South Asian Research Hub for Climate Change: Rationale, Strategy, Framework & Roles

Monirul Mirza
University of Toronto
“Climate is a function of time. It varies; it is subject to fluctuations; it has a history”

-Emmanuel Le Roy Ladurie (1929-)

Emmanuel Le Roy Ladurie (1929-)

Climate is a function of time. It varies; it is subject to fluctuations; it has a history.
First World Climate Conference

- Identified the leading cause of global warming as increased atmospheric concentrations of carbon dioxide
- Examined the possible impacts on specific activities such as agriculture, fishing, forestry, hydrology, and urban planning
- Highlighted the international community's emerging perception of the climate as a vital natural resource
- It urged governments "to foresee and to prevent potential man-made changes in climate that might be adverse to the well being of humanity."

WCCC-1, Geneva, 1979

Source: WMO
Ability to Understand Extremes

Relative confidence in attribution of different extreme events

How well we understand the likely influence on event types in general

NOAA Climate.gov, adapted from NAS 2016
Weather and Climate Extremes

**Hot Extremes**

Type of observed change in hot extremes
- Increase (41)
- Decrease (0)
- Low agreement in the type of change (2)
- Limited data and/or literature (2)

Confidence in human contribution to the observed change
- High
- Medium
- Low due to limited agreement
- Low due to limited evidence

**Heavy Precipitation**

Type of observed change in heavy precipitation
- Increase (19)
- Decrease (0)
- Low agreement in the type of change (8)
- Limited data and/or literature (18)

Confidence in human contribution to the observed change
- High
- Medium
- Low due to limited agreement
- Low due to limited evidence

IPCC AR6 2021
Too Little Water: Droughts

Type of observed change in agricultural and ecological drought

- Increase (12)
- Decrease (1)
- Low agreement in the type of change (28)
- Limited data and/or literature (4)

Confidence in human contribution to the observed change:

- High
- Medium
- Low due to limited agreement
- Low due to limited evidence

Source: IPCC, 2021
Increasing Extreme Rainfall Events (ERE)

• The increasing trend of the intensity of ERE is clearly observed over India
• ERE occurred almost in the entire year
• ERE found to be dominant in July followed by June and September
• Very high ERE occurred in recent years in many locations
• Extreme precipitation events surged in western mountainous areas in Nepal.
• The risk of 100-year extreme rainfall event already increased in Bangladesh
• Regional variation found in Pakistan’s monsoon precipitation trend

Samantaray et al., 2023; Talchabhadel et al., 2018; Rimi et al., 2022; Ullah et al., 2023.
Increased risk due to shift in the mean: An Example

\( p_1 = 0.0017 \) (1974 rainfall)
Return period, \( T_1 = \frac{1}{p_1} = 588 \) year

\( p_2 \), with 12% increased in the mean rainfall in 2030
\( p_2 = 0.0207 \)
\( T_2 = 48 \) year

Risk = \( \frac{T_1}{T_2} = \frac{588}{48} = 12 \) times more likely to occur

Source: Warrick et al., 1996
Climate Change & Engineering Infrastructure

Why Climate Change is Important for Engineering Infrastructure

• Much of South Asian infrastructure are aging & designed based on existing climate patterns.

• These designs need to be revisited to improve safety and protection for South Asians by incorporating climate change

• Unless climate change impacts are not addressed on infrastructure design and operation, public safety and interest could be affected.

• Public safety impacts: Disruption of life, injury, loss of life, relocation, etc.

• Public interests: Business disruption and loss of employment, damage and destruction to infrastructure, environmental impact and high costs of repairs and replacement
Padma Bridge: CC Considerations

• Consideration of several climatic parameters during the design process
• Inclusion of IPCC AR4 sea level rise scenarios in the design
• Projection of rising water levels at the bridge site
• Design discharge set at 151,000 m³/sec
• Design velocity specified at 5 meters/sec

Source: Ahmed et al., 2022
Water
Monsoon in the GBM Basins

Source: Mirza, 2003
River Discharge Characteristics

Data source: BWDB
Sensitivity of Runoff: Case of the Ganges Basin

Source: Mirza, 1997
The snow in the Himalaya region are depleting. The change threatens millions as the flow dynamics of rivers change.

Photographs: Courtesy Jack D. Ives/The Mountain Institute/Fritz Müller and Alton Byers, Guardian and Kunda Dixit
The assessment of this change needs to consider cascading impacts across the region.
a) Normal snow fall and rainfall

The flow will resemble the state of earlier years. The exposure of landscape, people and infrastructure will increase exacerbating risks.
b) Depleting snow will face less snow fall and deficient rainfall

Will exacerbate drought condition. More springs will become dry affecting small irrigation and drinking water schemes. The rivers flows will dwindle and water at sharing instruments will be low and treaty provisions will be stressed.

Ecosystem flow for freshwater diversity and people

1954 agreement sets the water sharing modality
Agriculture & Food Security
Number of Undernourished People on the Rise

Source: FAO, 2022
Insecurity by severity differs greatly across the regions of the world

Source: FAO, 2022
South Asia: Food Insecurity

Data Source: World Bank & Statista
Climate & Cropping Pattern

Source: Brammer et al., 1996
• “Based on many studies covering a wide range of regions and crops, negative impacts of climate change on crop yields have been more common than positive impacts (high confidence)”

Source: IPCC AR5, 2014
Climate Change Challenges for Rice

- **Temperature**: Rising temperatures can significantly impact rice cultivation
- **Water Scarcity or Irregularity**: Cultivation is affected by variability in rainfall
- **Sea Level Rise and Salinity Intrusion**: Coastal rice-growing areas are vulnerable to sea-level rise
- **Pests and Diseases**: Increased prevalence and distribution of pests and diseases could affect rice
Climate Change & Food Security

• Escalating global food insecurity, primarily driven by climate-related factors.

• Weather pattern alterations resulting from global warming, leading to occurrences of extremes.

• Beyond a certain temperature threshold agriculture practices could be difficult.

• Declining crop yields will result in a higher number of people falling into poverty.

• Food insecurity could lead to many health problems.

Source: IPCC & World Bank
Human Health
CC & Human Health

• Climate hazards are increasingly contributing to a growing number of adverse health outcomes

• Several chronic, non-communicable respiratory diseases are climate-sensitive

• Heat is a growing health risk due to burgeoning urbanization

• Extreme climate events act as drivers of involuntary migration & displacement
• A significant increase in ill health and premature deaths from climate-sensitive diseases
• Projection of significant increase population exposure to heatwaves
• CC is expected to have adverse impacts on well-being
• Increase in burdens of several climate-sensitive food-borne, waterborne, and vector-borne diseases
• Future climate-related migration is expected to vary by region and over time depending on many factors
Mitigation
Global Temperature Change

Data Source: NOAA, 2022

1901-2000=13.6°C
2022 Temp.=14.81°C
AGGI_{2022} = 1.49
CO_2\text{ equivalent} = 523\text{ ppm}
Annual GHG Index

• The AGGI in 2022 was 1.49, which means that we’ve turned up the warming influence from greenhouse gases by 49% since 1990.

• It took ~240 years for the AGGI to go from 0 to 1, i.e., to reach 100%, and 32 years for it to increase by another 49%.

• In terms of CO₂ equivalents, the atmosphere in 2022 contained 523 ppm, of which 417 is CO₂ alone. The rest comes from other gases.

• CO₂ is by far the largest contributor to the AGGI in terms of both amount and rate of increase.

• Note: The IPCC suggests that a constant concentration of CO₂ alone at 550 ppm would lead to an average increase in Earth’s temperature of ~3°C.

Source: NOAA, 2023
Global Distribution of CO$_2$ Emissions

Per capita CO$_2$ emissions
Carbon dioxide (CO$_2$) emissions from fossil fuels and industry$^5$. Land use change is not included.

Data source: Global Carbon Budget (2022); Population based on various sources (2023)
OurWorldInData.org/co2-and-greenhouse-gas-emissions | CC BY
Resilient Cities
Why Emphasizing on Cities?

• Cities have a disproportionate impact on climate change ➔ mitigation
  - 55% of global population, 75% of CO₂ emissions

• Urban heat island effect.
  - Warmer compared to non-urban surroundings
  - Increasing pollution hazard
Why Emphasizing on Cities?

• Cities are disproportionately affected by natural disasters and climate change. ➔ adaptation
  - Port cities: 9% of global GDP exposed
  - 20 world’s large coastal cities are exposed

• Cities stand at the forefront for preventive measures, emergency preparedness, and response.
Climate Tipping Points

• Current levels of GHG emissions risk triggering climate tipping points (TPs).
• TPs are the shifts in the climate system that cause devastating irreversible changes.
• Many parts of the climate system are sensitive to tipping
• Certain tipping points being triggered now when global warming stands at roughly 1.2°C.
• Halting warming at 1.5°C would reduce the chances of triggering multiple climate tipping points

Source: McKay et al, 2022.)
Climate Tipping Points

(1) The melting of the **Greenland ice sheet** is accelerating
(2) The West Antarctic Ice Sheet (WAIS) is vulnerable to collapse
(3) Atlantic Meridional Overturning Circulation (AMOC) could shut down
(4) One fifth deforestation of Amazon rainforest could trigger crossing of its tipping point
(5) Thawing permafrost
(6) Warming ocean could push ENSO past tipping points
Climate Tipping Points

Source: McKay et al, 2022.)
Greenland Ice Sheet

The West Antarctic Ice Sheet (WAIS)

Atlantic Meridional Overturning Circulation (AMOC)

Amazon rainforest
Strategic Direction

- Encouraging collaborative research initiatives involving specialists from across South Asian nations.
- Creating alliances with global entities, research establishments, and financial backers.
- Advocating interdisciplinary research to tackle intricate, interrelated challenges.
- Enabling the exchange of knowledge through workshops, seminars, and digital platforms.
- Enhancing expertise and delivering training to researchers, policymakers, and local communities.
- Echo the South Asian Voice to the Global Leaders
- Reframe the South Asian Cooperation in the current climate context
Framework

- Fostering cooperative research endeavors that engage experts from all South Asian countries.
- Forging partnerships with international organizations, research institutions, and funding sources.
- Promoting cross-disciplinary research to address complex and interconnected issues.
- Facilitating the sharing of knowledge through workshops, seminars, and online platforms.
- Strengthening skills and providing training to researchers, policymakers, and communities at the grassroots level.
- Strengthening people to people cooperation on shared strength of South Asia.
The Role of South Asian Research Hub

*The South Asian Research Hub will play a pivotal role in our region*

Providing decision-makers with current, fact-based data and information for decision making.

Fostering innovation and achieving excellence in research.

Establishing a network of collaboration among scientists, scholars, and policymakers, development actors and communities.

Enhancing resilience at the community, regional, and national tiers.

Serving as an exemplar of global cooperation in addressing worldwide climate challenges.
“We cannot solve our problems with the same level of thinking that created them”

- Albert Einstein

“Speed is irrelevant if you are going in the wrong direction.”

- Mahatma Gandhi
1st South Asian Conference 2023

UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENERIO

Social Science Faculty, Dhaka University, Bangladesh

25th November, 2023
Empowering the waves: Feminist climate movement building through community-based ecosystem management in coastal Bangladesh

SOUTH ASIAN CONFERENCE ON “UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENARIO”
September 14th, 2023
climate change: We must acknowledge

- **Worsening Crisis (IPCC AR6):** IPCC's Sixth Assessment Report warns of an escalating climate crisis driven by human activities.

- **Temperature Rise (IPCC AR6):** Global temperatures have increased by 1.2°C, causing extreme weather events.

- **Vulnerable Communities (Oxfam):** Oxfam highlights disproportionate impacts on vulnerable communities, leading to poverty and displacement.

- **Urgent Action Needed (Greenpeace, Current Position):** Greenpeace emphasizes the need for rapid emission reductions, renewable energy, and sustainable practices.

- **Global Cooperation (Paris Agreement, 2015):** International cooperation under the Paris Agreement is crucial, but more ambitious goals and financial support are required.
Bangladesh is highly vulnerable to climate change despite contributing very little to global greenhouse gas emissions (0.56%).

Hotspots of climate change and ranked the seventh extreme disaster risk-prone country in the world as per the report from the Global Climate Risk Index 2021.

Communities of coastal districts rely on industries like fishing, agriculture, and forestry, which are dependent on natural resources.

Socio-economic conditions and limited participation in decision-making processes hinder access to resources and environmental justice for coastal communities.

Development programs by the government and non-governmental organizations have yet to effectively address poverty and sustainability concerns in the coastal areas.
Situation Analysis
Deforestation and Environmental degradation

South-west

Source: Deforestation Mapping of Sundarbans Using Multi-Temporal Sentinel-2 Data & Transfer Learning
Examining the Ecosystem Service Values Due to LULC Changes: A Case Study on Cox's Bazar, Bangladesh
Situation Analysis
Deforestation and Environmental degradation

1972
Chakaria-Sundarban Mangrove visible

1990
Chakaria-Sundarban Land Transformation

2023
Chakaria-Sundarban Shrimp Farm
Situation Analysis
Climate Change GENDERED EXPERIENCES

- Among 146 countries, Bangladesh has been ranked at 139th position for women’s economic participation and opportunity (Global Gender Gap Report 2023)

- Women are at the bottom of the power structure and have the least power, privileges, and resources

- Only around 7.5% of 5.8 million rural enterprises are women-led (International Growth Centre, LSE)
Moni Biswas - one of the major victims of climate change in Assasuni, Satkhira
Anwara Begum – the worst victim of climate change from Moheshkhali, Bangladesh
Situation Analysis
Non-inclusive development

Powerplant
Sand-filled area
3 rotation cropland
I. Participatory Study on Feminist Climate Actions

II. Participatory research on climate change-induced loss and damage

III. Intersectional Gender Analysis

IV. Strategic and Impact Assessment of Projects

V. Green Business Assessment

Looking Dipper
At a glance: Economic loss and damage

- Economic loss and damage accounts for **about 20% of annual household income**
- **Greatest damage to housing-related physical assets** (house, garden, etc.)
- Loss of **drinking water facility is the most common** among other assets
- The **higher the dependency on natural resources** (land, waterbody, etc.), the higher the loss and damage
- **Higher total loss and damage in the south-west** region as well as high dependency on fisheries and livestock
- **Limited attention in the south-east area by GOs** and NGO interventions
At a glance: Non-Economic loss and damage

✓ Women suffer more non-economic loss and damage in all areas

✓ Most common loss and damage involve physical injury during extreme events like cyclones, health problems from personal hygiene due to water logging and salinity intrusion

✓ Loss of biodiversity in fisheries and agriculture are related to higher economic loss and damage in south-west

✓ Loss of productivity of land over the years
## At a glance: Women’s Perception and Empowerment

<table>
<thead>
<tr>
<th></th>
<th>Shyamnagar</th>
<th>Assasuni</th>
<th>Koyra</th>
<th>Chakaria</th>
<th>Moheshkhal</th>
<th>i</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Female-headed family</strong></td>
<td>16.98%</td>
<td>15.38%</td>
<td>6.49%</td>
<td>10.98%</td>
<td>4.76%</td>
<td></td>
</tr>
<tr>
<td><strong>Earning members</strong></td>
<td>1-2 members (80.88%), 2-4 members (19.12%)</td>
<td>1-2 members (74.29%), 2-4 members (25.71%)</td>
<td>1-2 members (80.43%), 2-4 members (19.57%)</td>
<td>1-2 members (81.63%), 2-4 members (18.37%)</td>
<td>1-2 members (88.33%), 2-4 members (11.67%)</td>
<td></td>
</tr>
<tr>
<td><strong>Major disasters</strong></td>
<td>Saline Water, Cyclone, Floods, River erosion</td>
<td>River erosion, Salinity, Floods, Waterlogging</td>
<td>Drought, River erosion, Salinity, heavy rainfall</td>
<td>Saline Water, Cyclone, Floods</td>
<td>Cyclone, Flood, River erosion.</td>
<td></td>
</tr>
<tr>
<td><strong>Compensation to Female</strong></td>
<td>16.92%</td>
<td>8.57%</td>
<td>10.87%</td>
<td>8.16%</td>
<td>1.67%</td>
<td></td>
</tr>
<tr>
<td><strong>Females Covered by SSN</strong></td>
<td>18.18%</td>
<td>88.24%</td>
<td>14.29%</td>
<td>26.67%</td>
<td>68.89%</td>
<td></td>
</tr>
</tbody>
</table>
| **Female-led movement to overcome climate & disaster** | 1.47% | 5.71% | 0.00% | 0.00% | 0.00% | OXFAM
Harsh Reality: The Undeniable Truth

✓ Breaking Barriers: Women as the Unsung Heroes of Climate Resilience

✓ Shifting the Balance: Sufferings are always with the women, but are we creating exposure for them?

✓ Unlocking the Climate Code: Is Bangladesh's Policy Truly Gender-Inclusive?

✓ From Grassroots to Advocacy: Is it easy for grassroots women Participants to become Climate Advocates?

✓ From Margins to Mainstream: Is Climate Advocacy Becoming an Elite Agenda?

