Eberswalde University for Sustainable Development

.Sc. Global Change Management
Summer Semester 2025
Module Strategies for Change and Transformation

Climate change adaptation: Concepts, strategies, and examples from urban and rural areas

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Goals for today

- Learn about Adaptation to climate change
  - what does adaptation mean?
  - What are adaptation strategies?
  - what different types of adaptation exist?
  - How does adaptation relate to transformation and change?

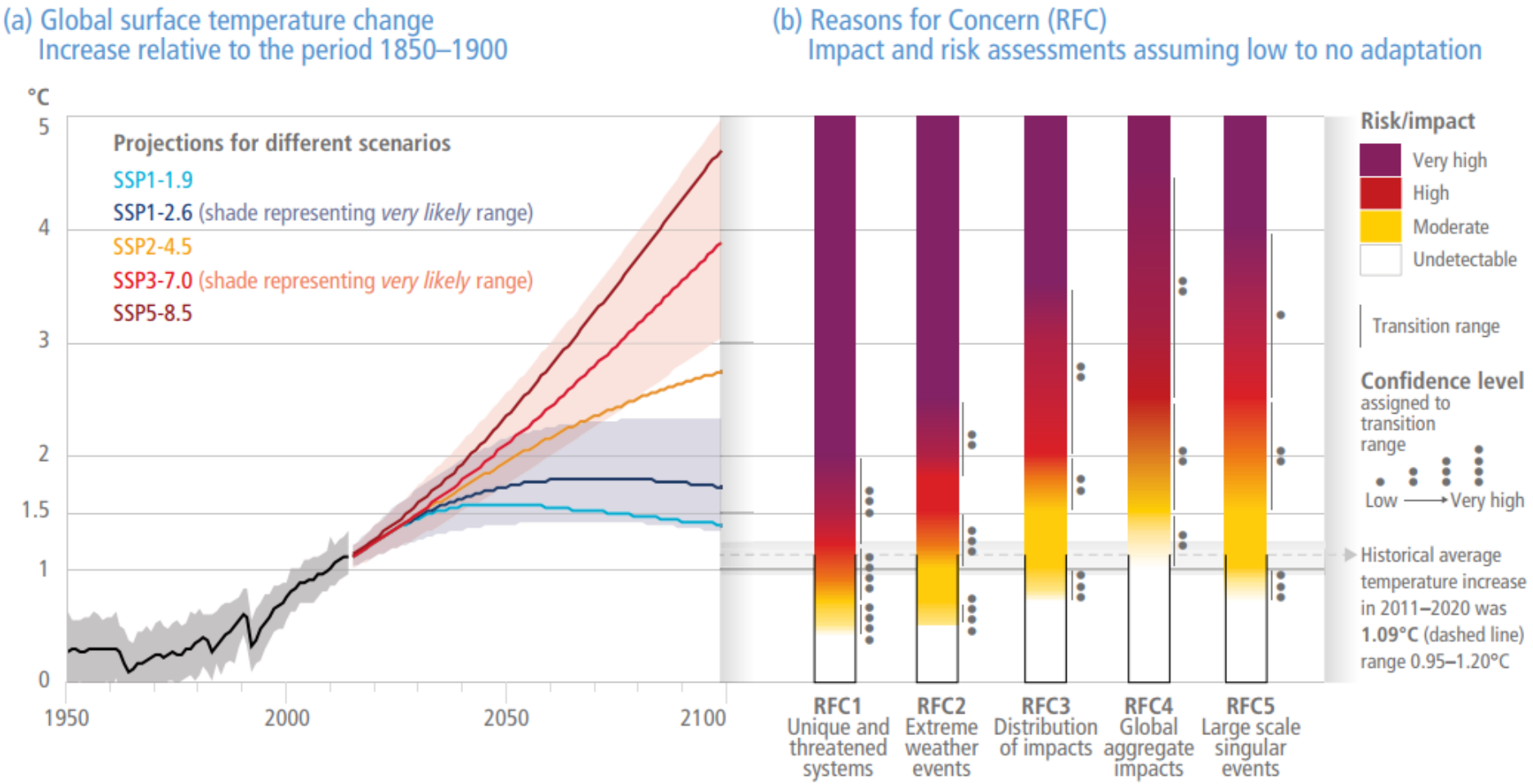
Discuss local adaptation strategies and their challenges, with inputs from case studies

  - Flood adaptation in Jakarta, Indonesia
  - Adaptation to glacier change in High Asia

Schedule

PART I – Concepts and theory	
09:30 – 10:00	Climate change: impacts and vulnerabilities (recap) Mitigation and adaptation
10:00 – 11:00	What is adaptation? Types of adaptation Critique of the adaptation concept Interactive exercise
11:00	Coffee break
PART II – Case studies: Adaptation examples in urban and rural areas	
11:15 – 12:15	Case study 1: Flood risks and community-based adaptation in Jakarta, Indonesia
	Case study 2: Failed and successful adaptation to glacier change: Examples from the Karakoram mountains
12:15 – 12:30	Final discussions

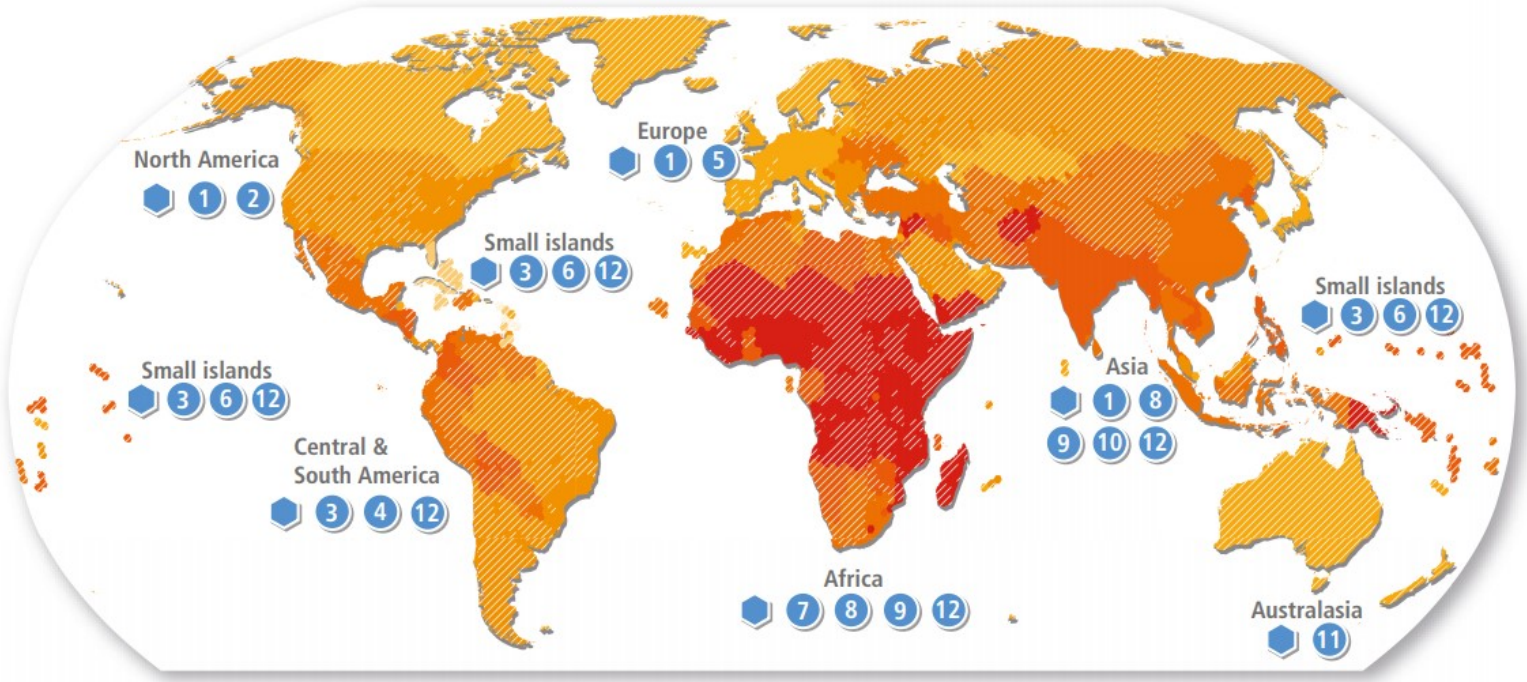
Global and regional risks for increasing levels of global warming



IPCC (2022): *Climate Change 2022: Impacts, Adaptation and Vulnerability.*
Working Group II Contribution to the IPCC Sixth Assessment Report, p. 58

Observed human vulnerability differs between and within countries and strongly determines how climate hazards impact people and society

(a) Map of observed human vulnerability based on two comprehensive global indicator-systems using national data, plus examples of selected local vulnerable populations and Indigenous Peoples



IPCC (2022): *Climate Change 2022: Impacts, Adaptation and Vulnerability.* Working Group II Contribution to the IPCC Sixth Assessment Report, p. 76

Vulnerability

“The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements, including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.”

