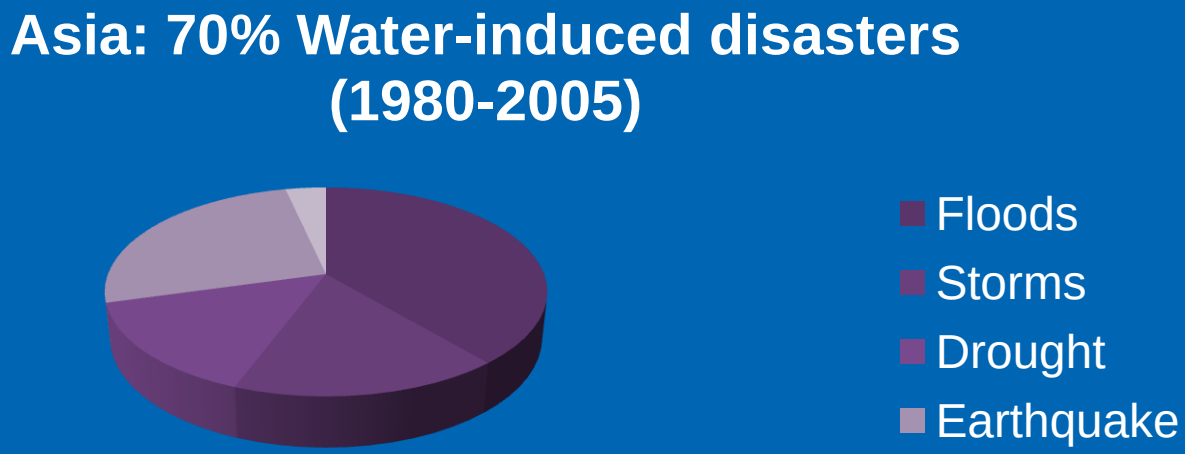
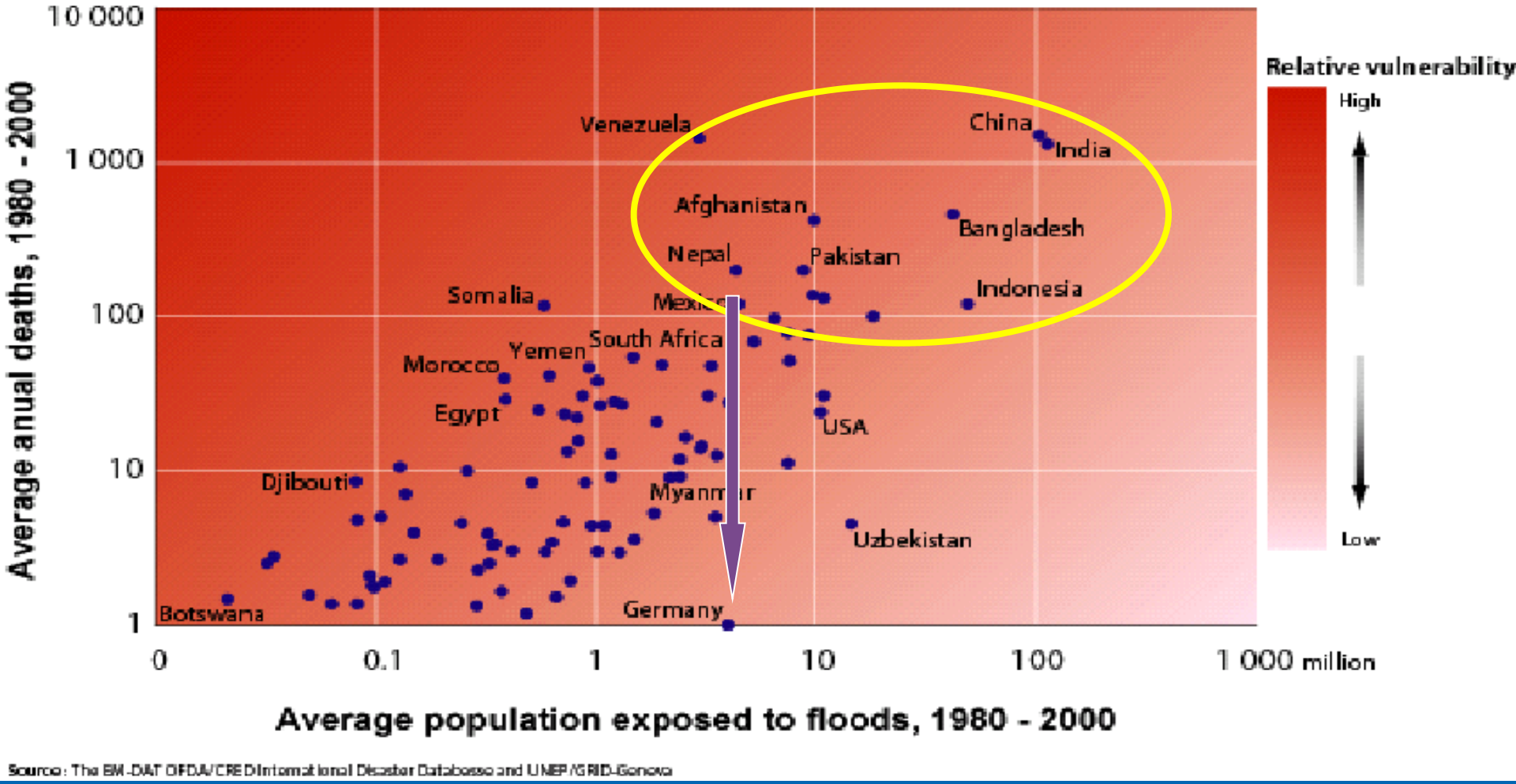