Connecting the Dots ...
Understanding the Feminist Climate Movement

The feminist climate movement seeks to address gender issues in the context of climate change. This movement takes a broader intersectional approach that encompasses a wide range of gender-related inequalities and seeks to reshape the entire narrative surrounding climate action.
Feminist Climate Movement

- Addressing Gendered Impacts CC
- Environmental Activism
- Awareness and Justice Building
- Empowerment and Knowledge
- Policy Advocacy
- Partnerships and Collaboration
Blue Economy and Inclusive Development for Climate Justice (BID4CJ)
What are we Aiming For?

Empowered coastal communities to nurture healthy ecosystems and a climate-just economy in southwest and southeast Bangladesh through feminist climate movements, ecosystem restoration, and ethical business development.
Coastal Communities of Bangladesh have an Equal Share of the Benefits of Healthy Ecosystems and a Climate-Just Economy.

- **Feminist Climate Movement Building**
  Coastal communities, especially women and marginalized people, have increased power over decisions that affect their lives and livelihoods and practice stewardship on ecosystem management and economic development.

- **Ecosystem Restoration**
  Revitalized ecosystems equitably benefit the most marginalized people in the community.

- **Resilient Livelihood and Private Sector Engagement**
  Coastal communities and businesses benefit from climate- and gender-just economic development. Working with the government, private sector, and local communities.

Theory of Change (ToC)
Outcome 1: Coastal communities, especially women and marginalized people, have increased power over decisions that affect their lives and livelihoods.

At least 10,000 marginalized people will be able to raise grievances with duty bearers and get involved in coastal ecosystem management efforts to influence both public and private sector policies.
Outcome 2: Restored ecosystems benefit the most marginalized people in the community.

Aiming to enhance the collective economic value of ecosystem goods and services created for the community in Bangladesh's coastal areas while lowering climate risks and shocks to the community & ecosystem.
Outcome 3: Coastal communities and businesses benefit from climate- and gender-just economic development.

Working with the government, private sector, and local communities, BID4CJ will develop participatory and inclusive business models (at least 50) that include the community’s interests, the environment, and the enterprises themselves.
THANK YOU

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SOCIAL MEDIA

WEBSITE
1st South Asian Conference 2023
UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENERIO
Social Science Faculty, Dhaka University, Bangladesh
25th November, 2023
P1.1 Factors and Potential Climate-induced Migration in Coastal Belt of Bangladesh

Mizanur Rahman, Zereen Saba, Asma Akther Popy, Khaled Md. Mehzabin Alam, Umme Hani Asha, and Musrat Jahan Momo
Introduction

Coastal belt of Bangladesh is characterized by climate-induced:

- Sea-level rise
- Salinity intrusion
- Cyclones and Storm Surges

Due to climatic-induced disaster, fragile livelihoods leading the forced migration of coastal people.
Study Area

- Patuakhali
- Barguna
- Cox’s Bazar
Objective of the study

• To explore the socio-economic factors behind the climate-induced forced migration
• To identify potential climate displacement locations from Patuakhali, Barguna and Cox’s Bazar.
# Methods and methodology

## Primary Data

<table>
<thead>
<tr>
<th>Methods</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Household Questionnaire Survey</strong></td>
<td><strong>Total 620</strong></td>
</tr>
<tr>
<td></td>
<td>Cox’s Bazar- 248 (M 112, F 112, PWD 24)</td>
</tr>
<tr>
<td></td>
<td>Barguna- 155 (M 70, F 70, PWD 15)</td>
</tr>
<tr>
<td></td>
<td>Patuakhali- 217 (M 98, F 98, PWD 21)</td>
</tr>
<tr>
<td><strong>Focus Group Discussion (FGD)</strong></td>
<td><strong>Total 27</strong> (9 in each district)</td>
</tr>
<tr>
<td></td>
<td>Men, women, mixed group (male and female), youth, persons with disability, farmers, fisher folk, forest-dependent communities, and market actors</td>
</tr>
<tr>
<td><strong>Key Informant Interview (KII)</strong></td>
<td><strong>Total 21</strong> (7 in each district)</td>
</tr>
<tr>
<td></td>
<td>Department of Agriculture Extension (DAE), Department of Livestock Services (DLS), Dept. of Disaster Management (DDM), Ward Disaster Management Committee, Union Disaster Management Committee (UDMC), Financial Institute</td>
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</tbody>
</table>
# Methods and methodology

## Secondary Data

<table>
<thead>
<tr>
<th>Methods</th>
<th>Documents/Quantity</th>
</tr>
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<tbody>
<tr>
<td>Relevant Policies and Act</td>
<td>Migration Policy, Water Policy, Agriculture Policy, Forest Policy, Gender Policy were reviewed and analyzed.</td>
</tr>
<tr>
<td>Relevant Articles</td>
<td>IPCC Sixth Assessment Report (AR6), Bangladesh Climate Change Strategy and Action Plan (BCCSAP), National Plan for Disaster Management (NPDM, 2021 to 2025), Standing Order on Disaster -2019, 8th Five-Year Plan of Bangladesh, Delta Plan, Integrated Coastal Zone Management Plan, National Plan on Water and Sanitation for hard to reach area, Coastal Embankment Improvement Plan, Mujib Climate Prosperity, Water Policy, Agriculture Policy, Forest Policy, Gender Policy and other relevant articles were reviewed and analyzed.</td>
</tr>
<tr>
<td>Relevant Stakeholders and Institutions</td>
<td>Department of Agriculture Extension (DAE), Dept. of Disaster Management (DDM), Ward Disaster Management Committee, Union Disaster Management Committee (UDMC), Bangladesh Water Development Board (BWDB), and other relevant organizations</td>
</tr>
</tbody>
</table>
## Result and discussion

### Occupational Vulnerability

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Barguna</th>
<th>Cox’sbazar</th>
<th>Patuakhali</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fishermen</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmer</td>
<td></td>
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<td></td>
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<tr>
<td>Small trader</td>
<td></td>
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<td></td>
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<tr>
<td>Boatman</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Day labor</td>
<td></td>
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</table>

### Index

<table>
<thead>
<tr>
<th>Index</th>
<th>0-33%</th>
<th>34-65%</th>
<th>66-100%</th>
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<tbody>
<tr>
<td>Low</td>
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<td></td>
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<tr>
<td>Medium</td>
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<tr>
<td>High</td>
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</tbody>
</table>
Result and discussion

Migration Threat

- Patuakhali: 27.05%
- Cox's Bazar: 9.05%
- Barguna: 39.56%
Result and discussion
Livelihood Opportunity

Employment scenario in the study area

<table>
<thead>
<tr>
<th>Location</th>
<th>Yes (%)</th>
<th>No (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patuakhali</td>
<td>50.41%</td>
<td>49.59%</td>
</tr>
<tr>
<td>Barguna</td>
<td>53.39%</td>
<td>46.70%</td>
</tr>
<tr>
<td>Cox's Bazar</td>
<td>51.85%</td>
<td>48.15%</td>
</tr>
</tbody>
</table>

Primary livelihoods option changing scenario

<table>
<thead>
<tr>
<th>Location</th>
<th>Yes (%)</th>
<th>No (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patuakhali</td>
<td>8.61%</td>
<td>91.39%</td>
</tr>
<tr>
<td>Barguna</td>
<td>10.99%</td>
<td>89.01%</td>
</tr>
<tr>
<td>Cox's Bazar</td>
<td>12.45%</td>
<td>87.65%</td>
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</tbody>
</table>
Result and discussion
Conclusion

The climate change impacts also enhance human displacement and migration, where women and children suffer the most. Changes in ecosystem services impact local migration, income, and livelihoods. Permanent residency as one of the mandatory criteria for Social Safety Net (SSN), so migrated people don’t have access to SSN.
I would like to gratefully acknowledge Center for People & Environ for data and knowledge sharing support.
“Assessment of Community Stewardship over Ecosystem Services within Climate Nexus: A Pathway Towards Locally-led Adaptation in Nijhum Dwip, Bangladesh”

Mehedi Hasan, Rafiul Alam

*Climate Justice and Natural Resource Rights, Oxfam in Bangladesh*
Introduction

✓ Nijhum Dwip, the southern coastal part of the country is a dynamic island with its enriched biodiversity that plays a pivotal role in serving essential ecosystem services.

✓ Nijhum Dwip faces numerous environmental challenges, including cyclones, forest cover loss, and mangrove deforestation (Kumar, 2018; Kader, 2013; Islam, 2021; Rahman, 2019).

✓ It is also home to around 30,000 people (BBS, 2011) who are highly vulnerable and largely dependent on ecosystem services such as fishing, forest and on other natural resources of that area for their livelihood. (Rahman et al., 2012a, 2012b).
Background of the study

✓ Marginalized communities harness ecosystem services are impacted by climate change consequences and excluded from natural resource governance (Reid, 2016)

✓ On top of that, Imposed restrictions are progressively intensifying the vulnerabilities of marginalized coastal grower communities by limiting their livelihood options. (Santos F D., Ferreira P L., Pedersen J S., 2022).

✓ Besides, stakeholders promote alternative income generating activities in the name of protection – resulting in displacement of primary growers from their traditional works.
Objective of the study

Considering the situation, the study aims to assess community stewardship over ecosystem services in contrast to conservation restrictions (e.g. MPA) in Nijhum Dwip, Hatia Upazila, Bangladesh.

✓ Exploring community rights and conflict sensitivity over ecosystem services amidst imposed restrictions and the interplay with climate-related factors.

✓ To assess the Spatiotemporal changes of landscape happened due to environmental and anthropogenic factors in Nijhum Dwip.
Study Area
Methods and methodology

**Qualitative Technique**
- Interviews with focal personals (KII)
- Focus Group Discussions (FGD)
- Multi-Stakeholders (Govt and CSOs)

**Natural resource dependent community**
- Community rights and conflict within restriction

**Stressed situation due to socio-environmental factors**

**Geospatial Technique**
- Data Acquisition
- Image Pre-processing
- Supervised Classification
- LULC Change Detection

**Atmospheric Correction**

**Result**
- Change Measurement
- Class Statistics

**Change detection of resources**
## Result and discussion: Focus Group Discussion (FGD)

### Data Coding Table

<table>
<thead>
<tr>
<th>Thematic Areas</th>
<th>Major Findings</th>
</tr>
</thead>
</table>
| **Impact resulted from imposed restrictions on natural resource dependent communities** | 1. Fisherfolks were found to have migrated from their own occupation.  
2. Artisanal fishing being compressed and becoming vulnerable to inherit traditional fishing.  
3. Predominant Power hierarchy prevails and large scale fisherfolks are equipped with more technologies leading to more capitalization in the system.  
4. Restrictions are eventually exacerbating the underprivileged and vulnerable communities more marginalized. |
| **Women leadership in natural resource governance** | 1. Women members involved in income generating activities, for instance weaving fishing net to support livelihood, don’t have decision making power and control over.  
2. When the male member goes for fishing in deep sea, women members seem to be unwilling to move to cyclone shelters leaving their cattle behind.  
3. Gender based violence (climate induced) existing at the household level, but the women were found reluctant to stand against it and to speak up. |
| **Livelihood opportunities being limited due to climate change impact** | 1. Recurrent and intensive natural disasters coupled with the non-inclusive governance system bearing the hardest hit to livelihood sustainability.  
2. Marginalized people can not come out from the circle of the poverty since they are compelled to mobilize financial resources in response to disasters.  
3. There is an absence of a community-oriented insurance mechanism, and the community remains trapped within the cycle of indebtedness.  
4. Alternative livelihood options are not welcomed most of the time by the local community. Ex: fisherfolks are unwilling to switch to farming activities. |
Result and discussion: Key Informant Interviews (KII)

Data Coding Table

<table>
<thead>
<tr>
<th>Thematic Areas</th>
<th>Major Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conflict amongst stakeholders</strong></td>
<td>1. Absence of cooperation and synergies amongst institutions.</td>
</tr>
<tr>
<td></td>
<td>2. Conflict arises in land use management.</td>
</tr>
<tr>
<td></td>
<td>3. Conservation efforts are being highlighted and alternative income-generating activities are promoted.</td>
</tr>
<tr>
<td></td>
<td>4. Land privatization vs Plantation</td>
</tr>
<tr>
<td></td>
<td>5. Urbanization in the forest areas through infrastructure development.</td>
</tr>
<tr>
<td><strong>Promoting alternative incomes, compensations and development initiatives</strong></td>
<td>1. Co-management groups established where the local communities govern the group.</td>
</tr>
<tr>
<td></td>
<td>2. Power practices, transparency issues, high interest loan and exclusion of the primary growers contribute the inequality even collaboration in the co-management group.</td>
</tr>
<tr>
<td></td>
<td>3. The promotion of tourism poses a threat to the biodiversity and ecosystem.</td>
</tr>
<tr>
<td></td>
<td>4. Govt claims the increased fish catch and project implemented on creating alternative income sources during the ban period.</td>
</tr>
<tr>
<td><strong>Adaptation practices facilitated by the local stakeholder</strong></td>
<td>1. Community involvement in homestead and roadside plantation under a programme where community is sharing the profit for plantation and taking care of them.</td>
</tr>
</tbody>
</table>
Result and discussion: FGDs and KIIs (Interlinkage)
Result and discussion: LULC Changes at Hatiya

Land-Use Landcover Pattern Over Time (1990-2020)

Area (Sq.km)

-50  0  50  100  150  200  250  300  350  400  450

LULC types
- Agricultural Land
- Arable Land
- Vegetation
- Settlement
- Forest
- Mud Flat

2020  2010  2000  1990
Result and discussion: LULC Changes at ND

Land-use Landcover Pattern Over Time (1990 & 2020)
Result and discussion

✓ There has been a noticeable decrease in forested areas, with the expansion of settlements, domestic plantations, and agricultural cultivation being the primary causes. Another study conducted by Sobnam and Mamun, 2021 found same findings with additional reason of unauthorized logging for financial gain.

✓ As shown in the research, another study by Ali et al. in 2021 highlighted the potential for further expansion of accreted land in the future subject to the improved management and protection of the mangrove forest

✓ Restrictions on fishing have adversely affected the income and livelihoods of vulnerable coastal fishers, as indicated by studies conducted by Brillo et al. (2019), Napata et al. (2020), and Aswathy et al. (2011). The research further highlights that these restrictions particularly impact small-scale fisherfolks to income loss due to the absence of rationale reparation mechanism.
Conclusions

✓ Imposed restrictions exacerbating vulnerabilities of marginalized coastal growers by shrinking their livelihood options while the powerful and large-scale business entities are getting benefited.

✓ Lack of synergies and conflict sensitivity lead to unplanned ecosystem management and natural resource governance.

✓ Local stakeholders are promoting alternative income and livelihood alteration rather establishing community rights over ecosystem services.

✓ Very few women are engaged in income-generating activities and no decision-making authority.

✓ Nonetheless, the overall study findings can be utilized in establishing inclusive community-based ecosystem management that would contribute towards climate adaptation and resilience strategies of the inhabitants of Nijhum Dwip.
Acknowledgments

Authors would like to thank communities participated in the discussion and MR. Gourab Saha, Umme Humayra, Sharmin Siddika, MD Tajbib Rahman for their contribution.
References


7. Reid, H. Ecosystem- and community-based adaptation: learning from community-based natural resource management, Climate and Development, 2016 8, 1, 4-9, DOI: 10.1080/17565529.2015.1034233


Thank You!
1st South Asian Conference 2023

UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENERIO

Social Science Faculty, Dhaka University, Bangladesh

25th November, 2023
ESTABLISHMENT OF LIVELIHOOD VULNERABILITY INDEX BASED ON CYCLONE AMPHAN: A CASE ON SHATKHIRA DISTRICT, BANGLADESH

Tasnim Zarin Meem
M.Sc. Student, Bangladesh University of Engineering and Technology

Advisor: Md. Najmul Kabir
Assistant Professor, Shahjalal University of Science and Technology
Introduction

➢ Tropical cyclones in the south-west of Bangladesh are the most prominent.
➢ Cyclone Amphan was one of the strongest tropical cyclones to strike in South Asia in May 2020, with a windspeed up to 180 kph and over 10 feet tidal surges which tremendously affected the south-east coast of Bangladesh, especially Shyamnagar upazila.
Background of the Study
Background of the Study

➢ Bangladesh is currently ranked as one of the foremost disaster-prone countries in the world and natural disasters like cyclones are likely to hit Bangladesh every year. The geographical location makes Bangladesh a cyclone-prone area. Which is why Bangladesh has a long history of being hit by cyclones.

➢ These cyclones can be destructive and needless to mention that these cyclone affect millions of lives.
Background of the Study

➢ Cyclone Amphan was one of the strongest tropical cyclones to strike in South Asia in May, 2020 and affected the lives of about one million people in Bangladesh’s coastal area.

