Climate change, salinity intrusion and water insecurity in peri-urban Khulna, Bangladesh

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Khulna: Overview

• Khulna is the **third largest** metropolitan city in Bangladesh
• One of the five biggest **river ports** in Bangladesh
• Important for its proximity to the second seaport of the country at **Mongla**
• Central **urban corridor** of the **southwest** coastal region
• Once known as an **industrial city**
• Gained importance for **shrimp farming and processing**
Khulna: Overview

• Set up as a **thana** in 1836, upgraded to a **sub-division** in 1842 and to a **district** in 1882.
• During the **British period**, Khulna was a market town and the seat of regional administration
• Declared a **municipality** in 1884, and was linked with the regional **railway** network in 1885
• Rapid growth during the **post partition** (1947) and **post liberation** (1971) periods
Khulna: Overview

• Spatial growth largely guided by the local topography

• City originated at the southern end of a natural levee along the western side of the Rupsha-Bhairab river, linearly expanded along the levee

• Growth pattern further shaped by Khulna-Jessore highway

• Low lands and fallow lands are decreasing whereas the built-up areas are increasing

• Projected that water bodies and low lands will reduce to 3% and 29%, respectively,

• Built-up areas will expand to 33% in 2019
## Peri-urban Research Sites

<table>
<thead>
<tr>
<th>Location</th>
<th>Socio-economic characteristics</th>
<th>Issues/problems identified</th>
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</thead>
<tbody>
<tr>
<td>Alutala</td>
<td>Alutala is 2-3 km away from the Khulna City Corporation (KCC) boundary. It is located in Botighbata upazila of Khulna district. Agriculture, fisheries and livestock rearing are the major livelihoods options of the local communities. Some are also engaged in the city’s informal sector for livelihood.</td>
<td>Conflict in water use between urban and peri-urban water users of the Mayur. Vulnerable to climate change and sea level rise. Vulnerable to rainfall flooding and water logging. Salinity ingress and arsenic contamination in groundwater. Absence of participatory regulator operation.</td>
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<tr>
<td>Labonchara</td>
<td>Labonchara is located near the Rupsha bridge within the city boundary with thousands of households in North and South Labonchara. Most of the people are dependent on informal business in the city and adjacent peri-urban areas.</td>
<td>Acute water scarcity for drinking, washing and sanitation. Vulnerable to water logging due to absence of drainage system. Salinity and water pollution limit access to safe drinking water and sanitation. Absence of any institutional framework. Existing natural channels are not properly functional.</td>
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<tr>
<td>Chhoto Boyra</td>
<td>Land use is still agriculture dominated. Thousands of farmers are dependent on the Mayur river’s water for irrigation. A significant number of people are engaged in formal and informal businesses and service sectors in the city.</td>
<td>Acute water scarcity for irrigation. Conflict in water use between urban and peri-urban users. Vulnerable to rainfall flooding and water logging. Solid waste dumping in the Mayur river. Lack of institutional arrangement for saving the Mayur river.</td>
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</tbody>
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Water Security Issues

- Encroachment of the water body
- Long queues to collect water
- Water pollution
- Increased demand

% of households

- Alutala
- Labonchara
- Chhoto Boyra
Climate Change: Assessing from Observed Data

- **Temperature** is rising very fast since 1980
- Number of extremely **cold nights** is decreasing and the **heat index** is increasing
- **Sunshine** duration has a **decreasing** trend
- **Humidity** has an **increasing** trend
- **Rainfall** is increasing in terms of both magnitude and **number** of rainy days
Climate Change: People’s Perception

![Bar graph showing the percentage of households that perceived climate change in Alutala, Labonchara, and Chhoto Boyra. The graph compares various aspects of climate change, including warmer and fewer cold days and nights, warmer and more frequent hot days and nights, warm spells, heavy rainfall events, area affected by drought increases, frequency and intensity of tropical cyclones increase, increased incidence of flooding due to sea level rise, and increased salinity intrusion.](chart.png)
Climate Change: Implications for Water Security

• Changes in **rainfall pattern**: irrigation water and crop production
• **Tidal water** level and **salinity**: agriculture and drinking water
• **Temperature rise**: work stress and comfort level
• Groundwater **recharge** and changes in the **hydrologic cycle**
• Rainfall intensity and temperature: **human health** and well-being
• Frequency and intensity of **climatic disasters**
Urbanization and Climate Change: Compounding Stressors

• Urban flooding from extreme rainfall
• Groundwater recharge
• Urban heat island effect and local micro-climate
Urbanization and Climate Change: Compounding Stressors

- Warmer and fewer cold days and night
- Warmer and more frequent hot days and night
- Warm spells
- Heavy rainfall events
- Area affected by drought increases
- Frequency and intensity of tropical cyclones increase
- Increased incidence of flooding due to sea level rise
- Increased salinity intrusion

% of respondents

Fast    Medium    Slow
Vulnerability: Behind the Scene

- **New demands and claims** over land and water makes peri-urban residents more vulnerable.
- **Conversion** of agricultural land: water availability, access and quality.
- **Contestation** for resources creates **conflicts** and weakens resilience - increases vulnerability.
- **Urbanization** degrades peri-urban **biophysical** systems and processes.
- These are **further degraded** by **climate change impacts** including sea level rise and salinity intrusion.

**Examples:** Urban land development projects, Urban elites taking control over peri-urban water resources, Urban wastes and wastewater flows to the peri-urban areas, Urban heat island effects spill over to the peri-urban areas and change the local environment and **micro-climate**.
Adaptation Practices

- **Technological** (RWH, building dikes around agricultural plots)
- **Institutional** (new forms of collective institutions – tubewells, ponds)
- **Changes in livelihood strategies** (shift in cropping pattern, salinity tolerant crop, switching to culture fisheries, non-agricultural livelihoods, migration)
Action and Advocacy

• Village plan: Needs, mobilization, action
• Climate change and adaptation awareness/trainings
• Community based solid waste management
• Art/debate/quiz competitions
Action and Advocacy

- Multi-stakeholder platform aided by short-term studies
- Policy interventions
- ‘Save the Mayur’ campaign
Thanks!