(IPCC 2022)

Risk = **Hazard** × **Vulnerability**

(Wisner et al. 2003)

Alternative conception:

Risk = **Hazard** × **Exposure** × **Vulnerability** (see IPCC 2014)

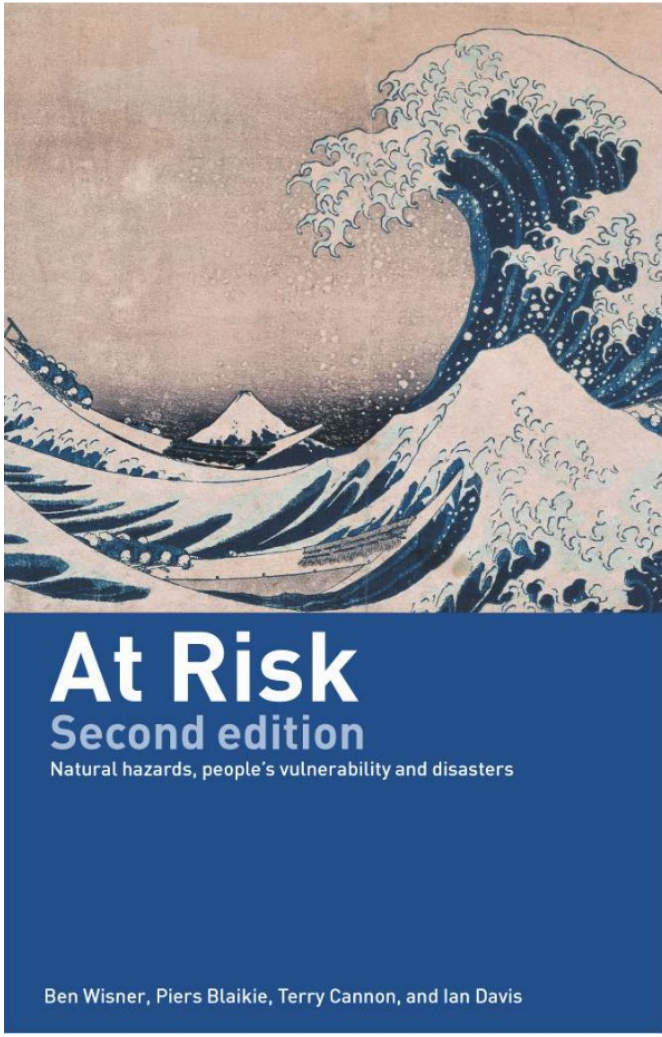
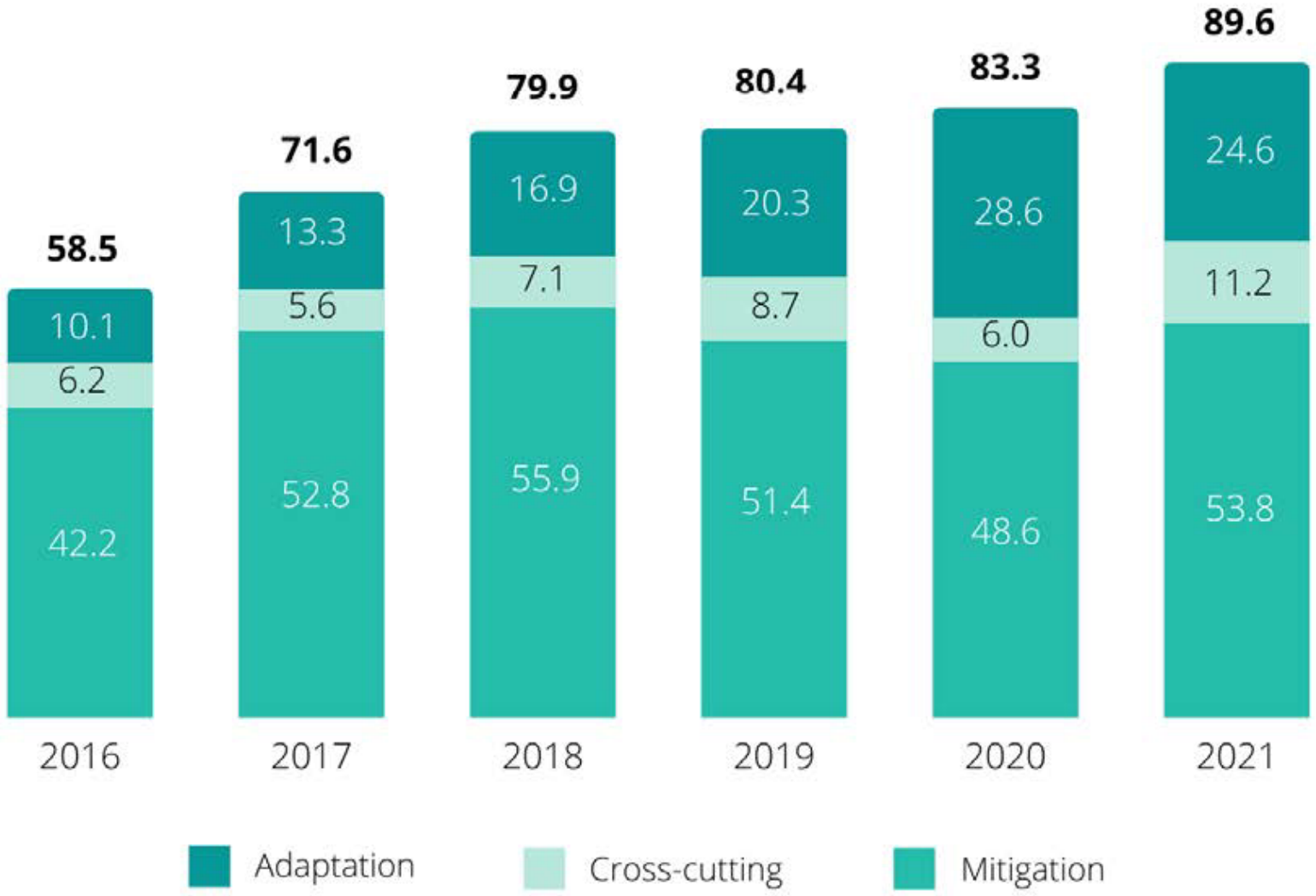


Figure 2. Climate theme of climate finance provided and mobilised in 2016-2021 (USD billion)



OECD (2021):Climate Finance Provided and Mobilised by Developed Countries in 2013-2021. https://doi.org/10.1787/e20d2bc7-en

Mitigation and Adaptation

Mitigation

- Address root cause of climate change:
  emission of greenhouse gases
- Two main types of strategies:
  - Reducing sources.
    - Reduce emissions from burning fossil fuel through various strategies (substitution, efficiency, sufficiency…)
    - Conserving forests, peatlands, etc.
    - Reduce other sources, e.g. from animal husbandry
  - Enhancing sinks (and carbon storage).
    - Taking carbon out of the atmosphere, e.g. through re- and afforestation
    - Carbon Capture and Storage (disputed)

MIT Climate Portal (https://climate.mit.edu/explainers/mitigation-and-adaptation)

Mitigation and Adaptation

Adaptation

- Focus on climate impacts
- Even if mitigation is successful, changes and risks are already "locked in" and require action to adapt
  → Failure to mitigate only makes this more important
- Adaptation needs vary from place to place, depending on different impacts and vulnerabilities

Source: MIT Climate Portal (https://climate.mit.edu/explainers/mitigation-and-adaptation)

Adaptation

IPCC definition (AR6, WGII report):

"In **human systems**, the **process** of adjustment to **actual or expected** climate and its effects, in order to **moderate harm** or **exploit beneficial opportunities**.

In **natural systems**, the process of adjustment to **actual climate** and its effects; human intervention may facilitate adjustment to expected climate and its effects."

