Transdisciplinary science insight for understanding managed retreat across hazards, scales and geographies

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Climate resilient development pathways

There is a rapidly narrowing window of opportunity to enable climate resilient development

(a) Societal choices about adaptation, mitigation and sustainable development made in arenas of engagement

- Dimensions that enable actions towards higher climate resilient development
  - Ecosystem stewardship
    - Knowledge diversity
  - Equity and justice
  - Inclusion

- Arenas of engagement:
  - Community
  - Socio-cultural
  - Political
  - Ecological
  - Knowledge + technology
  - Economic + financial

(b) Illustrative development pathways

- Pest conditions (emissions, climate change, development)
- Present situation

(c) Actions and outcomes characterizing development pathways

- SDGs
- Well-being
  - Low poverty
  - Ecosystem health
  - Equity and justice
  - Low global warming levels
  - Low risk

- Sustainable development action
- System transitions
  - Transformation
- Adaptation
- Mitigation

- Unstable development action
- Enforced systems
  - Vulnerability
    - High poverty
    - Ecosystem degradation
    - Inequity and injustice
    - High global warming levels
    - High risk

- Maladaptation
- Rising emissions

Illustrative climatic or non-climatic shock, e.g., COVID-19, drought or floods, that disrupts the development pathway

Narrowing window of opportunity for higher CRD

IPCC SPM, 2022
Figure SPM 5
Responses to ongoing sea level rise and land subsidence in low-lying coastal cities and settlements and small islands include protection, accommodation, advance and planned relocation (*high confidence*). These responses are more effective if combined and/or sequenced, planned well ahead, aligned with sociocultural values and development priorities, and underpinned by inclusive community engagement processes (*high confidence*).
Disaster and climate resilience in a changing climate. What capacities for what change?

Change along resilience pathways

From incremental... ...to transformational

Intensity of change

Adapted from Thornton & Manasfi, 2010; IPCC, 2018

Capacities and enablers

Social
Physical
Human
Ecological
Financial
Learning
Innovation
...

Absorptive coping capacity
(Persistence)

Adaptive capacity
(Incremental adjustment)

Transformative capacity
(Transformational responses)

Stability
Flexibility
Change

Resilience

Adapted from Tanner et al., 2017
Case of geomorphic change and flooding in Bangladesh


Methods:
- Geomorphic change analysis
- Measurement of resilience and adaptive capacity
- Assessment of risk management options
Methodological approach

Biophysical riverine hazard identification at national scale

- Geomorphic hazard
  - Use results from Paszkowski et al. (in preparation) for geomorphic hotspot identification

- Flood hazard
  - Simulated flood extents and magnitudes from GLOFRIS global data
  - Use GIS to establish national map of riverine hazards in Bangladesh

Socio-economic resilience assessment at the community scale

- FRMC data Bangladesh
  - Collect data through household surveys, focus group discussions, key informant interviews and secondary data for 41 communities
  - Grade 44 sources of resilience (A-D), aggregated by means, based on data collected
  - Translate ordinal scale grades to numeric and continuous scale
  - Aggregate subsets of sources into predefined lenses, apply equal weighting

Riverine communities’ transformational capacity

- Identify frequency and magnitude of hazards in 35 riverine communities

Applying transformational capacity framework

Analysis of transformational adaptation:
- Apply DRM and Context lenses for resilience
- Aggregate sources for awareness, planning and organisation
- Apply SCs and 4Rs lenses for flexibility
- Extract socio-economic data for willingness & political voice

Paszkowski et al., 2021
Geomorphologic change and floods in Bangladesh

Legend
- Communities
- Geomorphic hotspots

100yr Inundation depth (m)
- 0
- 0-1
- 1-2
- 2-3
- 3-4
- 4-5
- >5

Paszkowski et al., 2021
Measuring Resilience Capital/Capacity
Flood Resilience Measurement for Communities (FRMC) tool

- Indicator-based resilience capacity assessment tool
- 5 capacities logic associated with livelihoods model
- Research working with implementation
- Boundary object and work: Engagement and trust
- Used in >250 communities globally