➢ The cyclone badly affected 26 districts and caused damage worth Tk 1,100 crore along with a damage of 1.76 lakh hectares of crop yield across the country.
OBJECTIVES OF THE STUDY

➢ To observe the socio-economic scenario of the study area.
➢ To determine the vulnerability level based on cyclone Amphan.
2. Methods and Methodology

2.1 Study Area
(Shyamnagar Upazila)

Due to its geographic location, low lying elevation and livelihood pattern, the region is at high risk to cyclones. It is at higher risk of cyclonic disasters, positioning second in the risk rank.
2.2 Sampling
A random sampling method was used to conduct the study

2.3 Parameters of Primary Data Collection - The questionnaire was structured with six components: social condition, livelihood strategies, awareness level, preparedness level, during disaster and after disaster

2.4 Data Collection

2.4.1 Primary Data Collection - Primary data for the study was collected through following instruments -

- Household Questionnaire Survey
- Focus Group Discussion (FGD)
- Key Informants Interview
2.5 Data Analysis

Descriptive analysis along with average base LVI and factor base LVI analysis method were used to analyse the data –
2.5.1 Livelihood Vulnerability Index (LVI):

The major six components of the study were standardized using the following equation:

\[
\text{index}_i = \frac{\text{Max}_i - \text{value}}{\text{Max}_i - \text{Min}_i}
\]  

(1)

The next step was averaging the standardized major domains with the following equation:

\[
M_z = \frac{\Sigma \text{index}_i}{n}
\]

(2)

Where \( n \) = number of subdomains under the major domains

The livelihood vulnerability index was then calculated with the following equation:

\[
LVI = \frac{\Sigma M_i M_z}{\Sigma M_i}
\]

(3)
2.5.2 Factor Base analysis

To calculate the factor base LVI, the first step followed was to calculate the correlation matrix among the six major domains of the study

The table shows the highly positive relationship between two major components of the study
2.6 Framework of the Study
3. Results and Discussion

3.1 Social Condition:

**House Type**
- Kacha: 56%
- Pakka: 21%
- Semi Pakka: 23%

**SANITATION SYSTEM**
- Safe: 67%
- Kacha: 33%
### 3.1 SOCIAL CONDITION

#### Drinking Water Sources

<table>
<thead>
<tr>
<th>Source</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor</td>
<td>22%</td>
</tr>
<tr>
<td>Tube Well</td>
<td>96%</td>
</tr>
<tr>
<td>Deep Tube Well Gov. Source</td>
<td>28%</td>
</tr>
<tr>
<td>Water Bodies</td>
<td>49%</td>
</tr>
<tr>
<td>Others</td>
<td>78%</td>
</tr>
</tbody>
</table>

**ELECTRICITY SOURCE**

- Government: 94%
- Solar: 3%
- Government & Solar: 3%

---

Dhaka, November 25-26
3.1 SOCIAL CONDITION

HEALTH SATISFACTION

- Poor: 16%
- Moderate: 60%
- Good: 24%

FUEL SOURCES

- Wood: 71%
- Gas: 8%
- Both Wood & Gas: 21%
The LVI score for the social condition is .60 which indicates the poor scenario of the social condition.
3.2 LIVELIHOOD STRATEGIES

Professions of the Respondents

- Farmer: 44%
- Boatman: 17%
- Fisherman: 8%
- Labour: 5%
- Job Holder: 0%
- Businessman: 21%

Monthly Income of the Respondents

- 3-10 thousands: 181
- 11-20 thousands: 74
- 21-30 thousands: 16
- 31-40 thousands: 10
3.2.1 LIVELIHOOD STRATEGIES VULNERABILITY

The LVI of livelihood strategies was .64 determining the poor condition of the major component.
3.3 Knowledge Level

The study evaluated the knowledge level to be in a strong position as per the LVI (0.00)
3.4 PREPAREDNESS LEVEL

IF FELT SAFE DURING CYCLONE

- Yes: 70%
- No: 30%

IF HOUSE FELT SAFE DURING CYCLONES

- Yes: 72%
- No: 28%
3.4 PREPAREDNESS LEVEL

Precautionary Steps for Cyclone

- Rising the basement: 15%
- Keeping dry food: 9%
- Going to cyclone shelter: 9%
- Keeping domestic animals in safe place: 11%
- Keeping documents in safe place: 36%
- Keeping first aid: 20%

The study evaluated that 90% of the respondents took precautionary steps before cyclone Amphan.
3.4 PREPAREDNESS LEVEL

**PRESENCE OF CYCLONE SHELTER**

- Yes: 36%
- No: 64%

**DISTANCE OF CYCLONE SHELTER**

- 0.5-2 Kilometer: 194
- 3-4 Kilometer: 57
- 5-6 Kilometer: 30
3.4 PREPAREDNESS LEVEL

TRANSPORTATION MEDIUM TO CYCLONE SHELTER

- By walk: 242
- By any vehicle: 39

FACILITIES IN CYCLONE SHELTER

- Food: 57%
- Drinking water: 18%
- Health service: 5%
- All of them: 20%
3.4.1 PREPAREDNESS LEVEL VULNERABILITY

The LVI for preparedness level is .50 showing the moderate vulnerability of the component
3.5 DURING DISASTER

TIMING OF CYCLONE WARNING
- 1 to 2 days before the cyclone: 268
- Some hours before the cyclone: 13

MEDIUMS OF CYCLONE WARNING
- 92% Local Dissemination
- 6% Television, Radio, Local Dissemination
- 2% Others
3.5 DURING DISASTER

Steps During Cyclone Amphan

- Keeping Dry Food & Other Necessary Things: 102
- Keeping Documents in Safe Place: 35
- Helping Neighbours & Relatives: 32
- Praying: 112

Shelter During Cyclone Amphan

- Others: 13
- At Home: 87
- School or College Buildings: 42
- Buildings: 43
- Cyclone Shelter: 96
3.5 DURING DISASTER

**IF AFFECTED BY AMPHAN**

- Yes, 276, 98%
- No, 5, 2%

**IF THE LOSS WAS WORSE THAN PREVIOUS DISASTERS**

- Yes: 52%
- No: 48%
3.5.1 DURING DISASTER VULNERABILITY

The LVI for the during disaster was calculated .42 suggesting the comparatively good condition of the component than preparedness level (LVI .50)
3.6 AFTER DISASTER

RECEIVING IMMEDIATE ASSISTANCE (GOVT/LOCAL AUTHORITY)

- Yes: 83%
- No: 17%

RECEIVING LONG TERM ASSISTANCE (GOVT/LOCAL AUTHORITY)

- Yes: 98%
- No: 2%
3.6 AFTER DISASTER

**LOSS OVERCOMING ABILITY**

- Yes: 70%
- No: 30%
The vulnerability was evident (LVI) in the post-disaster state. The study found that the area's post-disaster status was poor.
3.7 LVI (Average Base and Factor Base) of Six Major Components of the Study
3.8 VULNERABILITY SPIDER WEB DIAGRAM OF THE LVI FOR THE MAJOR SIX COMPONENTS
### 4. Conclusion

#### 4.1 AVERAGE BASED AND FACTOR BASED LVI FOR THE MAJOR SIX COMPONENTS

<table>
<thead>
<tr>
<th>Major Component</th>
<th>Sub Component</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Condition</td>
<td>House Type</td>
<td>0.60</td>
</tr>
<tr>
<td></td>
<td>Water Source</td>
<td>0.65</td>
</tr>
<tr>
<td></td>
<td>Electricity</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>Sanitation</td>
<td>0.68</td>
</tr>
<tr>
<td></td>
<td>Fuel</td>
<td>0.72</td>
</tr>
<tr>
<td></td>
<td>Health Service</td>
<td>0.68</td>
</tr>
<tr>
<td></td>
<td>Communication System</td>
<td>0.49</td>
</tr>
<tr>
<td>Livelihood Strategies</td>
<td>Livelihood Source</td>
<td>0.64</td>
</tr>
<tr>
<td></td>
<td>Basic Need</td>
<td>0.42</td>
</tr>
<tr>
<td></td>
<td>Income</td>
<td>0.62</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.88</td>
</tr>
<tr>
<td>Knowledge Level</td>
<td>Knowledge</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>Cyclone Warning Knowledge</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>Dissemination</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>Benefit from Cyclone Warning</td>
<td>0.00</td>
</tr>
<tr>
<td>Preparedness Level</td>
<td>Feeling Safe</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>House Safe</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td>Prepared</td>
<td>0.72</td>
</tr>
<tr>
<td></td>
<td>Preparedness Steps</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>Cyclone Shelter</td>
<td>0.43</td>
</tr>
<tr>
<td></td>
<td>Distance of cyclone Shelter</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>Transportation System</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td>Cyclone Shelter Facilities</td>
<td>0.86</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.65</td>
</tr>
<tr>
<td>During Disaster</td>
<td>Cyclone Warning before Amphan</td>
<td>0.42</td>
</tr>
<tr>
<td></td>
<td>Dissemination Time</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>Media</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Taking Shelter during Amphan</td>
<td>0.48</td>
</tr>
<tr>
<td></td>
<td>Affected by Amphan</td>
<td>0.52</td>
</tr>
<tr>
<td></td>
<td>Loss</td>
<td>0.98</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.48</td>
</tr>
<tr>
<td>After Disaster</td>
<td>Immediate Support</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td>Long Term Support</td>
<td>0.84</td>
</tr>
<tr>
<td></td>
<td>Overcome from Disaster Loss</td>
<td>0.98</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.30</td>
</tr>
<tr>
<td>LVI</td>
<td>Average base Analysis</td>
<td>0.48</td>
</tr>
<tr>
<td></td>
<td>Factor Analysis</td>
<td>0.49</td>
</tr>
</tbody>
</table>
4. Conclusion

➢ The social condition and livelihood strategies show poor vulnerability with the LVI score .60 and .64 respectively.

➢ Knowledge level about the disasters is highly strong with (LVI 0.00)

➢ Preparedness level is moderately vulnerable (LVI .50)

➢ During disaster with LVI .42 is also moderately vulnerable

➢ After disaster scenario is the worst with a LVI .70 meaning highly risked condition of the domain.

➢ The overall LVI for average base analysis is .48 and for factor base analysis is .49 meaning the moderate vulnerability due to cyclone Amphan for the study area.
Acknowledgement

I take profound privileges to express my sincere gratitude to
- Md. Najmul Kabir
References

THANK YOU
Exploring Tropical Cyclone Vulnerability in Bangladesh: A Climate Change Perspective

Ummul Momanin Coalee, Md Tamjid Al Noor Pobon, Raju Ahmed, Dr. Khandakar Hasan Mahmud

Presented By

Ummul Momanin Coalee

Department of Geography and Environment
Jahangirnagar University, Savar, Dhaka-1342
Background of the study

• Bangladesh is particularly vulnerable to tropical cyclones due to its geographical position, climatic variability, the occurrence of tropical cyclone re-curvature in the funnel-shaped bay, and the shallow continental shelf (Rahman, 2022).

• Due to the changing climate, these regions become more susceptible to the adverse impacts of storm surges, saline water intrusion, and other dangers associated with cyclones.

• Understanding Bangladesh's vulnerability to tropical cyclones in the context of climate change is crucial for developing targeted adaptation strategies, mitigating risks, and safeguarding lives and livelihoods.

Source: Banglapedia, 2021
Aim and Objectives of the study

Aim:
The broader aim of this study is to analyze the evolving vulnerability of Bangladesh to tropical cyclones in the context of changing climatic scenario.

Objectives:

• To explore the climatic variability associated with tropical cyclogenesis in the Bay of Bengal.

• To investigate the vulnerability of Bangladesh to tropical cyclones under this climatic variability.

• To review the initiatives and adaptation policies implemented by Bangladesh in response to this vulnerability.
Materials and Methods

- The historical records of the temperature database of Bangladesh were compiled in Microsoft Excel by four climatic years (1901-1930, 1931-1960, 1961-1990, and 1991-2020).

- The Bay of Bengal SST data was extracted by analyzing NetCDF data from NASA Ocean Color in ArcMap from 2002 to 2022.

Figure: Methodological Workflow
Results and discussion

• The annual mean temperature of the four climatic years exhibits an ascending trend with an R² value of 0.8443.

• This suggests a significant 84.43% association between the temperature and climatic years.

• The trend of the cyclonic events of these four climatic years shows an R² value of 0.3972.

• This indicates a 39.72% relationship between the tropical cyclone frequency and climatic years.
Results and discussion

Various in-depth maps of the sea surface temperature have been produced for the years 2002 to 2022 to demonstrate the variations in surface temperature across the Bay of Bengal.
Results and discussion

The graphs show that from 2002 to 2022, the average annual low SST was 20.64°C to 24.89°C and the average annual high SST was 33.95°C to 37.54°C. Particularly, the high SST values promote conditions of tropical cyclone formation in the Bay of Bengal.
Results and discussion

- The movement and distribution of tropical cyclones in the Bay of Bengal have been analyzed in ArcGIS from 1960 to 2022.
- The map shows that the mean and median center of the tropical cyclone distribution is centered in the northern region of the Bay of Bengal.
- This indicates serious threats to the southwestern and south-eastern coast of Bangladesh.
Results and discussion

• The pie chart depicts the declining scenario of loss of human life caused by tropical cyclones in Bangladesh from 1985 to 2023.
• The year 1991 exhibits the most significant loss of life, while the year 2023 shows the least amount of life loss.
• The trend of loss and damage caused by tropical cyclones shows a declining rate since 1985.
Results and discussion

- Bangladesh has improved disaster preparedness by implementing measures like the Cyclone Preparedness Programme (CPP).
- Infrastructure, such as cyclone and flood shelters, are designed to accommodate all genders and disabled people.
- Resources like boat ambulances, aid warehouses, and digital information centers, including Mujib Killa, have been constructed.
Conclusion

• Bangladesh's diversified strategy for dealing with tropical cyclone vulnerability demonstrates a commitment to safeguarding lives, livelihoods, and ecosystems.

• Bangladesh's proactive actions serve as a model of disaster management and adaptation techniques, highlighting the importance of community involvement, advancements in technology, and policy frameworks.

• While these actions have considerably decreased the loss of life and property damage, challenges remain, particularly in light of the increasing effects of climate change.

• Continuous efforts, investments, and international collaboration are required to boost resilience, adapt to changing climatic circumstances, and maintain long-term development in the face of tropical cyclone hazards.


THANK YOU FOR YOUR TIME AND CONSIDERATION
Welcome to the Presentation

Anamul Kabir, Bayezid Khan*, Israt Jahan Juie, Mortuja Mahamud Tohan, Md. Tanvir Hossain,

Khulna University, Khulna-9208
Ecosystem-Based Solutions for Coastal Resilience: An Investigation in Coastal Regions of Bangladesh

Presentation Outline

- Introduction
- Research Objective
- Research Question
- Methods & Materials
- Findings & Discussion
- Conclusion & Recommendations
Introduction

➢ Increasing vulnerability in coastal Bangladesh coastal due to global and regional climate change impacts

➢ Detrimental impacts predicted on economy, environment, society

➢ Traditional adaptation strategies do not help protect coastal ecosystems and biodiversity

➢ Ecosystem solutions can reduce vulnerability, encourage adaptation
Contd....