Exercise Part I

- What adaptation strategies to climate change exist and are needed?

Types of Adaptation

Evolutionary adaptation

"The process whereby a species or population becomes better able to live in a changing environment through the selection of heritable traits. Biologists usually distinguish *evolutionary adaptation* from *acclimatisation*, with the latter occurring within an organism's lifetime."

Autonomous adaptation

"*Adaptation* in response to experienced *climate* and its effects, without planning explicitly or consciously focused on addressing *climate* change. Also referred to as spontaneous *adaptation*."

→ In contrast to **planned** climate change adaptation

Adaptation as "strategy"?

Source: IPCC AR6, WGII (Glossary)

Critique of adaptation concept

- Adaptation as biological metaphor applied to societies
  neglects social-political complexities
- Adaptation predominantly conceptualised as technical-managerial rather than social and political
  → gives preference to direct & more immediate measures such as climate-resilient irrigation systems and early warning systems (Ayers and Dodman, 2010)
- Neglect of root causes and vulnerability – lessons should be learned from previous research on disaster risk reduction
- Adaptation as part of depoliticized politics/post-politics of climate change (Swyngedouw 2013) - climate politics as “post-politics”?

→ **But**: Critique has in part been incorporated, particularly by the IPCC (e.g. removal of the term ‘stimuli’ in the 2007 definition, acknowledgment of different types of adaptation

Two fundamentally different types of adaptation

1. Incremental adaptation

"Adaptation actions where the central aim is to maintain the essence and integrity of a system or process at a given scale."

2. Transformational adaptation

"Adaptation that changes the fundamental attributes of a system in response to climate and its effects."

→ Rooted in earlier works in disaster research & geography on "transformative adaptation": requires changing power relations and fundamental redesign of existing regimes to fight the root causes of vulnerability (Bassett & Fogelman 2013, Pelling 2011)

Definitions: IPCC AR6, WGII (Glossary)

Exercise Part II

- *What adaptation strategies to climate change exist and are needed?*

→ What different types of adaptation (incremental, transformational) can we identify here?

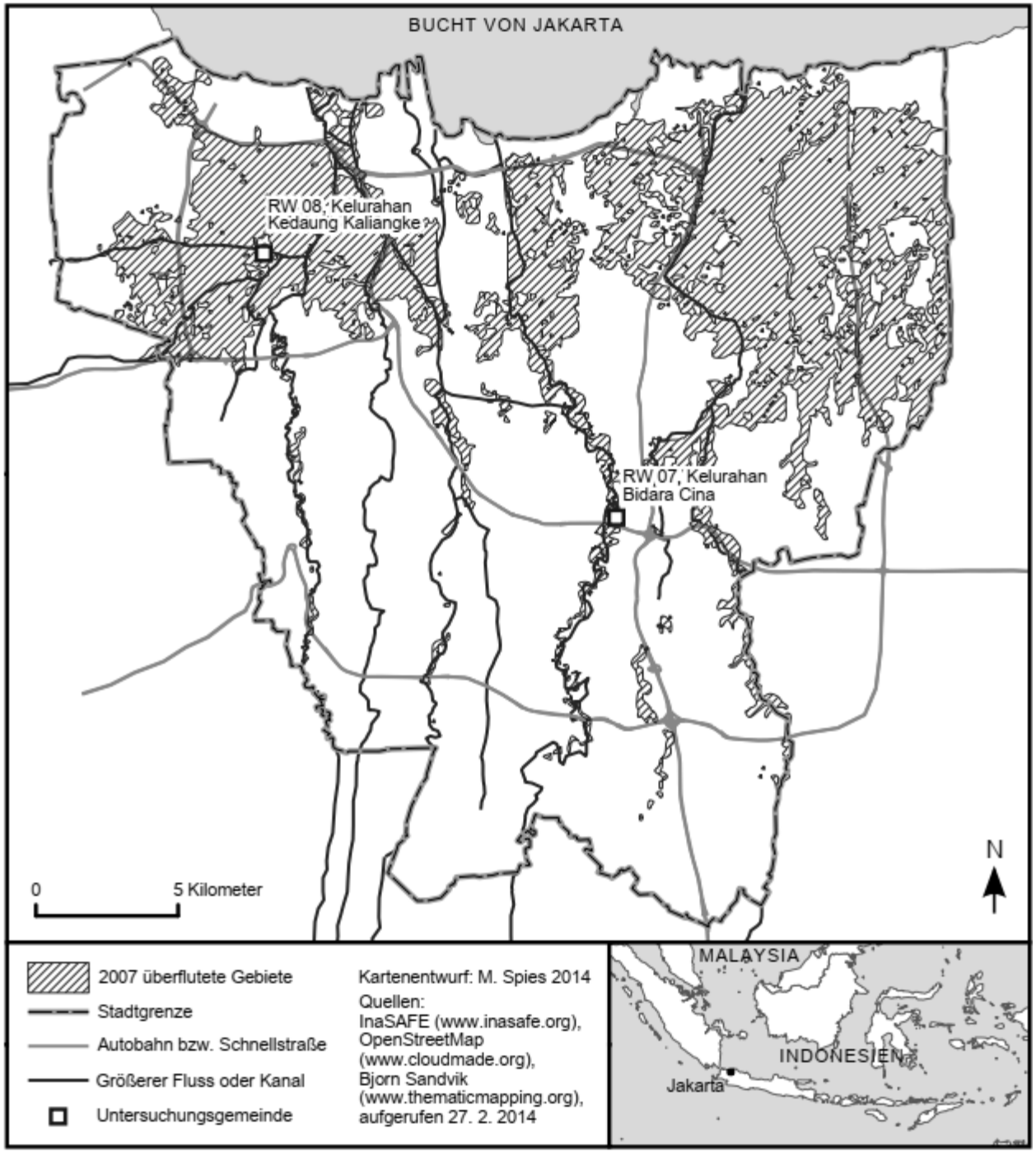
Case study: Flood risks and community-based adaptation in Jakarta, Indonesia

Picture source: Bagus Indahono/EPA (via ajazeera.com, 2022)

Picture source: Spies 2011

Source: Kusumanto et al. 2022

- Heavy floods year during rainy season
- Major flood events in 2002, 2007, 2013, 2020, 2025 – more to be expected
- Complex causes
  - Rapid & unplanned city growth, lack of pervious surfaces
  - Land subsidence & tidal floods
  - Land use change in upstream river catchments
  - Extreme rainfall events (in city & upstream)
  - Expected impacts of climate change: see level rise & increase of extreme rainfall events



Flood risk adaptation strategies

- Infrastructural approaches
  - East Flood Canal (completed 2023) and river widening – with forced evictions
  - Worldbank project of river dredging in 2010s
  - Sea wall
- City-wide flood early warning system
- How to reach the most vulnerable communities – poorest strata of population living in the flood-prone areas?

Figure 2. Kampung Pulo/Bukit Duri 2014 and 2017.