Laurien et al., 2020
FRMC indicator system to understand capacities

Stages of risk management per FRMC

- **Preparedness**
  - Stability
  - Absorptive coping capacity (Persistence)
  - Preparedness
    - Business continuity
    - Household income continuity strategy
    - Evacuation and safety knowledge
    - First aid knowledge
    - Flood emergency infrastructure
    - Community participation in flood activities
    - Inter-community flood coordination
  - Response
    - Water and sanitation awareness
    - Flood healthcare access
    - Transportation interruption
    - Flood emergency food supply
  - Recovery
    - Household asset recovery
    - Community disaster fund
    - Provision of education
  - Corrective Risk Reduction
    - Flood exposure awareness
    - Asset protection knowledge
    - Governance awareness
    - Priority managed units
    - Household flood protection
    - Large scale flood protection
    - Community representative bodies
    - Social Inclusiveness
    - Risk reduction investments
    - Natural habitat restoration
    - Integrated flood management planning
  - Prospective Risk Reduction
    - Education commitment during floods
    - Future flood risk awareness
    - Environmental management awareness
    - Priority natural units
    - Community disaster risk management planning
    - Local leadership
    - Conservation budget
    - Natural capital condition
    - Natural resource conservation

- **Flexibility**
  - Adaptive capacity (Incremental adjustment)
  - Prospective Risk Reduction
    - Future flood risk awareness
    - Environmental management awareness
    - Priority natural units
    - Community disaster risk management planning
    - Local leadership
    - Conservation budget
    - Natural capital condition
    - Natural resource conservation

- **Change**
  - Transformative capacity (Transformational responses)

**Resilience**

- Stability
- Flexibility
- Change
# Heatmap of disaster risk management across riverine communities in Bangladesh

<table>
<thead>
<tr>
<th>Community</th>
<th>Preparedness</th>
<th>Response</th>
<th>Recovery</th>
<th>Corrective Risk Reduction</th>
<th>Prospective Risk Reduction</th>
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Transformational capacity in key river basins in Bangladesh

**NORTH TEESTA RIVER**
- Predominant hazards: Flooding, erosion, drought
- Total population: 14,110
- Population below poverty line: 44%
- Planned responses:
  - Community Resilience Action Groups
  - Early warning systems
  - Improving health services
  - Use of fallow land for farming
  - Community and Government Departments Joint Planning
  - Physical infrastructure repair/upgrade
  - Homestead raising
  - School building raising
- Average temporary migration: 40%
- Transformational capacity: low
- Key barriers:
  - Enabling environment
  - Lack of community organisation

**UPPER JAMUNA RIVER**
- Predominant hazards: Flooding, erosion, drought
- Total population: 27,015
- Population below poverty line: 40%
- Planned responses:
  - Creation of Community Resilience Action Groups
  - Early warning systems
  - Improving health services during floods
  - Use of fallow land for farming
  - Community and Government Departments Joint Planning
  - Physical infrastructure repair/upgrade
  - Homestead raising
  - School building raising
- Average temporary migration: 34%
- Transformational capacity: Medium
- Key barriers:
  - Financial rapidity
  - Physical resourcefulness

**KUMAR RIVER**
- Predominant hazards: Waterlogging, erosion, cyclones
- Total population: 17,703
- Population below poverty line: 67%
- Average temporary migration: 20%
- Transformational capacity: low
- Key barriers:
  - Low levels of overall flexibility

**PADMA RIVER**
- Predominant hazards: Flooding, erosion, heatwaves
- Total population: 12,455
- Population below poverty line: 36%
- Transformational capacity: higher
- Key barriers:
  - Social rapidity
  - Physical resourcefulness

**LOWER JAMUNA RIVER**
- Predominant hazards: Flooding, erosion, drought
- Transformational capacity: low
- Key barriers:
  - Lack of community organisation
  - Social flexibility
  - Physical rapidity
Geomorphologic hazard vs. prospective risk reduction

Paszkowski et al., 2021
Summary

- Managed/strategic retreat moving to the spotlight in the context of worsening riverine and coastal floods hazards (as well as other hazards) – to anticipate forced displacement.
- Adaptation Pathways offer technical insight into the options space and timing of potential actions.
- Comprehensive capacity assessment can support change where and when needed – to consider intensifying efforts in situ along a spectrum of change as well as ex situ systemic change (e.g., retreat)- e.g., programme managers.
- Int’l policy debates on Adaptation and Loss&Damage starting to consider action and support for transformation and retreat.