➢ Solutions for ecological, social and economic benefits for coastal resilience

➢ The present world needs innovative and sustainable solutions to adapt to climate change impacts

➢ The study will provide empirical evidence on the effectiveness of EbS from social science aspect

➢ Help in decision and policy making process
➢ To explore the effectiveness of ecosystem-based solutions in reducing vulnerability and building resilience
Ecosystem-based Solutions

Conceptual Framework

- Protecting & Restoring Coastal Ecosystem
  - Conserving Mangrove Forests
  - Sustainable Fishing
  - Reducing Pollutions
  - Creating Marine Protected Areas

- Providing Nature-based Infrastructure
  - Oyster Shell Breakwaters
  - Geo-textile Sand Bags
  - Artificial Oyster Reefs
  - Natural Levees & Floodplains

- Managing Watersheds & Sustainable Land use
  - Integrated Shrimp Aquaculture
  - Sustainable Agriculture Practice
  - Avoid Cross-dams & Hard Infrastructure
  - Introducing Hydroponic & Geophonic Cultivation

- Community-based Adaptation
  - Building on Local Knowledge & Practices
  - Addressing Social & Economic Vulnerabilities
  - Diversification of Livelihoods
  - Access to Information & Resources

- Enhancing Disaster Preparedness
  - Early Warning System
  - Strengthening Emergency Response Capacity
  - Developing Contingency Plan

- Vulnerability Reduction
  - Promoting Renewable Energy
  - Reducing Carbon Emission
  - Climate-smart Agriculture Practice

- Addressing Climate Change

Sustainable Development
# Methodology

<table>
<thead>
<tr>
<th><strong>Research Design</strong></th>
<th>Qualitative and exploratory approach</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Study Location</strong></td>
<td>Southwestern coastal region of Bangladesh, vulnerable to natural disasters specifically Dacope upazilla of Khulna</td>
</tr>
<tr>
<td><strong>Sampling Technique</strong></td>
<td>Purposive sampling to select knowledgeable participants.</td>
</tr>
<tr>
<td><strong>Sample Size</strong></td>
<td>Based on availability and willingness, aiming for diverse perspectives (8 participants)</td>
</tr>
</tbody>
</table>
| **Data Collection Methods** | • Key informant interviews (KII) from ecosystem experts, in-depth interviews (IDI) from community members  
• Interviews conducted in Bengali with consent and audio recording |
| **Analysis of Data** | • Collected data were analyzed using thematic analysis  
• Looking closely at the data to find common themes: repeated ideas, topics, or ways of putting things  
• Summarizing the key points and presented the themes that emerged from the in-depth and key informant interviews |
Key Findings

Growing environmental problems

• Increase Temperature
• Salinity intrusion
• Sea-level rise water level
• Shift in seasonal patterns
• Prolonged Drought

“Only those who have access to pure water on their land can grow crops effectively, but most areas are affected by salinity”
Drivers of Environmental Degradation

1. **Natural factors**
   - Natural disasters (tidal surge, cyclone, flood)
   - Tidal fluctuation
   - Soil erosion

2. **Human-induced factors**
   - Deforestation
   - Overfishing
   - Pollution
   - Unsustainable Practices
   - Unplanned Urbanization

“*It’s tough for us to survive and bring food three times a day, thus, environmental concerns seems to be ‘luxury’ for us*”
Integration of Ecosystem-based solutions recognized as important for environmental management

- Afforestation
- Eco-friendly agricultural practice
- Rain water harvesting
- Promoting sustainable aquaculture
- Collective sustainable action
- Community-Based Water source Management
- Protecting wetland

“Simultaneously, we engage in fish cultivation within the pond and grow various vegetables on the floating shade. Further fruit trees planted along the pond’s banks to meet our family’s own needs.”
Factors contributing to the success of ecosystem-based solutions

- Collaboration among multiple stakeholders
- Implement integrated approaches
- Tailored adaptation strategies based on traditional knowledge
- Commitment and dedication of local people
- International support specially knowledge based interventions

“Now, We have many NGOs come here and help us in various activities”
Challenges in implementing ecosystem-based solutions

- Absence of collaboration among stakeholders
- Lack of modern technological development
- Less educational development and infrastructural development
- Less understanding about the benefits provided by the natural ecosystems
- Sometimes community people are not willing to adapt with new systems
- Lack of accountability and transparency in local governance
- Absence of effective monitoring

“We have enough policies, laws and frameworks, but there is a huge gap in the proper implementation of these laws and policies”
Conclusion

- The findings of this study indicate that ecosystem-based solutions have played a significant role in reducing vulnerability and building resilience among coastal communities.
  Mangrove forests, the implementation of rainwater harvesting systems, and the adoption of sustainable agricultural practices emerged as effective strategies.

- Challenges and barriers to the implementation of ecosystem-based solutions were also identified:
  Less participation of local communities, weak governance structures, lack of enough scientific research, less integration of traditional wisdom, absence of collaboration among stakeholders, and no long-term planning and investment.
Recommendations

- Effective collaboration and engagement among various stakeholders
- Strengthening awareness and education
- Investing in research and innovation
- Improving policy and governance frameworks

Further research is recommended to dig deeper into specific aspects of ecosystem-based solutions, such as their economic viability, social acceptability, and long-term effectiveness.
Limitations of the Study

✓ Limited awareness or understanding of ecosystem-based solutions (EbS) among respondents particularly community people may have affected data quality and depth
THANK YOU
1st South Asian Conference 2023
UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENARIO
Social Science Faculty, Dhaka University, Bangladesh
25th November, 2023
Gender-based Vulnerabilities at the Cyclone Shelters in Coastal Belt of Bangladesh; a study in Hatiya Upazila

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Bangladesh University of Professionals, Mirpur Cantonment, Dhaka-1216.
Introduction

Natural Hazard-Induced Disasters

Topography and geographical location

Cyclone Shelter

More than 500 Cyclone Shelters in Coastal Belt of Bangladesh [World Bank, 2022]

Affected Community

Condition of the shelters is deplorable, with the lack of proper hygiene conditions, safe residency, etc.
Background of the study

Cyclone → Coastal Belt of Bangladesh → Poor Resident During Disaster Period

Vulnerability of Women

- Gender-based Violence
- Limit access to Crucial Supplies
- Impact the Health and Well-being
- Low Facilities

Gender-Based Vulnerability
Objective of the study

To identify and reduce the vulnerability of women in cyclone Shelters in coastal belts during catastrophe phases.

Specific Objectives,

• To evaluate the current gender-based vulnerabilities and risks in Bangladesh's cyclone shelters, including but not limited to violence, discrimination, and inadequate access to vital resources.

• To identify specific hurdles and problems faced by women and girls in accessing and utilizing cyclone shelters, and determine how these might be addressed by enhancing shelter design, management, and services.

• To provide recommendations for strengthening the safety, inclusiveness, and equity of cyclone shelters in Bangladesh, with consideration for the needs and perspectives of women and girls.
Methods and methodology

Data

Collection

Base Line Study

Study Area Analysis

Data Analysis

Analytical Framework

Primary Data

Transect Walk
Questionnaire Survey
Focus Group Discussion
Interview

Secondary Data

Literature survey
Article Review
Newspaper Report
Documentary Video

Final Result
### Census of 2011

<table>
<thead>
<tr>
<th>Total Population</th>
<th>Male-Female Ratio</th>
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<td>2,23,853</td>
<td>49.50:50.50</td>
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<tr>
<td>2,28,610</td>
<td></td>
</tr>
</tbody>
</table>

- **50% of Population Proportion**
- **5% Margin of Error**
- **90% of Confidence Level**

**Sample Size 273**
- 178 Female and 94 Male

**Methods and methodology**

- 15 FGDs from local community people
- 5 FGDs from the Governmental and Non-Governmental Organization’s personnel
- 10 KII from Governmental Bodies of Upazila Porishod
- 20 KII from the Local Community Personnel
Methods and methodology

**Gender Dynamics of Disaster Risk and Resilience (GDDRR) Framework**

Global Facility for Disaster Risk Reduction and Recovery (GFDRR)

Gender Inclusive Approaches for better Disaster Risk Management.

A new World Bank Group report, Gender Dimensions of Disaster Risk and Resilience – Existing Evidence, financed by GFDRR, shows how disaster impacts often reflect, and reinforce, gender inequality. This happens because the conditions driving disaster impacts are influenced by gender dynamics of society.

A Conceptual Framework for considering Gender Dynamics and Disaster Impacts adapted from World Bank 2012 and Hallegatte et al. 2017
Gender Dynamics of Disaster Risk and Resilience (GDDRR) Framework

Disaster Effects and Gender Inequality:
- **Orange circle:** Effects depend on hazard type and severity, exposure, vulnerability, preparedness, and ability to handle disasters.
- **Purple circle:** Gender inequality arises from societal roles, affecting socioeconomic status and disaster preparedness and recovery.
- **Maroon area:** Factors causing disaster impacts and influenced by gender dynamics.

- Different disaster effects can worsen gender imbalance, making recovery from future disasters harder.
- Different impacts can make individuals less able to handle future disasters.
Result and discussion

According to statistics of The Business Standard, during the cyclone Amphan in 2020, there were around **185 cyclone shelters in the Hatiya upazila**, and in these Shelters, **80,000 people can be evacuated**.

- The local Upazila Chairman and local youth leader said that the cyclone shelter's condition is perfect for women in the Hatiya Upazila.
- The Coastal Forest Department of Bangladesh's officials said that some cyclone shelters are usable for emergencies, but the maximum is unfit for gender basis residence.
- The Sub-Assistant Agriculture Officer said that the cyclone shelter's condition is inappropriate for the women's residence. There is no separate washroom in most of the shelters. Also, there is no safety for the women here.

The impact factors shaped by gender dynamics

**Exposure, Vulnerability, Preparedness, and Coping Capacity**

- Are not influenced by negative norms
- Are influenced by norms (Exposure, Vulnerability)
Conclusion

- Collecting and analyzing **gender- and age-specific data** on disaster impacts and vulnerability to inform policies and interventions based on evidence.

- Providing **equal access** to early warning systems, risk information, education, training, awareness-raising, and capacity-building.

- Ensuring that disaster response and recovery efforts are **gender-responsive** and **address the specific needs and rights** of both men and women, such as health, nutrition, shelter, water, sanitation, hygiene, protection, livelihoods, and psychosocial support.

- Supporting the **recovery and restoration** of livelihoods and assets of both men and women following disasters, with particular attention to women-headed households, female farmers, fishers, and forest users.

- **Raising awareness and advocacy** on gender equality and women's empowerment as a key component of disaster management among all stakeholders.
References


Adaptation of Smart Farming Techniques and Effects of Crop Management: A Descriptive Study of Farmers Perspective

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Introduction

• An novel element called "Smart Farming Technology" (SFT) seeks to increase the productivity and sustainability of agricultural practises. Farmers can benefit from SFT in a number of ways, including early disease detection of crops, reduced crop waste, efficient crop harvesting, tracking animal positions both inside and outside of farms, and observation of livestock behaviour patterns.

• SFT does, however, also face several difficulties, including its expensive price, risks to cyber security, problems with regulations and legality, and a lack of awareness and support for adoption. This essay will go over the benefits and drawbacks of SFT as well as potential ways to get around obstacles to its use.
Introduction Continue..

• Smart Farming Technology (SFT) is a novel feature that guarantees the application of appropriate supplies, equipment, and labour in field practice while limiting the use of unnecessary resources.

• SFT has the ability to track animal positions both within and outside of farms, detect crop diseases early, avoid crop waste, and harvest crops efficiently. It can also monitor the behaviour patterns of livestock.

• SFT can affect the cropping system, the available degree of interest, and the reasons for farmers' adoption by being controlled and integrated in the supply chain as well as on the farm.
Introduction

- SFT offers numerous advantages, including higher agricultural yields, better crop management, better decision-making, and a decrease in the environmental effect of farm activities due to less use of synthetic chemicals and cheaper fuel, water, and electricity costs.

- Further barriers to SFT adoption include its high cost, the difficulty small farmers face in obtaining training, guidance, and reliable digital infrastructure, as well as the need for government support and subsidies.

- SFT offers a path towards sustainable agriculture by diversifying technology, crop and livestock production systems, and networking among all stakeholders for increased food security.
Smart farming techniques

• Smart farming tools, also known as precision agriculture or precision farming tools, leverage technology to enhance the efficiency and productivity of agricultural practices. These tools utilize a variety of technologies such as sensors, GPS, data analytics, and connectivity to enable farmers to make more informed and data-driven decisions. Here are some examples of smart farming tools:

Drones and UAVs (Unmanned Aerial Vehicles):
• Drones equipped with cameras and sensors can provide real-time aerial imagery of fields. This data is valuable for monitoring crop health, identifying areas of pest infestation, and assessing overall field conditions.

Precision Farming Software:
• Software applications help farmers analyze data related to soil conditions, weather patterns, and crop performance. These tools assist in decision-making processes, optimizing planting schedules, and managing resources more efficiently.

IoT (Internet of Things) Sensors:
• Sensors placed in the field can collect data on soil moisture, temperature, humidity, and other environmental factors. This information helps farmers make precise decisions on irrigation, fertilization, and pest control.
GPS Technology:
• Global Positioning System (GPS) technology is used for precision navigation of farm machinery. This enables farmers to create accurate field maps, plan the layout of crops, and optimize the use of resources.

Automated Machinery:
• Smart tractors and other farm equipment can be equipped with GPS and automated control systems. This allows for precise and efficient planting, harvesting, and other tasks, reducing waste and improving overall productivity.

Robotics:
• Agricultural robots can perform various tasks, such as weeding, picking fruits, and monitoring crop conditions. These robots can work autonomously or be controlled remotely.

Weather Forecasting Tools:
• Access to accurate and timely weather forecasts helps farmers plan their activities, such as planting, harvesting, and irrigation, more effectively.
Smart farming techniques

Farm Management Software:
• Comprehensive software solutions assist farmers in managing their entire farm operation. These platforms often integrate data from various sources, offering insights into crop yields, expenses, and profitability.

Livestock Monitoring Systems:
• For livestock farming, smart tools can include wearable devices for animals, providing real-time data on health, location, and behavior.

Block chain Technology:
• Blockchain can be used to enhance traceability and transparency in the agricultural supply chain, ensuring the authenticity of products and facilitating better market access for farmers.
• Smart farming tools contribute to sustainable and resource-efficient agriculture by optimizing the use of inputs, reducing environmental impact, and improving overall farm management practices.
Smart farming techniques

1. Collect data from sensors
2. Monitor crop health and environmental conditions
3. Implement precision farming techniques
4. Decide making process based on data analysis
5. Automated irrigation and fertilizers
6. Use GPS for precise navigation of machinery
7. Employ drones for aerial surveillance
8. Feed and manage livestock

Successful smart farming
Smart farming techniques

Source: https://www.pinterest.com/agprodromou/precision-agriculture/
Background of the study

“Smart Farming Technology" (SFT) seeks to increase the productivity and sustainability of agricultural practises. However, there are a number of obstacles that farmers must overcome in order to adopt and use SFT, including its high cost, cyber security risks, legal and regulatory concerns, and a lack of information and assistance. The literature is lacking in information on how to get over these obstacles and maximise SFT's potential for sustainable agriculture. This research will investigate the variables that affect farmers' decisions to adopt SFT as well as the tactics that can be used to assist them.
Objective of the study

• To examine and delve into the effects of smart farming technologies on smallholder farmers' crop yield, quality, and profitability, as well as their overall crop management practices.
Methods and methodology

A Descriptive study with simple random method for data collected employed and semi-structured interview schedule was employed to collect information from 100 different farmers in the Jangoan Mandal of Telangana State.

The interview schedule asked farmers about:

- The types of SFT they use or know
- The benefits and drawbacks of SFT
- The sources of SFT information and training
- The impact of SFT on their livelihoods

The SPSS software, which is used for statistical analysis, was used to perform analysis on the data.
Result and discussion

According to the findings of the study, SFT had a positive impact on the farming methods, yield, economy, and pollution level of the majority of farmers.

Age group analysis

• The majority of responders (33%) were in the 25–35 age range. 26 percent of those in the 36–45 age range came next. The youngest generation of farmers comprised 59% of all those involved Smart farming.
Result and discussion

Income levels and land holding

• The majority of farmers 51% earned between 100,000 and 200,000 rupees annually. Just 6% of respondents earned between 400,000 and 500,000 rupees annually.

• Small land holdings contributed to low income; 72% of respondents owned one to four acres of dry land and 71% owned one to four acres of wet land. Of those with dry land, only 2 percent had 11 to 15 acres, and none had more than 10 acres of wet land. 5–10 acres of wet land made up 29% of the total.
Result and discussion

Key concept of innovative technology adoption. Different views among farmers on this issue

• To boost the productivity of their land, 88% of farmers utilise modern insecticides and other synthetic chemicals, while 79% of farmers use new fertilisers in their crop fields.

• Utilizing a conceptual framework to improve farmers' skills is another aspect of innovation.
Result and discussion

Analysis involved comparing Median and Mode

• 73% of respondents believed that new innovative techniques decreased crop illnesses, and 60% thought that contemporary technology might safeguard soil.

• But because social media and other platforms had an impact on their knowledge, farmers only had a theoretical understanding not a practical one.

• The idea of innovation technology was multifaceted rather than one-dimensional.

• The invention of synthetic fertilisers was the primary focus of farmers' perceptions of innovation.

• Farmers felt that using pesticides in combination with new approaches decreased fungal infections.
• It was good to hear from several farmers that they used fewer herbicides.

• 81% said they might cut back on insecticide use in the future as agricultural innovation.

• Nonetheless, the majority of farmers were overusing pesticides and insecticides. Results and consequences of the survey.

• The majority of farmers 79% thought that using technological advancements will shorten harvesting times and decrease the need for artificial chemicals.
Result and discussion

• 72% said that if people used new technology responsibly, it would also improve biodiversity.

• Farmers were conscious of the detrimental effects of pollution and degraded soil.

• 82% of respondents stated that using chemical fertilisers excessively could taint water sources and damage soil quality.
Farmers' knowledge and attitudes towards innovation

- 75% of farmers thought that innovation enhanced HYV use and irrigation. Nonetheless, 79% of them believed that innovation necessitated altering their practise routines.

- Furthermore, 83% of them had doubts about the possibility that innovation would lower the usage of chemical pesticides.

- However, 80% of them acknowledged the drawbacks and indicated a readiness to switch to better or different methods.

- Additionally, they stated that they needed instruction and training on how to put these ideas into practise.
Diffusion of innovation in agricultural technology

- Farmers were overwhelmingly in agreement 49% that the agriculture sector needed to innovate and improve by introducing new crop kinds.

- The majority of farmers 68% felt that their farm yields would rise as a result of the diffusion of innovation.
The importance of early promotion and adoption of new varieties

• The majority of the farmers 65% stated that early adoption and production benefits would improve their quality of life and reputation.

• Nonetheless, a sizable segment of farmers 38% expressed scepticism on the longevity and obsolescence of current innovations and technological advancements.
Result and discussion

Smart Farming Technology (SFT)

• SFT uses a variety of technologies to improve production and crop management.