Source: Dovey et al. 2019

Flood risk adaptation strategies

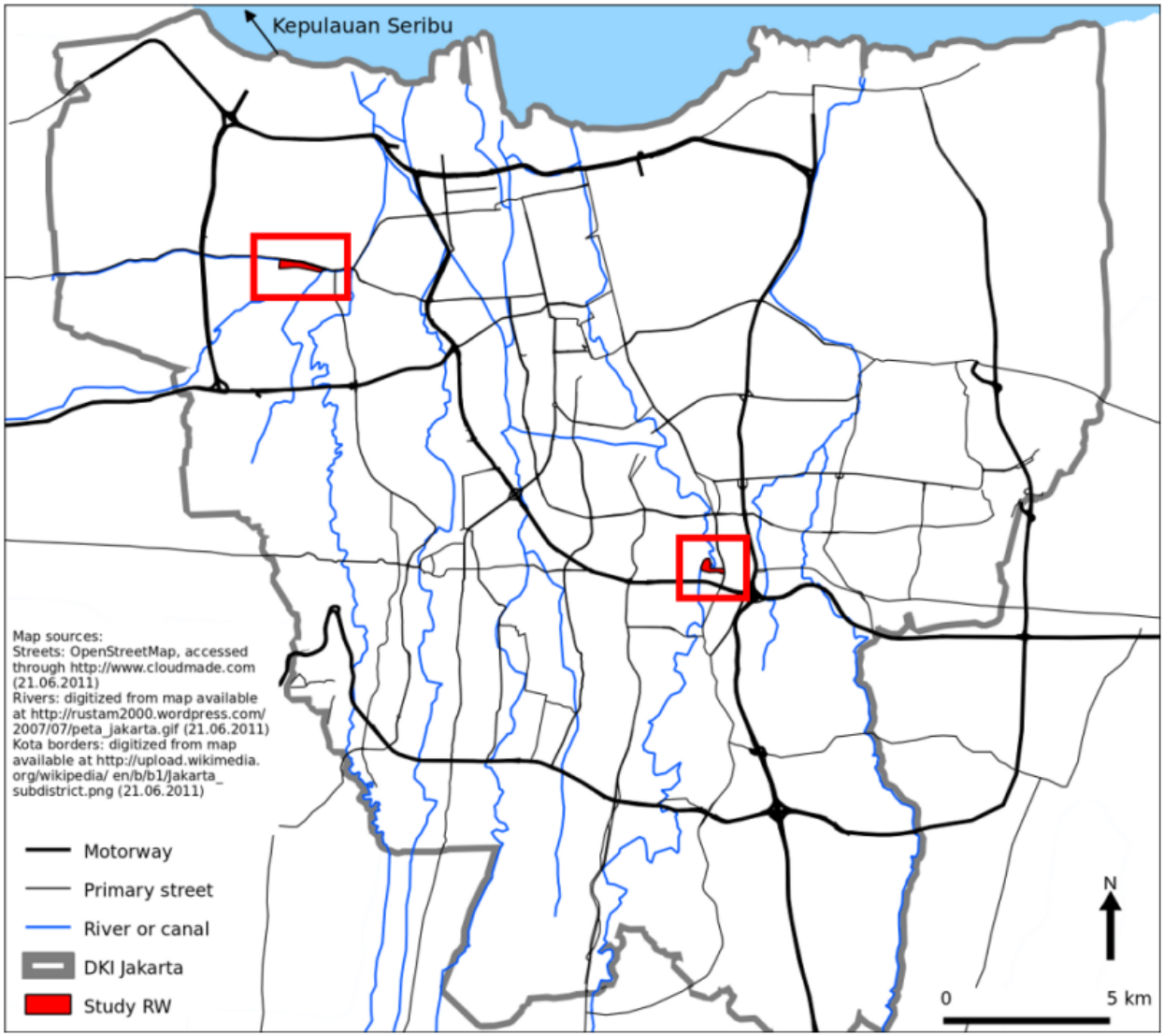
→ Suggestions by a recent policy brief:

- "Establish family emergency plan aimed at residents living in flood-prone areas"
  - Practical handbook, public education, awareness raising
- "Microinsurance to address the economic impacts of flooding for households"
  - Insurance scheme especially targeted at the poor

→ Approaches already pursued by international organizations more than a decade ago, as part of "community based disaster risk reduction" projects initiated following the 2007 mega-flood!

Kusumanto et al. 2022

- 2010/2011
  Study on local flood risk perceptions & adaptation in selected flood-affected k*ampong*
- For the “Integrated Community Based Risk Reduction and Climate Change Adaptation” (ICBRR/CC) project implemented by different Red Cross Organisations (2007 – ca. 2013)



Adaptation projects following the 2007 mega-flood

- UNESCO: “Community-based Flood Preparedness and Mitigation in Bidara Cina, East Jakarta”
- Asian Disaster Preparedness Center: “Flood Preparedness Initiatives of High-Risk Communities in Jakarta”
- USAID: “Program for Hydro-Meteorological Disaster Mitigation in Secondary Cities in Asia”
- And many more…

→ Strengthening capacities of **disaster response**;
small-scale **flood mitigation** projects such as improving waste management and sanitation;
awareness campaigns on causes and risks associated with floods.

ICBRR/CC Project: similar activities, but aims at more integrative approach of risk reduction

Local perceptions & risk adaptations in Jakarta's flood-prone communities

"Flooding is the least of the problems, it is a usual thing."

"We are not afraid of floods, we are used to them."

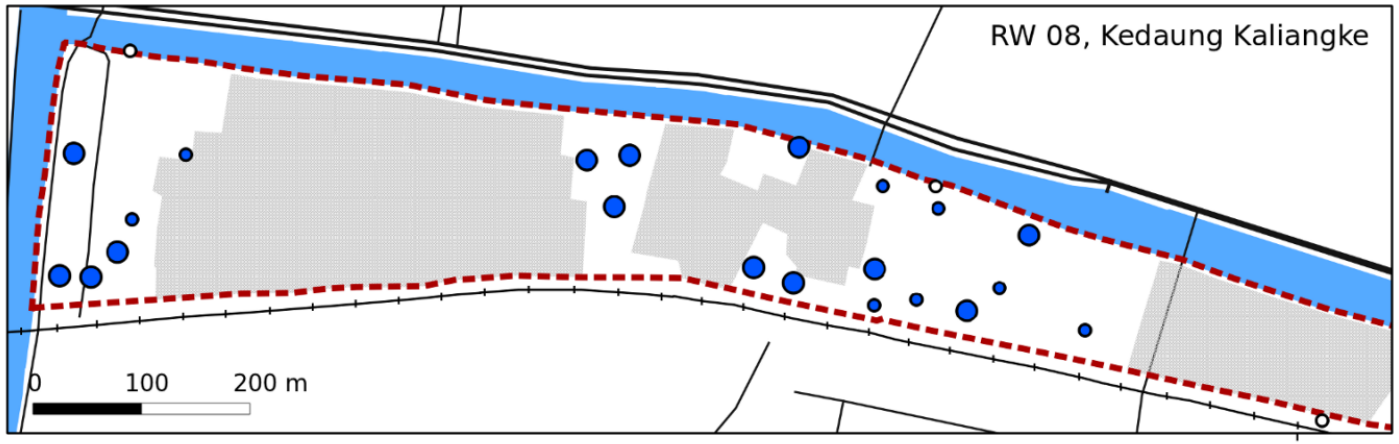
— Interviewees in one of the most flood-affected communities of East Jakarta, December 2010

Local perceptions & risk adaptations in Jakarta's flood-prone communities

Why this seemingly low perception of flood risks?

- Research methods:
  - 53 semi-structured household interviews
  - 17 interviews with local experts
  - Mappings and observations
  - Expert interviews with NGO workers

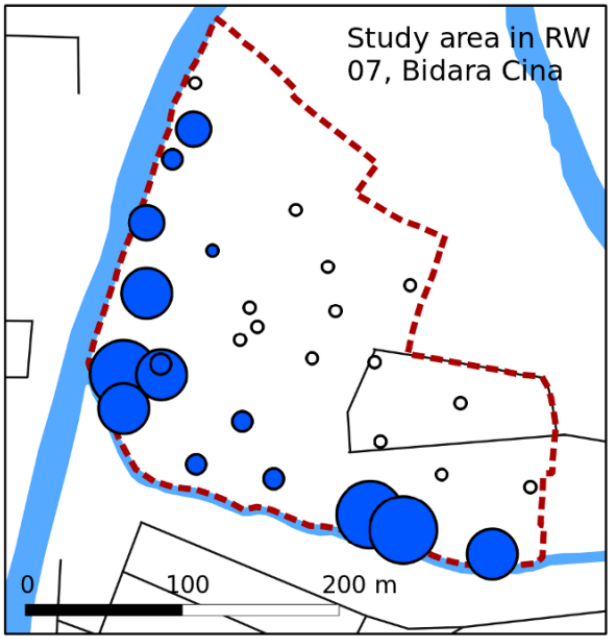
Local perceptions & risk adaptations in Jakarta's flood-prone communities



Number of floods experienced in 2010:

- 0
- 1
- 2-5
- 6-10
- 11-20
- >20

- Area occupied by factories
- Main street
- Side street
- Railway
- Study area

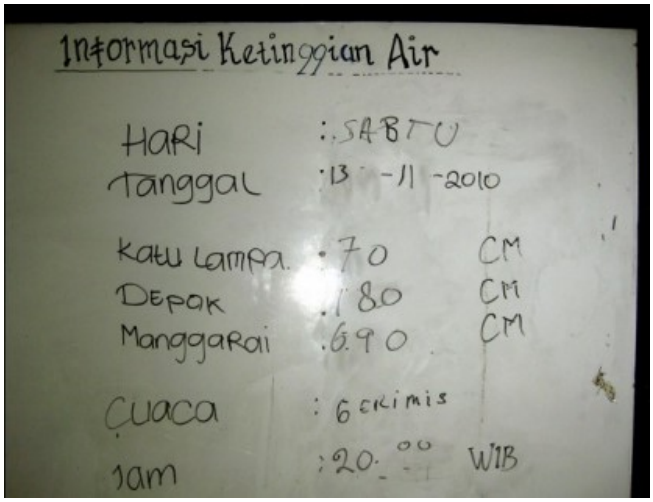


Map sources:
Rivers and factory areas - digitised from GoogleEarth
Streets - modified from OpenStreetMap, accessed through http://www.cloudmade.com (21.06.2010)

Spies 2011

Local perceptions & risk adaptations in Jakarta's flood-prone communities

- Already well-functioning disaster risk management
  - Good formal and informal early warning systems
  - Emergency shelters provided by government and humanitarian organisations
- Relatively low flood damages
  - Adapted housing structures
  - Experienced handling of flood situations (routine)



Local perceptions & risk adaptations in Jakarta's flood-prone communities

- Risk mitigation of flood-affected income losses
  - People save money for times of need
  - Free meals provided by organisations during big flood events
- Most importantly: Flood as *relatively* low risk – other risks are more severe!