Himalayan countries are vulnerable to floods



Source: The EM-DAT OFDA/CRED International Disaster Database and UNEP/GRID-Geneva

Key issues and research gaps

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- How to build regional hydrological and meteorological database for effective trans-boundary information sharing?
- How to establish early warning system to prepare downstream communities for disaster management?
- How to build capacity to mitigate and adapt to flood disasters?
- What kind of institutional and financial (insurance) measures can enhance resilience?

Climate change challenges and issues

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3. Environment Change & Forest/ Biodiversity Conservation

Increased vulnerability of the ecosystem services

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- Himalayan countries are facing unexpected risks due to degradation of forests, biodiversity, rangelands and pasture;

- People's high dependence on these ecosystems make them vulnerable and exposed to various risks and uncertainties.

Vulnerability assessment results:
Ecosystems

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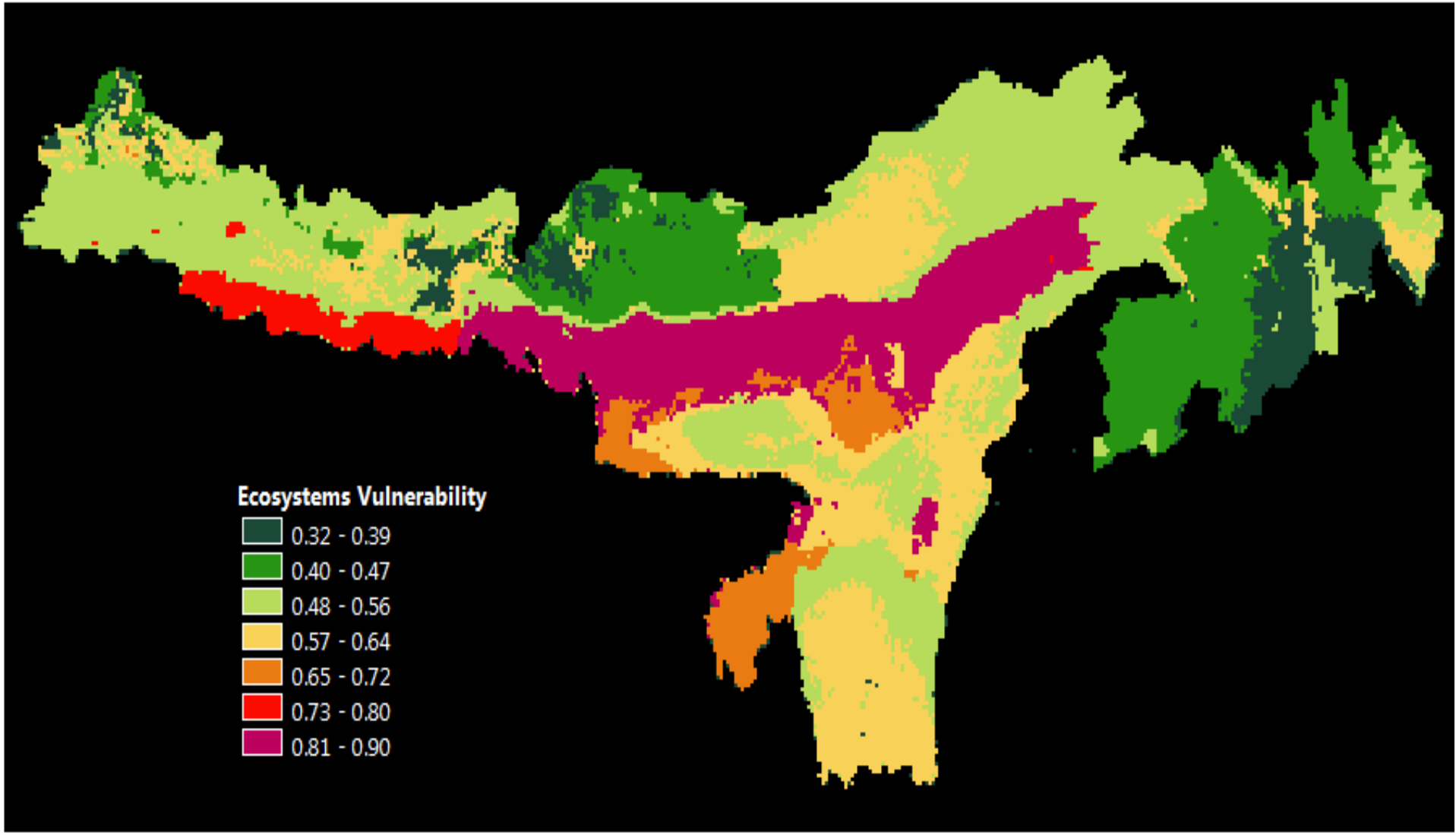

Climate change impact scenario on vegetation

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Large change in natural vegetation pattern is predicted: a) a northward shift of vegetation types; b) occurrence of invasive species

Key research questions:

- What will be the impact on forests and biodiversity species composition?
- What will be the impact of increased moisture stress on forest and agriculture ecosystem services?
- Degree of community's vulnerability to the impact on supply of ecosystem goods and services.

Climate change challenges & issues

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4. **Livelihoods and food security**

Issues & Challenges: Climate Change

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Expected Impact of Climate Change on cereal production.

	1990-2080 (% of 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	-3.9 to -7.5