• 74% of farmers thought that SFT was a strategic innovation that could enhance their practices and crop management.

• Additionally, 67% of them thought that SFT may improve biodiversity and natural resources, 76% thought it could improve farmers' work cultures and economic potential, and 51% thought it could reduce pollution.
Conclusion

A potential and creative approach to improving India's agriculture economy is smart farming technology. It can assist farmers in boosting their output, income, sustainability, and crop quality while also preserving the environment and soil fertility. The high adoption costs, the lack of knowledge and training, the technological difficulties, and the social and cultural hurdles are some of the difficulties that SFT must overcome. More research, development, extension, and policy assistance are therefore required to encourage and enable the adoption of SFT among Indian farmers. SFT has the potential to revolutionise both Indian and global agriculture.
Acknowledgments

Authors thank everyone who assisted us with this research. We also thank our colleagues for their assistance in data collection and analysis. Their feedback has improved our work's quality and clarity. No funding was provided for this study. We appreciate the anonymous reviewers' intelligent and constructive criticism, which improved the paper's presentation and rigour. We thank the panellists and conference attendees of the 1st Asian conference on "Unfolding Emerging Issues in the Context of Changing Climate Scenario." for his skilled and effective management of our work.
References


References


References


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UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENERIO
Social Science Faculty, Dhaka University, Bangladesh
25th November, 2023
“Assessing the Impact of Changing Rainfall Patterns on Flood Risks and Agriculture Production Resilience in the North-Central Region of Bangladesh: A Historical Analysis”

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2. Dept. of Environmental Science, Bangladesh University of Professionals, Dhaka-1216, Bangladesh
1. Bangladesh's North-Central region, a vital agricultural hub, is vulnerable to climate change due to shifting rainfall patterns.

2. This research examines the relationship between these changes, flood risks, and agricultural resilience in the region.

3. Historical analysis helps identify key drivers and informs adaptive strategies to mitigate climate change challenges in the region.
Background of the study

• This research aims to analyze the impact of changing rainfall patterns on flood risks and agricultural production resilience in the North-Central region of Bangladesh.

• It will examine historical trends and the interplay between climate variability and the socio-economic fabric of the region.

• The findings will inform policy initiatives, agricultural practices, and disaster management strategies to enhance the region's adaptive capacity.
Objective of the study

1. To analyze historical rainfall patterns in the North-Central region of Bangladesh and identify trends and changes over the past three decades.

2. To assess the historical flood risks and their relationship with changing rainfall patterns in the region.

3. To investigate the impact of these changing rainfall patterns and associated floods on agriculture production in the region.
Methods and Methodology

1. Data Collection:
This research relies on a wide array of secondary data sources, including historical rainfall records from meteorological department, flood event archives, and agricultural production statistics from government reports. The dataset spans the past few decades, allowing for an in-depth analysis.

2. Statistical Analysis:
Mann-Kendall Trend analysis was used to identify changing rainfall patterns. We assess the impact of changing rainfall on flood risks through correlation analyses.
3. Gumbel Distribution Analysis:

In our investigation of flood risk using extreme value analysis with the Gumbel distribution, we observed a distinctive relationship between the Reduced Variate ($YT$) and peak flow discharge. The Gumbel distribution, a widely utilized model for extreme events, provided valuable insights into the likelihood and magnitude of extreme flood events.
Result and discussion

Mann–Kendall Trend Test:
MK trend tests (Mann 1945; Kendall 1948) were used to assess the significance of the change. Here, each value is compared to all subsequent data i.e., the ordered data sample. Mann–Kendall statistic (S) for a time series $x_1, x_2, x_3, \ldots, x_n$ is calculated as,

$$S = \sum_{k=1}^{n-1} \sum_{i=k+1}^{n} \text{sign}(x_i - x_k),$$

Here,
- $S =$ Mann–Kendall statistic
- $n =$ Sample Size
- $x_i =$ data point at time $i$
Sen’s slope estimator:
Sen’s slope (Sen 1968) estimator has been widely used in hydro-meteorological time series for estimation of the slope or rate of change (Bari et al. 2016).

To derive an estimate of the slope $Q$, the slopes of all data pairs are calculated,

$$Q_i = \frac{x_j - x_k}{j - k}, \ i = 1, 2, \ldots N, \ j > k.$$

Here,

$N = n(n - 1)/2$ slope estimates $Q_i$. The Sen’s estimator of slope is the median of these $N$ values of $Q_i$. The $N$ values of slopes are ranked from the smallest to the largest and the Sen’s estimator is the median of all slopes.

Data Source: Bangladesh Meteorological Department
### Summary:

<table>
<thead>
<tr>
<th>Series Test</th>
<th>Kendall's tau</th>
<th>p-value</th>
<th>Sen's slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>-0.159</td>
<td>0.198</td>
<td>-0.963</td>
</tr>
</tbody>
</table>

#### p-values

- **Total**
  - p-value: 0.198
  - Sen's slope: -0.963
Gumbel Distribution Analysis of Flood Risk:

Extreme Value analysis by Gumbel distribution (Gumbel, E. J, 1958) is often used in hydrology and flood risk analysis to model the distribution of extreme events.
Gumbel Distribution:

- **Gumbel Distribution Equation:**
  \[ XT = \mu + K \cdot \beta \]

- **Frequency Factor (K):**
  \[ K = sn(y_T - y_n) \]

- **y_T:** Reduced Variate for a specific return period \( T \)
- **y_n, sn:** Values from Gumbel Extreme Value Distribution based on sample size considerations.

- **Reduced Variate (y_T):**
  \[ y_T = -\ln(\ln(T - 1)) \]

Gumbel Parameters and Return Levels

Maximum Likelihood Estimation (MLE)
Location Parameter (\(\mu\)): 1.39
Scale Parameter (\(\beta\)): 95004.28

Key Findings:

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Rainfall of the study area (mm)</th>
<th>Peak Discharge at Bahadurabad (Cumec)</th>
<th>Rice Production in Dhaka by financial year (Metric Ton)</th>
<th>Rice Production in Tangail by financial year (Metric Ton)</th>
<th>Rice Production in Mymensingh by financial year (Metric Ton)</th>
<th>Rice Production in Jamalpur by financial year (Metric Ton)</th>
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<tr>
<td>1998</td>
<td>216.95</td>
<td>102535</td>
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<td>3,56,995</td>
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<td>2004</td>
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<td>-</td>
<td>-</td>
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<tr>
<td>2019</td>
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<td>2020</td>
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<td>60034</td>
<td>1,491</td>
<td>12,211</td>
<td>256</td>
<td>10,889</td>
</tr>
</tbody>
</table>

Conclusions

The research explores the relationship between rainfall patterns, flood risks, and agricultural resilience in Bangladesh's North-Central Region.

It emphasizes the need for proactive measures, including integrated water management strategies, resilient agricultural practices, and community-based initiatives, to mitigate climate change challenges and promote sustainable development.
References


Thank You
Floating Grief: A Study on the Impact of Transboundary River Water Pollution on the Adjacent Community

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• Bangladesh, the labyrinth of river is now at risk because of the transboundary impact.

• Bangladesh is crisscrossed by 230 rivers, with 58 transboundary rivers originating in India or Myanmar, impacting the water quality in the region (Mozumder, 2010).

• SDG-6 advocates for “Clean Water and Sanitation” (UN, 2015).

• This study has identified the experiences of the adjacent community of river Korotoya (originated in India) around transboundary river water pollution.

Source: Khan, 2021
Background of the study

• Being a downstream country Bangladesh faces challenges like water scarcity, pollution, and disputes arising from upstream activities.

• Water pollution, as defined by Nathanson (2019), “involves the release of substances into water bodies, interfering with beneficial use and natural ecosystems”.

• The transboundary impact includes adverse effects on human health, flora, fauna, soil, air, and socioeconomic conditions (Handl, 2008).

Source: Bithi, 2023
Objective of the study

**General Objective** – To investigate the transboundary impacts and community perspective on river water pollution of Korotoya River in Panchagarh.

**Specific Objectives** –
- To observe the awareness about source of river water pollution of adjacent community.
- To explore the impact of river water pollution on adjacent community.
- To examine the perception and practices of the adjacent community for mitigating river water pollution.
Study Area

Source: Aziz, 2009

Source: Khan, 2014

Source: Google Map, 2022
Theoretical Framework

**Anthropocene** - The Anthropocene concept posits that human activities have become a dominant force shaping Earth's geological and environmental processes. It is marked by intensified globalization, leading to increased economic activities and transboundary pollution (Zalasiewicz et al., 2016).

**Ecofeminism** - “Ecofeminism relates the oppression and domination of all marginalized groups (women, people of color, children, poor) to the oppression and domination of nature (animals, land, water, air, etc)”.
Methods and Methodology

• This research followed **Qualitative** research methodology.

• **Insurgent approach** chosen to address power imbalances and prioritize the voices of marginalized communities.

• **Purposive sampling** employed for in-depth interviews.

• Sample size determined by **data saturation** level, emphasizing quality over quantity.

• In-depth interviews in the form of **testimonio** used to capture diverse community perspectives.

• **Field:** Bank of the river Korotoya, Debiganj, Panchagarh.

• Data was analyzed **thematically**.
Results and discussion

• Polluted water containing chemicals, heavy metals, and pathogens affecting fish health and water quality.

• Traditional livelihoods of fishing and agriculture becoming unsustainable.

• Economic losses for fishermen, increased vulnerability, and the need for alternative livelihoods.

• Shift to alternative livelihoods like day labor and small businesses.

Source: Bithi, 2023
Results and Discussion (Cont.)

• Pollution sources, including waste from India, negatively affecting river water usability for household necessities.

• Decline in fish stocks impacting food security and livelihoods.

• Declining water quality and fish stocks forcing communities to migrate.

• Indigenous communities forced to reconsider traditional practices, eroding cultural heritage.

Source: Bithi, 2023
Conclusion

• Transboundary river pollution in Korotoya, Bangladesh, is a complex issue disrupting livelihoods and cultural traditions.

• Fishermen's migration, triggered by declining fish stocks, affects not only income but also societal stability, risking the loss of cultural heritage.

• These impacts hampering the country to achieve SDG - 6.

Source: UN, 2015
Acknowledgments

The authors would like to thank all the individuals of the adjacent community to river Korotoya in Panchagarh, Bangladesh, for their participation and valuable insights. Without their cooperation, this study would not have been possible.
References


• Mozumder P. (2010) "Exploring Flood Mitigation Strategies in Bangladesh." https://digitalrepository.unm.edu/wr_sp/76


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Social Science Faculty, Dhaka University, Bangladesh
25th November, 2023
Contrasting Responses of Fluorescence Dissolved Organic Matter (FDOM) to the salinity Gradient Due to Upcoming Global Warming

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2Department of Environmental Science, Jahangirnagar University
Introduction

• Climate change is an implication of global warming
• Global warming results in unexpected weather changes
• For example, melting glaciers, raised ocean temperature, rises sea water level
• Excessive water level in sea promotes salt water intrusion in coastal areas
• 32% Of the area in Bangladesh belong to coastal region
• DOM: Organic matter fraction in solution pass through 0.45μm filter membrane.

• Considered as one of the most sensitive indicators of changes overlapping in the soil environment

• Crucial constituent of soil solution

• Plays an role in many chemical and biological processes in soils
• DOM that shows fluorescent properties termed as FDOM
• All DOM are not FDOM
• FDOM properties shows significant fluorescence efficiency at particular excitation – emission wavelength
• Can be characterize them by identifying different peak position at particular wavelength.
Background of the study

• Results indicated that green fertilizer and biochar could increase the DOM content in soil ecosystem (Lie et al. 2019)

• Xi et al. (2017) revealed that the DOM content of wetland soils varied with seasons and soil depth while structure was stable.
Background of the study

Previous studies focused in inland soil DOM and explored the role of human factors

• in forest (Hobley et al. 2019),

• farmland (Schmidt and Martinez, 2019)

• Grassland (Silva et al. 2019)

Whereas DOM content in soil can be affected by land use Management such as

• Fertilization (Hui et al. 2019)

• Organic amendment (Liu et al. 2019)

• Tillage (Warmsley et al. 2019)

• Changes to vegetation cover (Leroy et al. 2017)
Zeng et al. (2017) confirmed that sea water changes the DOM composition.

A few studies shown the effect of salinity on DOM.

Study needed how salinity can effect the DOM composition.

Background of the study
Objective of the study

• To characterize the FDOM components in different concentration of salinity by using EEM-PARAFAC model.

• To determine the changes of FDOM components and intensities due to increasing salinity.
Methods and methodology

Sampling design and soil sample

Soil Sample Collection and Sample Preparation

Preparation of Artificial Sea Water & Effects on soil

Analysis of Physico-chemical Parameter

Measurement of FDOM by using Fluorescence spectrophotometer

EEM-PARAFAC modelling

Data Processing, Analysis and Interpretation

Report Writing
Result and discussion

FDOM components in different concentration of salinity
Fluorescence intensity of different FDOM components in different concentration of salinity for HA-like
For FA-like
For PLF-like
Change of the fluorescence intensity of different components with respect to duration of extraction.
Fluorescence intensity of different FDOM components in different duration of extraction time with different concentration of salinity: For HA –like
FA-like

Fluorescence intensity, au

0% 25% 50% 100% 1-3hr 3-6hr 1-6hr

1-3hr 3-6hr 1-6hr
PLF-Like
- Fluorescence intensity increase with the level of salinity.
- DOM content highest in saline soil.
- Fluorescence intensity increase for 1hr and 3 hr and then decreases in 6 hour duration of extraction time.
Conclusion

✓ Firstly, we discovered that DOM content highest in saline soil. Four types of FDOM components were detected in different level of salinity.

✓ Secondly, fluorescence intensity increases with the level of rising salinity for a certain period of time. In our study it was for 1 hr. to 3 hr but in 6 hr it decreases.

✓ By this analysis it can be said that salinity level has certain effects on soil FDOM properties but it can’t change the fluorescence intensity for short period of time saline water contact with soil.
Acknowledgments

Special Allocation Fund, Ministry of Science and Technology, Bangladesh, 2021-22
References


• Bormann, H., Klaassen, K., 2008. Seasonal and land use dependent variability of soil hydraulic and soil hydrological properties of two Northern German soils. Geoderma 145, 295–302


1st South Asian Conference 2023
UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENERIO
Social Science Faculty, Dhaka University, Bangladesh
25th November, 2023
Nature based solution: Challenges and Opportunities in Coastal Areas of Bangladesh.

25 November 2023
Social Science Faculty, Dhaka University

Koushik Roy
Project Coordinator
LEDARS
Climate change in Bangladesh is a critical issue as the country is one of the most vulnerable to the effects of climate change.¹²

➢ In the 2020 edition of Germanwatch's Climate Risk Index, it ranked seventh in the list of countries most affected by climate calamities.

➢ According to Germanwatch’s 2021 Global Climate Risk Index (CRI), Bangladesh suffered economic losses worth $3.72 billion and witnessed 185 extreme weather events due to climate change from 2000 to 2019.
Consequences of climate change

- Global Temperature increase
- Melt down of polar ice and glaciers
- Sea Level Rise
- Increase intensity and magnitude of disasters
- Irregular Rainfall
- Health hazard increase
- Shifting of weather pattern
- Biodiversity is in threat
- Ecosystem degradation
- Coastal inundation increase
- Desertification increase
- Wildfire increase
Due to groundwater being saline and surface water contamination at the time of storm surge, salinity is increasing in the water and soil.

Due to erratic rainfall, the increased length of the dry season causes seasonal drought

Agriculture is decreasing every year by 3.45% on average

Livelihood scopes are declining due to spreading salinity in the coastal area

Migration increased from the coastal area, already reflected in National Population Census 2001, 2011 and 2022
Nature-Based Solutions are sustainable and cost-effective approaches that use the power of nature to address environmental challenges.

NbS interventions are the "Actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits."

IUCN (International Union for Conservation of Nature)
Growth for the sake of growth is the ideology of the cancer cell.

Edward Abbey

Opportunities in Coastal NbS

- **Ecosystem Services:** Mangroves as natural barriers, wetlands for water purification
- **Climate Resilience:** Nature-based approaches enhance the ability of coastal areas to withstand climate impacts
- **Economic Benefits:** Sustainable fisheries, tourism, and agriculture
- **Ensures green growth**
Main Considerations

1. Community engagement
2. Capacity Building on Adap. & Miti.
3. Low-cost Solutions
4. Knowledge Management
5. Sustainable resource management
6. Biodiversity Conservation
7. Collaboration
8. Ownership and Empowerment
9. Policy Advocacy
Embedding NbS in the existing policies of Bangladesh

- **National Adaptation Program of Action (2005, updated 2009):** Bangladesh’s first program for climate change adaptation emphasizes the importance of local involvement, contingency planning, capacity building and ecosystem-based adaptation.

- **Bangladesh Climate Change Strategy and Action Plan (2009):** Recognizes the importance of community involvement in adaptation and emphasizes environmental solutions for climate resilience.