Local perceptions & risk adaptations in Jakarta's flood-prone communities

Results from a problem- or threat ranking:

Average rank	Masalah ("problem")
2.1	Fire
2.8	Dengue fever
3.3	Loss of job / no work available
3.7	Tuberculosis
4.2	Diarrhea
4.8	Flooding

Data source: 51 household interviews

Local perceptions & risk adaptations in Jakarta's flood-prone communities

- Do projects of community based flood risk adaptation in Jakarta miss the point?
- ICBRR/CC Project:
  aimed at "integrative" approach addressing "all risks" in the target communities (from project proposal 2006)

→ adaptation as vulnerability reduction

→ strengthening capacities to cope with multiple risks

Local perceptions & risk adaptations in Jakarta's flood-prone communities

- Still, only one of the project components aimed at multiple risks:
  - Establishing formal savings- and credit associations on the local level to strengthen financial capacities for risk reduction
- All other prominent project components: narrow focus on flood risks as the "common problem" of the target communities (Drirahmadi et al. 2013):
  - Establishing first response teams for disaster preparedness
  - Awareness raising on flood causes and risks – e.g. by using traditional theater as a tool
  - Small-scale flood mitigation through waste reduction and drainage

Local perceptions & risk adaptations in Jakarta's flood-prone communities

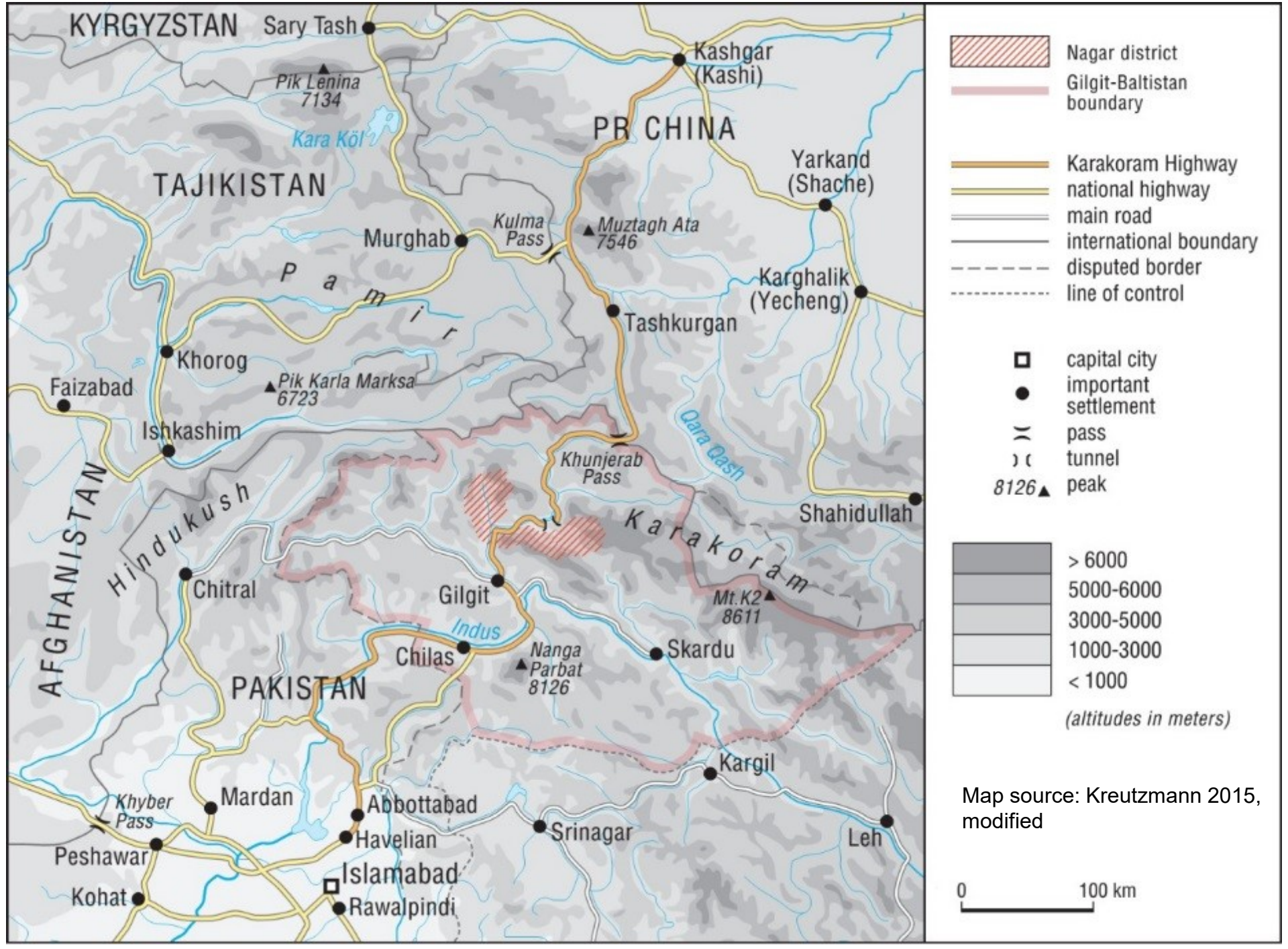
Discussion:

- What are possible reasons why more holistic & transformative approaches seem to be neglected?

Further reading:

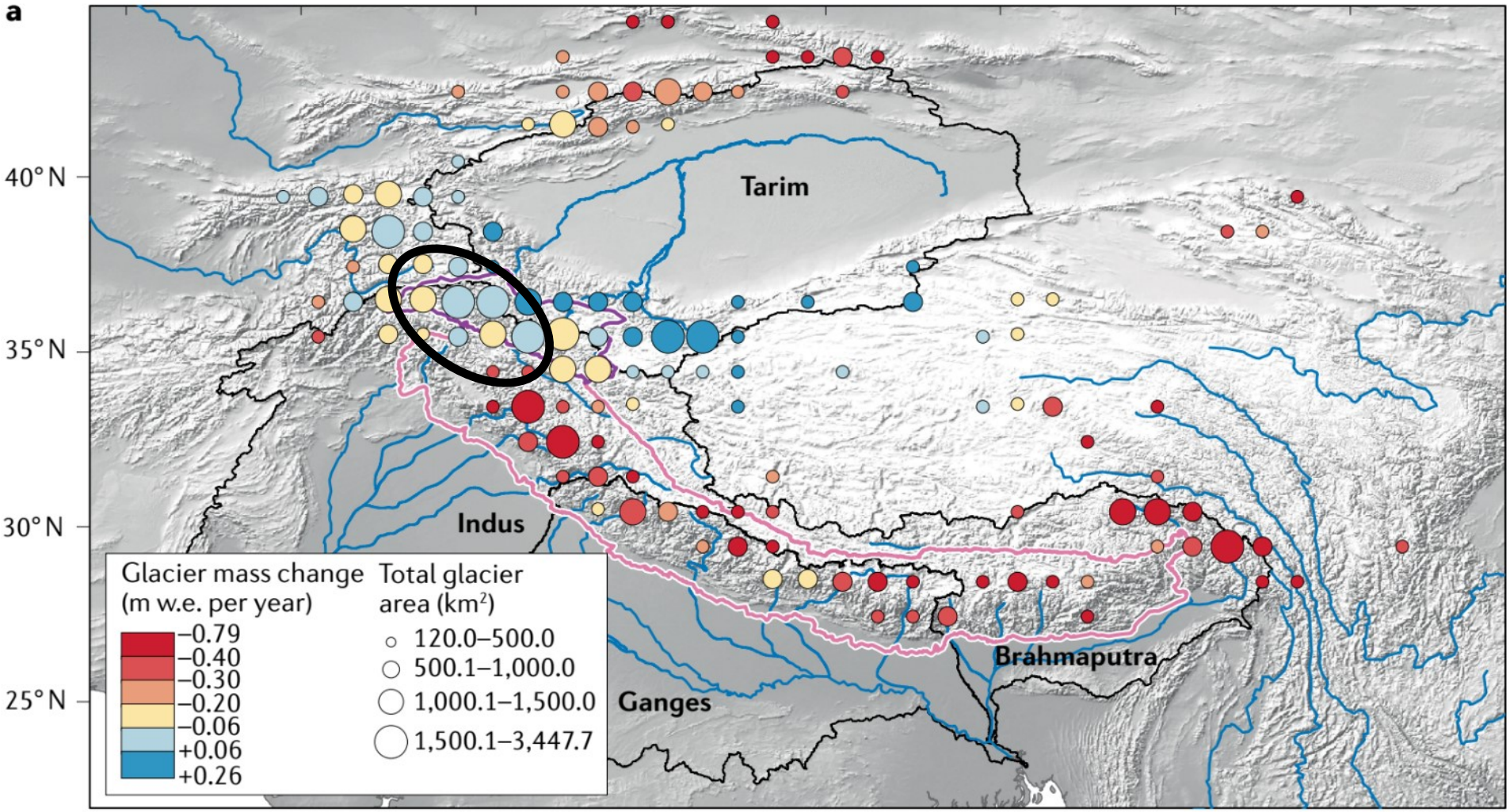
- Spies M. 2011. Deconstructing Flood Risks: A Livelihood and Vulnerability Analysis in Jakarta, Indonesia. Berlin: Centre for Development Studies, Freie Universität Berlin (Berlin Geographical Papers). https://www.geo.fu-berlin.de/geog/fachrichtungen/anthrogeog/zelf/Medien/download/Berlin_Geographical_Papers/BGP40_Deconstructing-flood-risks.pdf
- Spies M. 2014. Klimaanpassung als Diskurs: Ungleiche Perspektiven zur Hochwasserproblematik in Jakarta, Indonesien. Peripherie. 136:404–426. doi:https://doi.org/10.3224/peripherie.v34i136.22472.

Case study 2: Failed and successful adaptation to glacier change – examples from the Karakoram mountains

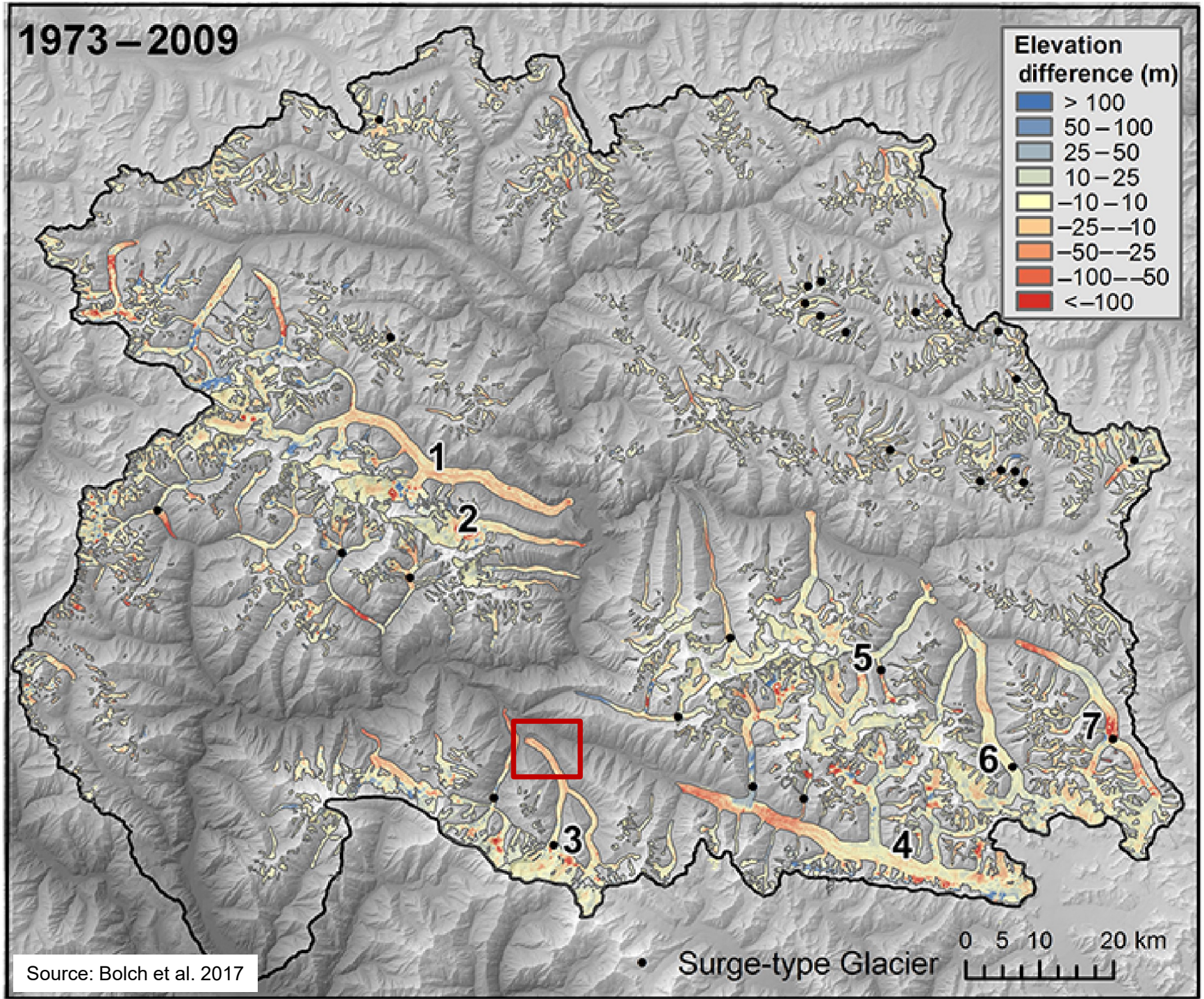


Map source: Kreutzmann 2015, modified

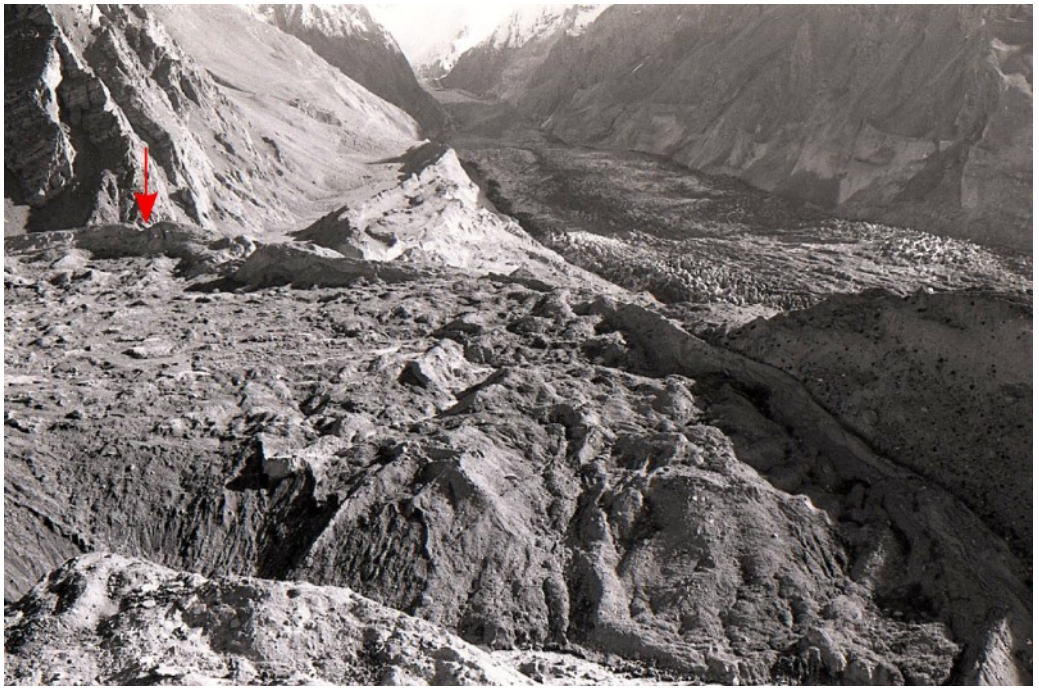
Changes in glacier mass balance, 2000-2016, based on a model using elevation data derived from ASTER stereo time series data