Latin America	5.2 to 12.5

Source: IFPRI, 2007

- Climate change> water stress, reducing water availability for irrigation
- Climate change may further reinforce the pressure on available resources & ecosystem services > trigger the spiral of resource degradation, poverty, social unrest

Options & Opportunities

Cereal Productivity in Selected Countries in Asia: Potential for increase yield

Country	Cereal yield kg/ha
Afghanistan	N/A
Bangladesh	3,551
Bhutan	1,614
India	**2,367**
Nepal	2,282
Pakistan	2,562
Maldives	1,000
Sri Lanka	3,432
China	**5,106**

Levels of productivity in South Asia have remained much lower than in neighbouring regions: e.g., China.

Key issues and research questions

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- How can we improve efficiency of water use, soil management, capacity to withstand extreme events (floods, drought), and carbon sequestration?
- Can forests and biodiversity contribute in long-term adaptation and community resilience building?
- How can we transfer knowledge and technologies to end-users?

Conclusions

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- Climate change is one of the most complex and difficult challenges for the Himalayan countries;
- ICIMOD offers a common venue for academia to research and study people-resource dynamics in the context of climate change;
- Academic collaboration is needed to reduce the scientific uncertainty and knowledge gap;
- ICIMOD has access to the policy makers and development partners

Conclusions

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- Scientific data to monitor and climate and environment change are lacking; IPCC has identified HKH region as the `data deficient';
- Long-term research and comprehensive data are needed to plan adaptation and mitigation program to deal with future changes;
- ICIMOD as a regional knowledge centre has defined protocols and organizing capacity;
- UNM faculty, graduate students and researchers, NSC scholars have scope for doing collaborative regional and global research.

Thank you

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