- **Bangladesh Climate Change Gender Action Plan (2013):** Highlights involving those usually ‘left behind’ — women, children, youth and people with disabilities — in curating equitable adaptation solutions.

- **Mujib Climate Prosperity Plan (2021):** Outlines NbS following LLA approach investments of US$3.89 billion and plans to mobilize an additional US$1 billion by 2030. Also aims to set up Mujib LLA hubs in all vulnerable areas emphasizing NbS to address climate change hazards.

- **National Adaptation Plan 2023–2050 (2022):** Acknowledges that NbS will be essential in mobilizing local communities to catalyze effective, equitable and transparent adaptation solutions based on local priorities.
Pursuing of SDGs

1. No poverty
2. Zero Hunger
3. Health and wellbeing
5. Gender Equality
6. Clean water and sanitation
8. Decent work and economic growth
13. Climate Action

Bangladesh Climate Change Strategy and Action Plan 2019
NAP/NAPA
Policies
Mujib Climate Prosperity Plan
Challenges of NbS in the context of Coastal Bangladesh

• Gap in providing patient finance
• Ignoring the essential knowledge and expertise of the local actors
• Lack of coordination between ministries and implementing bodies responsible for adaptation interventions, leading to poor implementation
• Gap in the comprehensive understanding of the concept of NbS and how those policies should work at the local government level
• Limited human resources to establish monitoring, evaluation and learning processes to assess the effectiveness of NbS interventions
• Other challenges are lack of capacity building, alternative livelihood opportunities, smooth and transparent financing, or context-specific interventions.
1. The frequency and magnitude of extreme weather events are increasing day
2. Fragile infrastructure of the coast
3. Limited resources compared to the number of vulnerable people
4. Overlapping of GO-NGO services in the coastal area
5. Migration of people from the coastal area
Recommendations

• **Integrated planning:** Coordinating efforts across sectors
• **Capacity building:** Training and educating local communities
• **Research and innovation:** Harnessing technology for sustainable solutions
• **Translating commitments to actions**
Thank you for your patience
1st South Asian Conference 2023

UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENERIO

Social Science Faculty, Dhaka University, Bangladesh

25th November, 2023
Multi-Hazard Vulnerability and its Impacts on Kishoreganj District

Asma Akther Popy, Zereen Saba, Mizanur Rahman, Khaled Md. Mehzabin Alam, Umme Hani Asha, and Musrat Jahan Momo
Introduction

• The Kishoreganj district Situated in North eastern Bangladesh and affected by climate change (Nath et al., 2010).
• Due to climate change livelihood, fisheries resources, crop production and fish habitat are directly affected by the Kishoreganj district (Ahmed, 2012).
Objective of the study

➢ To explore Multi- Hazard Vulnerability and Impact of climate change on livelihoods of the communities in Itna and Mithamain Upazila.
# Methodology

<table>
<thead>
<tr>
<th>Methods</th>
<th>Quantity and process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household survey</td>
<td>400 (200 male, 200 female)</td>
</tr>
<tr>
<td>Focus group discussion</td>
<td>12 (farmers, fisher folk, boatmen, small traders, and livestock rearers and housewife)</td>
</tr>
<tr>
<td>KII (Key Informative Interview)</td>
<td>13 (Department of Agriculture Extension (DAE), Department of Public Health Engineering (DPHE), District Relief and rehabilitation Officer (DRRO), Project Implementation officer (PIO), Department of Social Service (DSS), Department of Women and Children Affairs (DWCA), Department of livestock.)</td>
</tr>
<tr>
<td>Climate Vulnerability Analysis</td>
<td>(1991-2022) Time series analysis (Rainfall, Temperature) Heat wave, Cold Wave</td>
</tr>
<tr>
<td>Disaster Vulnerability Analysis</td>
<td>GIS and RS, Multi-hazard Vulnerability Index (2 Upazila)</td>
</tr>
</tbody>
</table>
Climate Change in Kishoreganj District

Rainfall

Temperature

\[ y = -0.8571x + 196.13 \]
\[ R^2 = 0.0383 \]

\[ y = 0.0298x + 30.272 \]
\[ R^2 = 0.4794 \]
Climate extreme in Kishoreganj District

Number of Heat Wave Days (1990-2022)

Number of Cold Wave Days (1990-2022)
Climate extreme in Kishoreganj District

Flood Vulnerability Map

River Bank Erosion (1992-2022)
## Disaster Trends in the study area

<table>
<thead>
<tr>
<th>Disaster</th>
<th>The trend in 2018-2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood</td>
<td>+</td>
</tr>
<tr>
<td>Flash Flood</td>
<td>+</td>
</tr>
<tr>
<td>Waterlogging</td>
<td>~</td>
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<tr>
<td>Heavy Rainfall</td>
<td>+</td>
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<tr>
<td>Drought</td>
<td>~</td>
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<tr>
<td>Riverbank erosion</td>
<td>+</td>
</tr>
<tr>
<td>Wave erosion</td>
<td>~</td>
</tr>
<tr>
<td>Heat wave</td>
<td>+</td>
</tr>
<tr>
<td>Cold wave</td>
<td>+</td>
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<tr>
<td>Thunderstorm</td>
<td>+</td>
</tr>
<tr>
<td>Hailstorm</td>
<td>~</td>
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<tr>
<td>Increased</td>
<td>+</td>
</tr>
<tr>
<td>Not increased</td>
<td>~</td>
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</tbody>
</table>
Disaster Vulnerability of the study Area

• **High**: Chauganga, Joysiddhi, Dhanpurn, Badla, Baribari, Mriga, Raituti, Khatkha, Gopedighi, Ghagra, Bairati, Dhaki, Mithamain unions of the study area are highly vulnerable.

• **Medium**: Itna and Elongjuri unions.

• **Low**: Keorjori and Dhaki.
### Disaster Vulnerability of the study Area

#### Hazard calendar of the study area

<table>
<thead>
<tr>
<th>Disasters</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>July</th>
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<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
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<tbody>
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<td>Flood</td>
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</tr>
</tbody>
</table>
# Disaster Vulnerability of the study Area

## Disaster Impact Matrix

<table>
<thead>
<tr>
<th>Index</th>
<th>Gender</th>
<th>Livelihood</th>
<th>WASH</th>
<th>Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>Itna</td>
<td>🟥apesh</td>
<td>🟥apesh</td>
<td>🟦 TE</td>
<td>🟪 TE</td>
</tr>
<tr>
<td>Mithamain</td>
<td>🟥apesh</td>
<td>🟥apesh</td>
<td>🟦 TE</td>
<td>🟪 TE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Index</th>
<th>Vulnerability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td></td>
</tr>
</tbody>
</table>
Climate Induced Extreme Impact on Demography

Household-level climate vulnerable group

- Male: 20.7%
- Female: 62.5%
- PLWD: 82.3%
- Elderly: 44.6%
- Youth: 33.1%
Climate Induced Extreme Impacts on livelihoods

Climate vulnerability of occupational groups

- Service holder: 25.0%
- Fishermen: 68.8%
- Day labour: 63.9%
- Farmers: 71.2%
- Small trader: 31.1%
- Boatmen: 46.0%
Climate Induced Extreme Impacts on Livelihoods

Disaster Impact on Livelihoods

- Agricultural land loss
- Gender discrimination
- Dropout rate increased
- Social insecurity
- Social discrimination
- Domestic violence increased
- Decrease education rate
- Increase agric input price
- Dropping of livestock product
- Increase food price
- Unemployment increase
- Income reduce
- Income generating option reduced
- Income generating option reduced
- Income generating option reduced
- Others

0.00% 10.00% 20.00% 30.00% 40.00% 50.00% 60.00% 70.00%
## Climate Induced Extreme Impact on Agriculture and Livelihoods

<table>
<thead>
<tr>
<th>Vulnerable sectors</th>
<th>Cold waves &amp; fog</th>
<th>Groundwater depletion</th>
<th>Flood</th>
<th>Heavy rainfall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homestead vegetable</td>
<td>Red</td>
<td></td>
<td>Red</td>
<td>Red</td>
</tr>
<tr>
<td>Rabi crops</td>
<td>Red</td>
<td>Orange</td>
<td>Red</td>
<td>Orange</td>
</tr>
<tr>
<td>Livestock</td>
<td>Orange</td>
<td></td>
<td>Yellow</td>
<td>Orange</td>
</tr>
<tr>
<td>Water &amp; Health</td>
<td>Orange</td>
<td>Red</td>
<td>Yellow</td>
<td>Orange</td>
</tr>
<tr>
<td>Wage earning</td>
<td>Red</td>
<td></td>
<td>Yellow</td>
<td>Orange</td>
</tr>
</tbody>
</table>

*Note: Wage earning for day labour & small traders only*

<table>
<thead>
<tr>
<th>Index</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Red</td>
</tr>
<tr>
<td>Medium</td>
<td>Orange</td>
</tr>
<tr>
<td>Low</td>
<td>Yellow</td>
</tr>
</tbody>
</table>
Climate Induced Extreme Impacts on Health

- Mithamain: 48%
- Itna: 52%

SUFFER FROM DISEASES
Climate Induced Extreme Impact on Health

Diseases suffered by respondents

- Diarrhoea
- Dysentery
- Cholera
- Skin diseases
- Malaria
- Dengue
- Jaundice
- Fever
- Cold
- Asthma
- Cancer
- Hypertension
- Anxiety
- Eating disorder
- Depression
- Post-Traumatic Stress Disorder
Climate Induced Extreme Impacts on Wash

Source of drinking water

- Deep tube well: 50.60%
- River and haor: 44.80%
- Tank water: 3.01%
- Bottled Water: 2.16%

Drinking water crisis months

Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec

Scarcity | No Scarcity

- Scarcity months: Jan, Feb, Mar, Apr, May, Jul
- No Scarcity months: Jun, Aug, Sep, Oct, Nov, Dec
Recommendation

• Raised homestead plinths, brick-mound walls, dams, rural roads and flood shelters are the major flood and wave erosion protection infrastructures, but these are insufficient for flood resilience.

• A brick mound protection wall should be considered an effective and sustainable community-based infrastructure to protect homesteads, home gardens, and livestock from flooding and wave erosion.

• Nature-based solutions (pati patha bushes as a safety measure against land erosion) can be promoted to plants along the island to protect them from wave erosion. It can also be income-generating by producing Shital Pati for women and PLWD because Shital Pati is widely used as a floor mate in Bangladesh and has a demand in rural and urban areas. If it can be promoted in the study area, it will protect the land from erosion and create employment for people.

• Raised bed tube wells can protect drinking water from pollution during a flood, but river osmosis is the adequate water infrastructure for the study area for the dry season.
References


The Nexus of NDVI and UHI: A Comprehensive Analysis from Bangladesh

Abdulla Al Imran, Naimur Rahman, Sujon Sheikh
Department of Geography and Environment
Jahangirnagar University, Savar, Dhaka

Afsana Mimi
Research Consultant
Center for Environmental and Geographic Information Services

25 November 2023
Background of the study

1. Dhaka city has been witnessing tremendous growth in population and in physical expansion.

2. It has experienced about population increase by 11.2 times during 1974-2021 from 2.056 million to 23.0 million.

3. However, the area has expanded only 3.82 times during the same period from 401 sq. kilometers to 1528 sq. kilometers.

4. Since 1971, a marked transformation in the existing land-use pattern has been observed both in city and suburban areas.

5. The land under Vegetation uses was changed into the form of non-crop farms, and various other land speculations.
Objective of the study

1. The main objective of this study is to explore the Normalized Difference Vegetation Index (NDVI) to investigate the influence of Land Surface Temperature (LST) through Urban Heat Island (UHI) by using satellite imageries.

2. We have selected different years in 10-year intervals from 2003 - 2023 to overview the change in our study area Uttara, Dhaka, Bangladesh.
Study Area

Uttara located to the north from the city center and slightly to the west of the most populous satellite city of Dhaka. Uttara has a population of close to 1,79,907 people and is considered one of the richest neighborhoods of the capital city.

In 1966, Dhaka Improvement Trust planned to build a satellite town under the North Satellite Town project in Dhaka District. In 1980, DIT changed the project name to the Uttara Residential Model Town Project.
Methods and methodology

- Landsat TM images of 2003, 2013, and 2023 were downloaded from the USGS (http://earthexplorer.usgs.gov) Earth Explorer website. All level-1 images of the Landsat satellites were used in this study.

- The methodology for this study includes Spatial analysis. NDVI and UHI have been done to analyze the process.

- The data used to address the central issues of land-use change and increase in temperature.

- The relevant data were analyzed with simple descriptive statistics and with spatial mapping techniques using Erdas Imagine software.
Result and discussion
Result and discussion
Result and discussion
Result and discussion

**Yearly Temperature Variation**

- **Minimum Temperature (°C)**
  - 2003: 0
  - 2013: 5
  - 2023: 10

- **Maximum Temperature (°C)**
  - 2003: 50
  - 2013: 100
  - 2023: 150

**VEGETATION COVER (ACRES)**

- 2003: 203.05 acres
- 2013: 69.83 acres
- 2023: 51.82 acres
Result and discussion

• In 2003, the minimum temperature recorded was 13.72°C, and the maximum temperature reached 17.88°C. Concurrently, the vegetation cover for that year was measured at 203.05 acres.

• In 2013, the minimum and maximum temperatures were 19.73°C and 23.04°C, respectively, while the vegetation cover decreased to 69.83 acres.

• By 2023, the temperature range shifted to 18.78°C (minimum) and 24.58°C (maximum), and the vegetation cover further decreased to 51.82 acres.
Conclusion

- The research outcome demonstrates the correlation between NDVI and UHI exemplified by a case study conducted over three different times, geographically as well as economically.

- In this study, we can see how vegetation cover and surface temperature are negatively correlated.

- In 2001 there were a lot of vegetation-covered areas when the temperature level was not so high where we can see the increase of temperature level over time with infrastructural and economic growth.

- In conclusion, we can say that though infrastructural and economic growth is mandatory, it can be the cause of Climate change, Human health issues, Environmental degradation, and other types of serious problems for the future world.


Thanks for Your Kind Attention...
1st South Asian Conference 2023

UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENERIO

Social Science Faculty, Dhaka University, Bangladesh

25th November, 2023

Center for People & Environ
Variation in drought resilience and climate sensitivity of Zanthoxylum Rhetsa at three sites along environmental and disturbance gradient

Kanta Bhattacharjee *, Mahmuda Islam, Hasibul Hasan, Mizanur Rahman

Department of Forestry and Environmental Science, Shahjalal University of Science and Technology, Sylhet 3114, Bangladesh.
Background of the study

- Global climate change has been affecting tree growth around the world and such impacts are predicted to be intensified under future climate change, particularly in the tropics.

- In addition, an increasing frequency of droughts might have altered forest dynamics and carbon balance of tropical forests along with mass mortality and tree growth decline.

- The forest ecosystems of Bangladesh are highly sensitive to climate and extreme climatic events because of the country’s geographic position.

- Drought tolerance of trees may vary with geographic position, drought severity and plant functional types.

- Thus, it is necessary to study the growth response of trees to extreme drought events and climate anomalies to forecast future tree growth under climate change scenarios.
Objective of the study

❑ To develop ring-width chronologies of *Z. rhetsa* from three study sites (RKWS, LNP and KNP).

❑ To evaluate the growth response of *Z. rhetsa* to the 1999 and 2006 drought events and compare drought resilience of this species at three sites and between two drought events.

❑ To investigate the sensitivity of *Z. rhetsa* to annual climate anomalies at three study sites.
Study area

Rema-Kalenga Wildlife sanctuary (RKWS)
- Drier site (Annual rainfall 2367 mm)
- Less disturbance

Lawachara National Park (LNP)
- Drier site (Annual rainfall 2367 mm)
- Most disturbance

Kaptai National Park (KNP)
- Comparatively wetter site (Annual rainfall 2726 mm)
- Intermediate disturbance
Data collection:

Species \quad \rightarrow \quad Zanthoxylum Rhetsa

Number of samples \quad \rightarrow \quad RKWS: 134 cores from 67 trees (2 cores from each tree)
\quad \rightarrow \quad LNP: 186 cores from 93 trees
\quad \rightarrow \quad KNP: 124 cores from 62 trees

Instrument used \quad \rightarrow \quad 5.3 \text{ mm increment borer}
Flowchart of the methods:

1. **Sample collection**
2. **Core placing and sanding** (C80-C2000) grit sandpaper
3. **Scanning** (2400 DPI, EPSON V550 scanner)
4. **Ring detection** (coorecorder and cdenro software)
5. **Crossdating** (TSAPWin software)
6. **Individual ring width series**
Scanned Image of *Z. rhetsa*:

Crossdating procedure of *Z. rhetsa* on TSAPWin Software:
Drought year:

✓ Standardized Precipitation Evapotranspiration Index (SPEI) indicates drought index

✓ Lower SPEI ↓ = Higher Drought ↑

✓ Red vertical lines indicate drought year 1999 and 2006 respectively
Characteristics of drought year:

Sreemangal Climate Data

Rangamati Climate Data
Components of Drought Resilience:

**Resistance** ($R_t$) = \( \frac{Dr}{Pre\ Dr} \)

**Recovery** ($R_c$) = \( \frac{Post\ Dr}{Dr} \)

**Resilience** ($R_s$) = \( \frac{Post\ Dr}{Pre\ Dr} \)

**Relative Resilience** ($R_r$) = \( \frac{Post\ Dr - Dr}{Pre\ Dr} \)

Statistical Analysis:
Characteristics of RWI chronologies:

Result and Discussion
Pre-monsoon temperature (Tmax and Tmean) had stronger influence on tree growth at all three sites.