Source: Nie et al. 2021

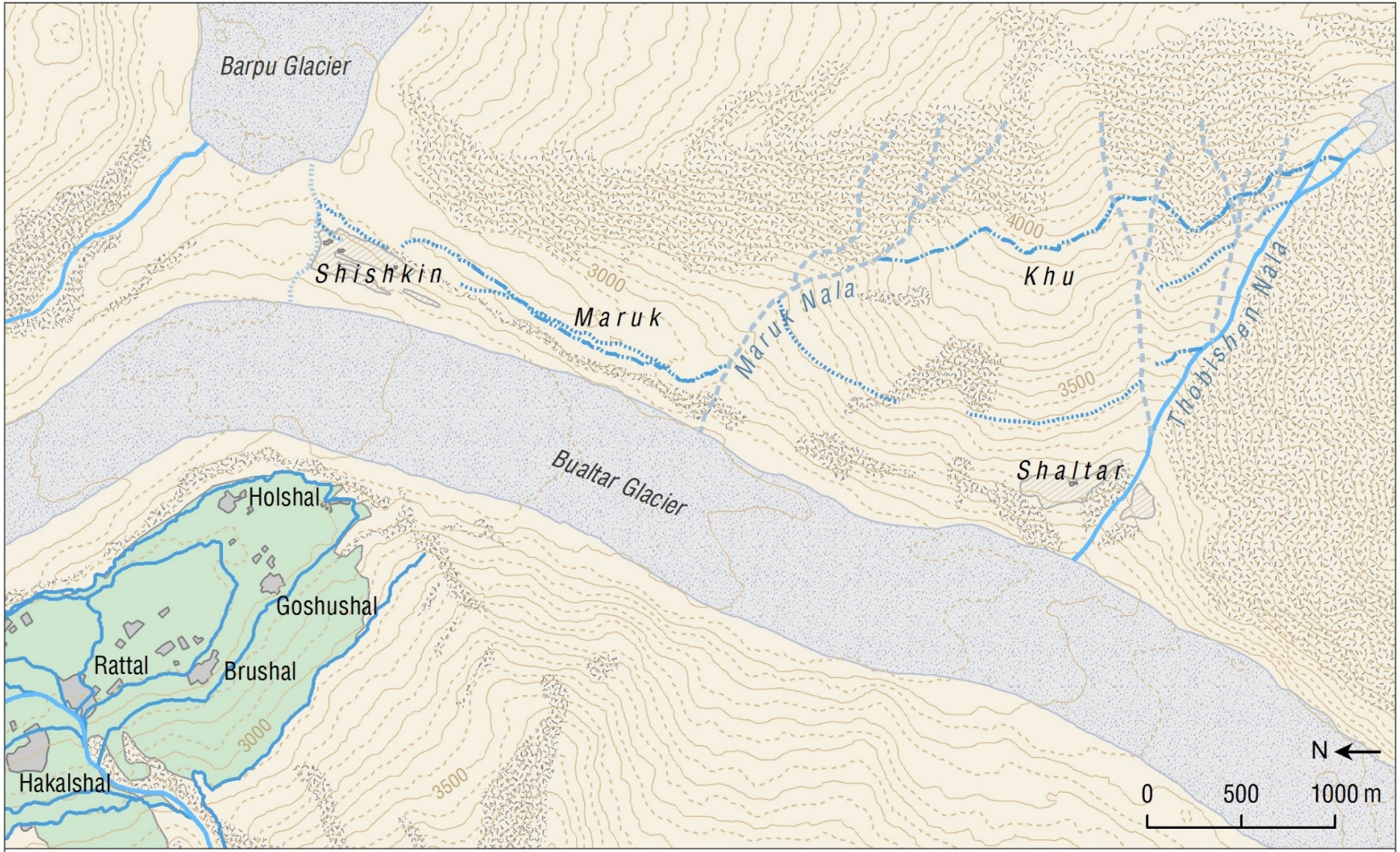

1973–2009
Elevation difference (m)
> 100
50 – 100
25 – 50
10 – 25
–10 – 10
–25 – –10
–50 – –25
–100 – –50
<–100
1
2
3
4
5
6
7
Surge-type Glacier
0 5 10 20 km
Source: Bolch et al. 2017

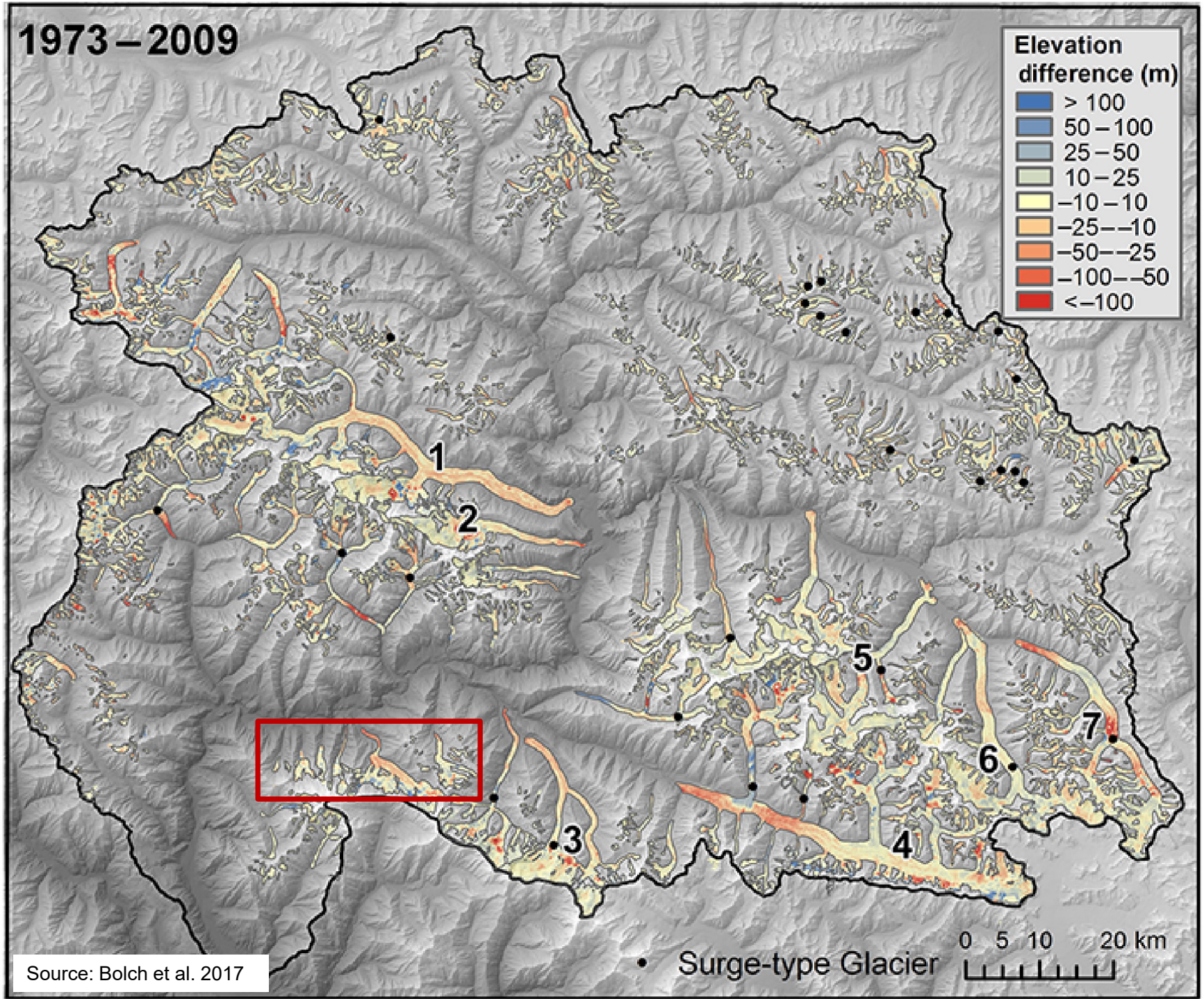
Barpu Glacier, Hopar, 1987
(Photo: K. Hewitt)



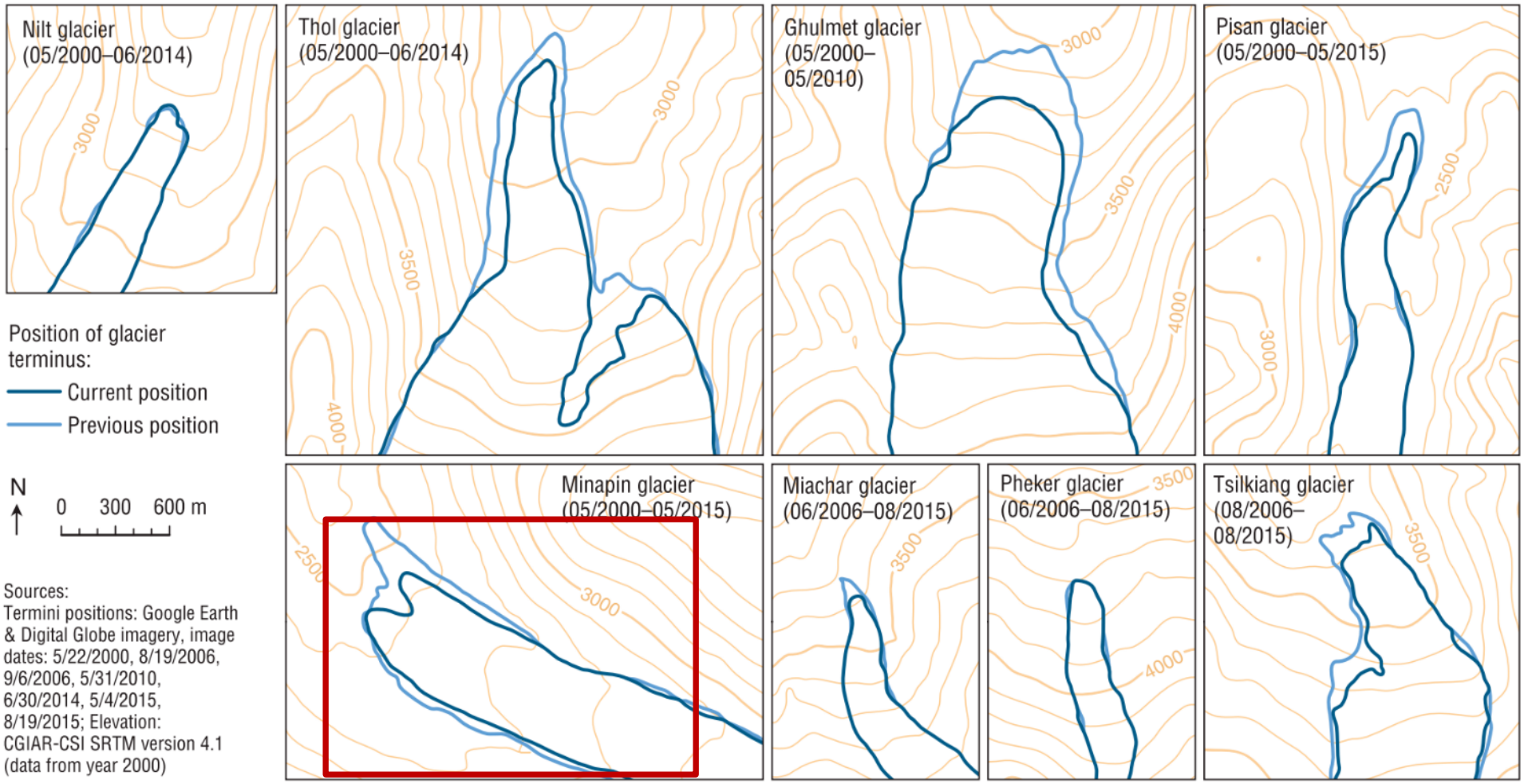
Barpu Glacier, Hopar, 2015
(Photo: M. Spies)


Hopar and
Shishkin
Photo: M. Spies, April 2015


Barpu Glacier
Shishkin
Maruk
Maruk Nala
Khu
Thobtshen Nala
Bualtar Glacier
Shaltar
Holshal
Goshushal
Rattal
Brushal
Hakalshal
3000
3500
4000
N
0
500
1000 m
Barren or pasture
Rocky
Cultivated
Field
Glacial meltwater
Dried glacier meltwater
Flood and snow meltwater
Active irrigation
Inactive
Channel
Sources: Own field surveys 2014 and 2015, CGIAR-CSI SRTM version 4.1, Bing Aerial Imagery



Source: Bolch et al. 2017



Source: Spies 2020

Image source: Pleiades 22/08/2014,
Digital Elevation Model: ASTER GDEM 2

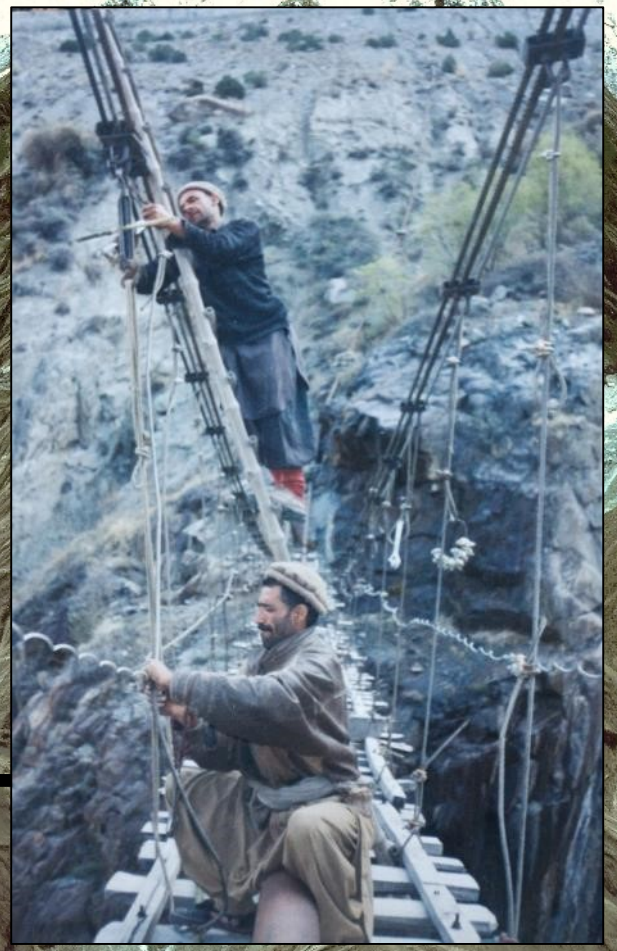


Photo: Raja Liaqat Khan 1994

Image source: Pleiades 22/08/2014,
Digital Elevation Model: ASTER GDEM 2

Factors for failure and success in local adaptation efforts

1. *Failed reirrigation schemes in Shishkin, Hopar*

- Beneficial factors & opportunities:
  - Suitable alternative water source
  - Various government and NGO funds
  - Efforts by village activists

- Destructive factors & threats:
  - Difficult environment
    - Landslides, debris and mudflows
    - Long distance of upper channel from village
  - Corrupt government contractors
  - Insufficient construction materials

Factors for failure and success in local adaptation efforts

2. Successful reirrigation scheme in Minapin

- Beneficial factors & opportunities:
  - Suitable alternative water source
  - Innovative idea
  - Strong social cohesion in village
  - Strong local leadership
  - Government and NGO funds

- Destructive factors & threats:
  - Individual sceptics
  - Steep river gorge & challenging maintenance
  - Possible disappearance of water source due to continued glacier retreat (but new source might emerge)

Conclusions

- Multifaceted local context is decisive for the outcome of adaptation efforts
- No one-fits-all solutions
- Learning from local initiatives instead of postulated notions of adaptation

Honunu, Hopar (Photo: M. Spies 2015)

Further reading:

- Spies M. 2016. Glacier thinning and adaptation assemblages in Nagar, northern Pakistan. Erdkunde. 70(2):125–140. doi:10.3112/erdkunde.2016.02.02.

Thank you for your attention!

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