Minimum temperature has significant impact on LNP only.

Precipitation had minimal impact on tree growth at RKWS and KNP, but no significant impact at LNP.
Spatial correlation of ring-width chronology and global climate data sets:

Tree radial growth of *Z. rhetsa* from RKWS showed correlation with regional precipitation, temperatures and SPEI mainly in the pre-monsoon season.
Spatial correlation of ring-width chronology and global climate data sets:

Tree radial growth of *Z. rhetsa* from LNP showed correlation with regional precipitation, SPEI 01 and SPEI 03.
Spatial correlation of ring-width chronology and global climate data sets:

Tree radial growth of *Z. rhetsa* from KNP showed correlation with regional precipitation, maximum temperature, June SPEI and vapor pressure.
Growth patterns during drought events:

✓ Average radial growth of *Z. rhetsa* from RKWS dropped by 31% during the 1999 and 2006 drought events.

✓ Radial growth of *Z. rhetsa* from LNP declined by 40% and 33% during the 1999 and 2006 drought events, respectively.

✓ Growth of *Z. rhetsa* from KNP dropped by 46% and 25% in the 1999 and 2006 drought events.
Variation in drought resilience among three sites and between drought events:

✓ Drier site like RKWS is more resistant but less recovery; On the other hand, wetter site like KNP is less resistant and higher recovery in low severe drought(1999)

✓ Site with high disturbance history and low stand density like LNP is more drought resilient in severe drought event(2006) for lower competition for water and nutrients
The ring-width time series of *Z. rhetsa* from all three sites crossdated well and the chronologies contained common environmental signals as depicted from the high EPS (0.85).

Pre-monsoon temperature (Tmean, Tmin, and Tmax) had stronger influence on tree growth at all three sites.

Precipitation had minimal impact on tree growth at RKWS and KNP, but no significant impact at LNP.
Drought significantly reduced tree growth at all sites ranging from 25% to 46% growth reduction.

Drought resistance, recovery, resilience, and relative resilience varied among sites depending on the variability of rainfall and drought severity.

Drier sites have higher resistance but lower recovery and resilience than wetter sites during the low severe drought (1999). During the severe drought (2006), sites with high disturbance history with low stand density may be benefitted from lower competition for water and nutrients and becomes more drought resilient.
Conclusions

➢ A considerable decrease in tree growth during drought years, as observed in this and other tropical research, may have substantial effects on the global carbon cycle.

➢ In addition to decreasing tree growth and the amount of fixed carbon, extending the dry season further may also raise the risk of tree mortality in tree species that are less suited to prolonged dry season duration.

➢ Species that are more drought tolerant should be taken into consideration for both forest management and the development of policies for the management of tropical forests and conservation of endangered species.
References


1st South Asian Conference 2023
UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENERIO
Social Science Faculty, Dhaka University, Bangladesh
25th November, 2023
Enhancing River Ecosystem through Nature-based Solutions: A Case Study on Sucker Fish in the Buriganga River

Khaled MD. Mehzabin Alam Prottoy, Zereen Saba, Mizanur Rahman, Asma Akther Popy, Musrat jahan Momo

Research Assistant (CPE)
Introduction

• Buriganga River is widely utilized for industrial, transportation route, agricultural, and is regarded as Dhaka's lifeblood.

• Samples of the water quality parameters were taken in monsoon season.

  chemical oxygen demand (COD), biochemical oxygen demand (BOD), TSS, TDS, and total dissolved oxygen are calculated and examined in this study.

• Air quality analysis of the river was conducted. Key pollutants NO2, S02 were calculated and examined in this study.
Buriganga River Ecosystem

Threatened by

• fast industrialization,
• Urbanization
• pollution growth
• Waste Disposal
Affected Buriganga River Ecosystem

- Breakdown OF Components of the Buriganga River
  - Flora (plants)
  - Fauna (animals)
  - Microorganisms
  - Abiotic factors (physical and chemical elements)
Background of the study (Suckerfish)

Exotic Fish Invading and disrupting Ecosystem

• Threat to Fish Diversity
• National Crisis
• Govt issues final notification banning Sucker Fish
• Food Competitive To bottom feeders
• Space Competitive To bottom feeders
Study Area

- Geographical Location:
  it is located altitude between 23° 36’ E and 23° 46’ E, with longitude between 90° 14’ N and 90° 36’ N

- Source of life:
  plants, animals, and microbes.

Threatened by
fast industrialization, urbanization, and pollution growth
Objective of the study

• The following were the study's goals:
• 1) To determine which aspects of the habitat encourage fish reproduction.
• 2) Nature based solution to restore fish diversity and fish habitat enhancement
• 3) To derive chlorophyll-a index from satellite data.
• 4) To derive river surface temperature from satellite data
• 5) Utilizing the Habitat Suitability Index (SI), identify possible fishing areas.
• 6) Usage of Doppler effect to study fish behaviour.
# Methodology

<table>
<thead>
<tr>
<th>Method (phase 1)</th>
<th>Empirical Formulae</th>
<th>outcome</th>
</tr>
</thead>
</table>
| 1. Acquiring Dataset                      | The estimated data was obtained by the Landsat 8 Thermal Infrared Sensor (TIRS). Landsat 8 provides metadata of the bands such as thermal constant, rescaling factor value | • $L_{\lambda} = M_{\lambda} \times Q_{\text{cal}} + A_{\lambda}$  
• $T = K2 \ln(K1L_{\lambda} + 1)$ | the digital number (DN) of band 10 and band 11 |
| 2. Dataset Training workflow              | Calculation of NDVI was important because subsequently the proportion vegetation (PV), which is highly related to NDVI and emissivity ($e$) which is related to PV must be calculated using Formula | • NDVI = Band5 − Band4Band5 + Band4                  | the proportion vegetation (PV), which is highly related to NDVI & emissivity ($e$) |
| 3. River surface Estimation               | The Landsat-8 data was stored in digital number (DN). It had to be radiometrically converted to the top-of-atmosphere radiance ($L_{\text{TOA}}$) | • PV = (NDVI − NDVIminNDVI max − NDVImin)$^2$ | Emissivity was computed |
# Methodology

<table>
<thead>
<tr>
<th>Method (phase 2)</th>
<th>Empirical Formulae</th>
<th>outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Rasterization and Calculation</td>
<td>LST equation was applied to obtain the surface temperature</td>
<td>LST = BT1 + (λ * BT/C2) * ln(e)</td>
</tr>
</tbody>
</table>
| 5.1 Bands spectral radiance of chlorophyll-a index | atmospheric correction that will automatically convert the top-of-atmosphere radiance value ($L_{TOA}$) to bottom of atmosphere reflectance using FLAASH in ENVI 5.3. FLAASH incorporates the MODTRAN radiation transfer code. | • LST = BT1 + (λ * BT/C2) * ln(e)  
• $L_{\lambda} = M_{\lambda} Q_{cal} + A_{\lambda}$  
• Chl_a = Band4/Band2 Chl_a = Band4/Band2 |
| 5.2. air quality Analysis NO2, SO2  | • SI = $Y_{fit} - minY_{fit}$/$maxY_{fit} - minY_{fit}$ | NO2, SO2 records were examined to find historical impact on Buriganga river |
| 6. Habitat Suitability Index formation | • SI = $Y_{fit} - minY_{fit}$/$maxY_{fit} - minY_{fit}$ | The suitability index determined the level of scores of the preferred ranges for fish |
Dataset Workflow (River Data)

- Rasterization and calculation
- Habitat sustainability value
- Landsat data imagery
- Image Processing
- Extract Chlorophyll-a
Dataset Workflow (Habitat)

- Landsat 8 TIR
- Radiometric Calibration
- Retrieval of RST
- BT Composition
- RST Calculation
  - Bands spectral radiance of chlorophyll-a index
  - Habitat Index formation
Sample TDS

Total Dissolved Solid

- TDS was recorded high before adsorption. After adsorption, it goes below the optimum value of 300 ppm.
Total Dissolved Solid (TSS)

- High TSS before absorption was decreased after adsorption
- Water's natural dissolved oxygen levels and water temperature increased
Result and discussion

Fish habitat appropriateness indices

RST

In this study using satellite-derived environmental factors and catch data, it was discovered that regions with river surface temperatures between 23.0°C and 28.3°C
Result and discussion

Fish habitat appropriateness indices

Chlorophyll-a

chlorophyll-a concentrations between 0.72 and 1.31 mg/m3 accounted for over 80% of the total catch.
Result and discussion

Air quality Analysis
Result and discussion

Air quality Analysis
Future Scope of Study

Ongoing Sample Tests

➢ COD (Chemical Oxygen Demand)
➢ BOD (Biochemical Oxygen Demand)
➢ Turbidity
Future Scope of Study

Air quality Analysis

➢ All pollutants calculation
Conclusion

➢ The satellite data are useful because they provide a geographical and temporal resolution for classifying the aquatic characteristics of habitat and ecosystems that impact aquatic life.

➢ The Classified areas can be characterized for next phase of study, fish behavior and population analysis using Doppler effect.

➢ Invading species can be reduced by mass fishing approach and process can be repeated.

➢ The amount of nutrients, chlorophyll-a, and lake surface temperature in Buriganga can be green zoned for fish habitat indexing.
Thank You
References


(2) Promoting community-based surveillance of economically important invasive species in lower-income economies: a case study of the suckermouth catfish (Pterygoplichthys pardalis) in BangladeshJuly 2022 DOI:10.21203/rs.3.rs-1836228/v1 LicenseCC BY 4.0(4) W. Lehmann, H. Rinke (Bayer AG) Ger. 838217, 1952.

Assessment on Noise Pollution (JKKNIU). Its Impact and Solution on Climate Change

Presented by: Mozakkir Azad
Environmental Science and Engineering Department
Jatiya Kabi Kazi Nazrul Islam University
Trishal, Mymensingh
The Condition of Noise Pollution in Bangladesh

This presentation provides an overview of the noise pollution situation in Bangladesh and its impact on people's daily lives. It also discusses the causes of noise pollution and suggests ways to reduce it.

https://www.newagebd.net/article/191862/noise-pollution-a-silent-killer
Introduction

• Noise pollution means unwanted or excessive noise that can harm human health and environmental quality. Noise pollution, also known as environmental noise, is typically generated indoors in many industrial facilities and some other workplaces, but also comes from highways, railroad, and airplane traffic and outdoor construction activities.
Background of the study

Location: Trishal, Mymensingh Division of Bangladesh.
GPS Location: Coordinates:
24°34′54″N 90°22′25″E
Objective of the study

The objective of the study is –

1. To explore and implement nature-based solutions, such as green infrastructure and vegetative barriers
2. To mitigate noise pollution's impact within the context of climate change adaptation and resilience strategies.

This research aims to assess the effectiveness of nature-based interventions in reducing noise pollution while also considering their broader ecological and climate-related benefits.
## Research and methodology

| Study conducted at 16 important sites | Analysis of noise levels using GIS (ArcGIS 10.8) with IDW technique | Detailed noise pollution mapping of the university campus |
Result and discussion
Dissuasion:
Key Findings

- Ambient noise level in the university campus is much higher than the standard
- Maximum sound level from Nazrul Murti: 95.8 dB (afternoon)
- Lowest average sound level in the residence area: 42.2 dB (evening)
Ways to reduce Noise Pollution

- Lower the volume of electronic devices
- Turn off appliances when not in use
- Plant more trees to create a natural sound barrier
- Regular maintenance of vehicles and machinery
- Use earplugs or noise-canceling headphones
Nature-based Solutions for Noise Pollution

This presentation explores nature-based solutions to mitigate noise pollution while considering climate change implications.

• Importance and benefits of NBS in addressing noise pollution

  • Nature-based solutions (NBS) for noise pollution and climate change
Greenery and Vegetation

- Planting Trees: Dense vegetation as a natural sound barrier
- Green Walls and Roofs: Insulation and noise reduction in urban areas
Wetlands and Natural Barriers

01 Utilizing Natural Barriers: Topographic features and artificial barriers

02 Wetland Restoration: Natural buffers against noise pollution
Urban Planning and Design

- Parks and Green Spaces: Noise buffers and carbon sinks
- Traffic Management: Reducing noise emissions and promoting alternative transportation
Protecting Biodiversity and Ecosystems

01 Reforestation and Habitat Restoration: Noise reduction and carbon sequestration

02 Preservation of Habitats: Maintaining biodiversity and reducing noise
Awareness and Education

- Community Engagement: Promoting nature-based solutions and their role in climate change
- Benefits of adopting nature-based solutions for noise pollution
Conclusions

• Nature-based solutions for noise pollution, such as green buffers and urban green spaces, not only mitigate noise but also contribute to climate resilience by fostering biodiversity and sequestering carbon, offering a sustainable, multi-faceted approach to addressing environmental challenges. In summary, integrating nature-based strategies for noise reduction not only improves human well-being but also supports climate goals through the preservation and enhancement of natural ecosystems.
Acknowledgments

I would like to thank – Mofassir Azad, Applied Mathematics Department, Rajshahi University
References


• Hiral Jariwala, Huma S Syed, Minarva J Pandya and Yogesh M Gajera, " Noise Pollution & Human Health: A Review " Noise and Air Pollution: Challenges and Opportunities, 2017


Thank you for your time and attention 😊
1st South Asian Conference 2023

UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENERIO

Social Science Faculty, Dhaka University, Bangladesh

26th November, 2023

CPE CENTER FOR PEOPLE & ENVIRON
Key Note Speech for Plenary 4

Rehabilitation Programs for the Climate Induced Displaced Persons in Bangladesh: A Critical Evaluation on the NGO interventions in Chittagong

Prepared by
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Prepared for
1st SOUTH ASIAN CONFERENCE ON “UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENARIO”

Organized by
Center for People and Environment (CPE) and Global Forum for Sustainable Rural Development (GFSRD)

Venue: Social Science Faculty, Dhaka University
Date: 25-26 NOVEMBER, Time: 9.00am
To be covered

• Scenario of Climate Vulnerability in Bangladesh
• Impact of Climate Change and sufferings of displaced
• Why is rehabilitation necessary?
• Government policy and strategy
• Government interventions
• What are the challenges?
• NGOs Interventions
• Problem facing by the NGOs
• Some observations and Ways forward
• References
Introduction

• Climate change contributes to the increase in extreme weather events and weather-related natural disasters, and to the increasing number of people who lose their life support base and are forced to flee their homes and migrate to other places.

• Today an average of 25.4 million people is displaced every year as a consequence of natural disasters.

• UNHCR mentions, it is a human crisis leads to displacement and it makes human life harder for those already forced to flee and also it is one of the multi-dimensional factors contributing to forced displacement.
Scenario of Climate Change Vulnerability in Bangladesh

- **World Bank** estimated that climate change could **displace 216 million people** across six world regions to move within their countries by **2050**, where **40 million** are in South-Asia.

- **Bangladesh**, a home to one of the **world’s largest delta systems**, is at risk from long-term climate change, particularly the sea level rise. **Two-thirds of the country is less than five metres** above sea level.

- It is estimated that climate change could cause **forced displacement of up to 30 million people in Bangladesh by 2100**, if sea level rises to expected **80 cm or more**.
Scenario of Climate Change Vulnerability in Bangladesh

• Global Climate Risk Index 2021, published by Germanwatch, reported, Bangladesh is ranked 7th among the countries affected most during 2000-2019 due to climate change.

• Though its contribution to global warming is negligible (less than 0.48% of global emissions), the country is impacted by all the adversities of climate change.

• However, Bangladesh is considered as one of the most climate-vulnerable countries in the world.
Scenario of Climate Change Vulnerability in Bangladesh

- A range of alternative predictions estimated that
  - Bangladesh would lose **15% of its landmass** and **displace over 35 million people from 19 districts** in the event of a one-meter sea level rise in this century;
  - More than 200 million people may be displaced permanently from their traditional habitats due to cyclone, tidal surge and river bank erosion combined with high saline water intrusion;
  - Approximately overall **78 million people** might be displaced.
Scenario of Climate Change Vulnerability in Bangladesh

- Displacement Solutions (2012) reported that one in every 7 people in Bangladesh will be displaced by 2050.
- Currently, on an average, total erosion in Bangladesh is 3,000 ha per year, displacing approximately 25,000 people annually.
- Researchers claimed that among the 64 districts in Bangladesh, 26 coastal and mainland districts are already producing severe climate induced migration.
Impact of Climate Change and sufferings of displaced

Due to climate change mainly there are two types of exposures occurring:

• Slow onset and Sudden onset events

**SLOW ONSET**

• Such as: Drought,
• Sea Level Rise,
• Salinity Intrusion,
• Temperature Rise,
• Change of Precipitation Pattern etc.

**SUDDEN ONSET**

• Such as: Cyclones,
• River erosion,
• Flood etc.

Due to these slow and sudden onset events the main sufferings are displacement and forced migration
Impact of Climate Change and sufferings of displaced

• As a consequence of climate change Migration mostly takes place through networking with relatives and/or known people, who have already been living in the point of destination (in a nearby safe area).

• But, some people cant migrate to any safer area, as they do not have any relatives and/or known people in the place of destination, they remain to live in the temporary settings at their place of origins, such as roadside, embankment side, or other’s land, without having basic rights and needs.

• They are called Trapped people, who time and again face displacement.
Impact of Climate Change and sufferings of displaced

• Major Sufferings of Displacement and Migration
  • Loss of Housing, Land and Property (HLP) rights, and so become landless, homeless, asset less
  • Failure to get employment opportunity,
  • Break of cultural rights, such as deprive of cultural harmony and Social cohesion
• Suffer from livelihood insecurity
• Denied access to basic services e.g. food, education, health, safe water, sanitation, etc.
• Suffer from the insecurity, especially women and Children
Impact of Climate Change and sufferings of displaced

A recent study by YPSA, a local NGO in Chittagong who has been working for these climate induced displaced persons in greater Chittagong region reported that:

• More than **15000 trapped people** are living in temporary settings (lands owned by others or *khas* land) after being displaced such as *embankment sides*, and *roadsides* in three sub-districts of Chittagong.

• **70%** of displaced households experienced displacement **two times and more**

• **50%** of displaced households were forced **to change their occupation**.

• **95% of families** use unhygienic **poor-condition of latrines** which leads to different diseases.

• Due to insecure living conditions, **child marriage, and many other social conflict** have been occurring with the local communities frequently.

• **68% of people** want to relocate **within the same union** (own territory).

• They are deprived of **basic needs and rights** both in the origin and destination.
Is rehabilitation necessary?

• Due to climate induced displacement, the OHCHR report states that the following human rights may be affected:
  • The right to life;
  • The right to adequate food;
  • The right to water;
  • The right to health;
  • The right to adequate housing; and
  • The right to self-determination.

• So climate induced displaced people need protection support and Rights-based rehabilitation programs.
Policy Response to Climate Change in Bangladesh

- Bangladesh has made commendable efforts to streamline regulatory and institutional settings in realizing the aspiration of climate-resilient sustainable development by creating required policies and regulatory frameworks. Over the years, the Government has formulated many policies, strategies, plans, and programmes to address climate change issues. Some of these are:
  - The Coastal Development Strategy, 2006
  - Bangladesh Climate Change Strategy and Action Plan (BCCSAP), 2009 (updated in 2022)
  - Bangladesh Climate Change Trust Act, 2010
  - National Adaptation Plan (NAP), 2022
  - Mujib Climate Prosperity Plan (MCPP) 2022-2041
  - Standing Orders on Disaster 2019
  - Plan of Action to Implement Sendai Framework for Disaster Risk Reduction 2015-2030
  - National Strategy on Internal Displacement Management 2021
  - National Plan for Disaster Management 2021-2025
  - Bangladesh Delta Plan, 2100
Government Interventions for Climate Induced Persons

- Over 7.1 million Bangladeshis were displaced by climate change in 2022, a number that could reach 13.3 million by 2050, said the WHO, assessing the situation in the country of around 168 million people.
- So rehabilitation interventions are necessary along with other strategic actions.

- **Popular Rehabilitation Project of the Govt. for Climate Induced People**
- Bangladesh has taken “Khurushkul Ashrayan Prokalpa” the world's biggest housing project for climate induced displaced persons in Cox’s Bazar to construct 139 five-storey buildings with modern facilities to shelter 4,409 climate induced families.
Government Interventions for Climate Induced Persons

• **Recent Landmark Initiatives**

• Under the “Ashrayan” project, a landmark initiative of the government for the landless and homeless people, a total of 442,608 families have been given houses. Besides enhancing disaster resilience, the project also focuses on mitigation by implementing 1.5 million tree plantations, rainwater harvesting, solar home systems and improved cook stoves.

• To enhance climate resilience, government has implemented 726 km river-bank protection, 2,123 km river excavation and dredging, 1,266 km embankment, excavation/re-excavation of 181 km irrigation canal, and 499 km drainage canal in the last 10 years.

• The government has planted 5.4 million Palm trees to reduce the risk of death due to lightning.
Problems of government intervened rehabilitation projects

• The Ashrayan project, one of the government intervened rehabilitation projects has become the milestone program for Bangladesh for rehabilitating the climate induced persons. However, some common problems for the inhabitants in these projects are:
  • Selection process of the places and beneficiaries for this rehabilitation program, were not appropriate. As the selection was completely dependent on the local Union Parishads, UP Chairman and members influenced the selection. As a result real landless and homeless people failed to get housing in the rehabilitation program.
  • All the houses constructed in the Ashrayan-1 project were Kutcha (tin shade and mud houses). As a result they were totally damaged within a very short period of time.
Problems of government intervened rehabilitation projects

• Drinking water crisis found common problem in most of the Ashrayan project, shortage of tube-wells.
• Unemployment and negligence forced the ill-fated inhabitants of the Ashrayan project into a life of uncertainties and darkness.
• The Pacca houses build under the Ashrayan-2 project were also found with low grade of construction.
Rehabilitation programs of NGO’s for Climate Induced Persons

• **Rehabilitation program of YPSA:**
• **Right-based solution:**

- To face the challenge of mass displacement as a result of climate change, YPSA has been implementing Bangladesh Housing, Land and Property (HLP) rights initiative with the support of Displacement Solutions (DS) to find out rights-based solutions for climate displaced People since 2012.

- The main objective of this project is to identify rights-based solutions and actions that could be undertaken to resolve the displacement of these climate-affected communities as well as to ensure and safeguard their housing, land and property rights.
Rights and Needs based Climate Induced Displaced People Rehabilitation Model

Demand side
- Building the capacity of climate forced displaced people, Women, Community Teams and Youth Forums for claiming their rights and alternative livelihood skills

Supply side
- Advocacy/campaign with the relevant stakeholders for rights-based solutions to the climate forced displacement

Planned Relocation

Repairment of Loss and Damage and for durable solutions to the displacement
Rehabilitation programs of NGO’s for Climate Induced Persons

- **One Family one house program:**
  - Under "One Family One House Program", Climate Displaced families are engaged with some existing program such as micro credit support, training, homestead gardening support, blanket distribution, chick distribution, linked their children to the local school and having health facilities.

- **Capacity Building Training:**
  - Capacity building training to the Community Team members are being provided. The main focus of the these trainings were voluntarism and role of voluntarism for social development, leaders; leadership quality and importance of leadership; problem identification and advocacy process for raising the demand; rights of climate displaced people and planning process for ensuring rights of climate displaced people.
Rehabilitation programs of NGO’s for Climate Induced Persons

• **Community Team:**
  
  Community team are formed with local climate displaced people”. Community teams are formed with the member of 10 people who are victims of natural disasters and familiar of voluntary jobs for social welfare.

  The newly formed community teams work for mobilizing the displaced people for raising awareness, ensure services for vulnerable households, holding campaign such as rally, human chain, and letter writing to policy makers for claiming their rights, communicating local stakeholders as community representative and actively involved with planned relocation process.
Rehabilitation programs of NGO’s for Climate Induced Persons

• New Houses of Cyclone affected people:
• Homeless people affected by the earlier cyclone Aila, Roanu and lastly Mora were struggling as well as dreaming of a better life. YPSA has been working to let their dream come true. Dream of new house.
• For sustainable development YPSA in collaboration with Habitat for Humanity International Bangladesh started Cyclone post-Mora housing construction work in Chittagong.
Rehabilitation programs of NGO’s for Climate Induced Persons

• **Training on Cattle rearing:**
  Cattle rearing training for climate displaced families are being provided. Upazila Livestock Officer facilitated the training at the upazila livestock office. Another training to rear goat in scaffold for the climate displaced people.

• **Community Driven planned relocation:**
  Community-driven Planned Relocation project has been taken for the Highly Vulnerable Climate Displaced Households in South-Eastern Coast of Bangladesh”. During the implementation of the project, YPSA selected 18 women for tailoring training, 35 families for providing roofing sheets (tins) and 20 families for latrine support in these Upazilas.
Rehabilitation programs of NGO’s for Climate Induced Persons

• **Rehabilitation program of CODEC:**

• **Smart Project:**
  
  45 thousand people from disaster prone area are under this project for 5 years. Eco foundation funded this project for food security as well as development of the living standard of the Poor and marginal farmer families.

• **Shikhon Project:**
  
  Donor of the project is European Union and Save the Children international. The project if directing Shikhon School which is providing education to the 5000 poor children in Maheshkhali. Children living in the embankment area in Cox’s Bazar and South Chittagong also receiving the educational opportunity.

• **Creel project:**
  
  USAID is the donor of this project. It is working for the socio economic development of the people living in Bashkhali. The main objective of this project is to control climate change and also poverty elimination. It works for afforestation to save embankment, giving fertilizer, seeds and pesticides to the poor people, giving high quality stove to reduce deforestation, deep Tube-Well etc.
Rehabilitation programs of NGO’s for Climate Induced Persons

Rehabilitation program of Coast Trust:

• Coast trust has been working from 1998 for the development of the coastal community.

• Development Activities:
  • Microcredit, skill development, education, health, human right

• Advocacy:
  • National and international advocacy to protect coastal people from natural disaster.
Rehabilitation programs of NGO’s for Climate Induced Persons

• Humanitarian activities:
  • Health, sanitation, food for the sufferers of Aila, Sidr and Roanu. It work with the partnership of Bangladesh Government, Unicef, WFP, PKSF, CARE, DFID, USAID, IUCN etc.

• Socio Economic Empowerment with Dignity and Sustainability:
  • Its goal is not only to provide social and economic facilities but also establish their rights as a citizen for 3500 families in Coxes Bazar. Involving 3500 poor families to economic activities
  • Establish them as a small entrepreneur by marketing their products and value chain management.
Problems facing by the NGOs:

• The problems of NGOs regarding rehabilitation programs to the displaced people are:
  • Most of the NGOs can’t solve the problems of displaced people comprehensively like government because they are totally dependent on the external funds. So rehabilitation programs of the NGOs are mainly urgent basis, distribution of roof sheets, sanitary latrines, tube-well for pure drinking water or distribution of dry foods.
  • Many of the displaced people sell their reliefs like roof sheets without using it, their purpose is to show that they are in need to collect relief from another NGO.
  • They face problems to identify the number of displaced people because there is no specific initiatives by government to identify the actual number of displaced people and also to identify the priority of their basic needs.
Problems facing by the NGOs:

• There is also no coordination among NGOs and also the government in their rehabilitation program. Most of the time the initiatives of the relief and rehabilitation programs are not for their sustainable development. Programs are taken without thinking the sustainability.

• Displaced people are sometimes harassed by the surrounding community that’s why NGOs are not interested to replace them in another place by giving them land and house. They are interested to rebuild houses for those people who have own land.

• NGOs also face problems for arranging land for displaced people who are totally landless without the help of government. Because governments Khas land distribution process is really a complex and time consuming process.
Problems facing by the NGOs:

• It is found by NGOs that some displaced rehabilitated families have tendency to leave their home during flood or erosion and they go to their previous place to collect relief from government or NGOs.

• NGOs cannot provide their rehabilitation programs without consulting the community. The community decides who are needed the relief and rehabilitation.

• NGOs unable to arrange employment for the large number of displaced people. They only can provide some training or loans.
Some Observations and ways forward

• However, it is found that community people have the potential to assess their own problems and have possible solutions (Local Led Adaptation).
• Engagement of women and local communities is essential for sustainable impact.
• Creating scope for alternative livelihood and economic opportunities for displaced people, especially for women can protect their social dignity as well as mass migration to urban cities.
• ‘Community team’ comprising displaced people is the key to selecting the vulnerable household for relocation and sustainable solutions.
• Community based planned relocation is the durable solution to climate-forced displacement (instead of mass relocation).
• Climate change-affected people should be treated from a human rights perspective.
• Programs and projects for and with climate change-affected communities should be a long team and integrated for durable solutions.
Some Observations and ways forward

- **Identify climate hotspot** areas for long-term programs for the right-based approach of climate change affected people.

- **Archiving and promoting Indigenous Knowledge (IK) and grassroots experiences** hub for climate change adaptation.

- **Awareness program** for rights and needs based solutions of climate affected people.

- **Need protection-related programs** to reduce Gender Based Violence (GBV), Child Marriage, and community conflict created by climate-vulnerable and climate-displaced families.

- **Context based IGA program** for the economic well-being of climate affected household focus on women.

- **Promoting Healthcare facilities** (strengthen health systems capacity through training and sensitization to promote health, prevent disease, and improve inclusive service delivery and referrals).

- Women of climate change affected families should engage in different knowledge-transforming sessions on Health, SRHR, Nutrition, WASH, gender-GBV climate adaptive livelihoods, etc.
Some Observations and ways forward

- **Water security, sanitation, and hygiene** and different **input supports** for highly vulnerable Climate affected households.

- **Support local government Institutions (LGI), educational Institutions, and Disaster Management Committee** and develop their **capacity** on climate change induces vulnerability and Adaptation.

- **Mobilization programs** with different stakeholders to **raise awareness** and ensure a **climate-resilient society**.

- Take initiative for introducing **Community Based Planned Relocation Program** in **climate hotspot** areas.

- **Advocacy** with relevant departments or agencies for **ensuring HLP**.

- **Generate authentic information** and **evidence** from ground Zero and share this information with **wider audiences** including **COP by UNFCCC**.
References


• Bangladesh Water Development Board, webpage on erosion: www.bwdb.gov.bd


1st South Asian Conference 2023
UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENERIO
Social Science Faculty, Dhaka University, Bangladesh
26th November, 2023

CPE CENTER FOR PEOPLE & ENVIRON
Disability Inclusion in Climate Resilient Infrastructure: A Cross Sectional Study in Four Coastal Sub-Districts of Bangladesh

Zereen Saba, Musrat jahan Momo, Mizanur Rahman, Asma Akther Popy
Introduction

• Bangladesh's coastal region is extremely vulnerable to natural hydrological and climatological disasters.

• According to the 2013 "Persons with Disabilities Rights and Protection Act" of Bangladesh, 2.80% of the population has a disability, including 3.28% of males and 2.322% of females. Also the rate is greatest in the Khulna district (3.62 percent) (BBS, 2022).
Objectives of the study

• To understand the current scenario of climate change and climate induced disaster and vulnerability imposed by climate induced disasters on person with disability

• To investigate the climate resilient infrastructure of PWD’s in Bangladesh costal zone during natural disaster
# Methodology

<table>
<thead>
<tr>
<th>Methods</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household Questionnaire Survey</td>
<td><strong>Total 520</strong>&lt;br&gt;(130 respondents from each Upazila)</td>
</tr>
<tr>
<td>Focus Group Discussion (FGD)</td>
<td><strong>16</strong>&lt;br&gt;(4 in each Upazila)&lt;br&gt;(168 Persons with Disabilities and 182 non-Persons with Disabilities male and female)</td>
</tr>
<tr>
<td>Key Informant Interview (KII)</td>
<td><strong>Total 12</strong>&lt;br&gt;(3 in each Upazila)&lt;br&gt;Department of Social Services (DSS), Department of Women Affairs, Project Implementation Officer (PIO)</td>
</tr>
</tbody>
</table>
Study Area

Legend
- Dacope
- Koyra
- Mongla
- Paikgachha

Distance Scale
0 10 20 40 Kilometers
Result and discussion

Total Annual Rainfall of Khulna and Mongla station (1990-2020)

\[ y_k = 5.1891x + 1727.1 \]
\[ y_m = 4.8205x + 1867.2 \]
Result and discussion

Average Temperature of Khulna and Mongla station (1990-2020)

ym = 0.0011x + 24.062
yk = 0.0219x - 17.854
# Result and discussion

## Impact of climate change in the project area

<table>
<thead>
<tr>
<th>Impact</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drinking water crisis</td>
<td>98%</td>
</tr>
<tr>
<td>Agricultural production loss</td>
<td>89%</td>
</tr>
<tr>
<td>Health problem increased</td>
<td>69%</td>
</tr>
<tr>
<td>Livelihood reduced</td>
<td>69%</td>
</tr>
<tr>
<td>Disability increased</td>
<td>78%</td>
</tr>
<tr>
<td>Agricultural land loss</td>
<td>52%</td>
</tr>
<tr>
<td>Income generating option reduced</td>
<td>44%</td>
</tr>
<tr>
<td>Climate induced migration increased</td>
<td>31%</td>
</tr>
<tr>
<td>Reproductive health problem</td>
<td>73%</td>
</tr>
<tr>
<td>Social discrimination</td>
<td>23%</td>
</tr>
<tr>
<td>Social insecurity</td>
<td>21%</td>
</tr>
<tr>
<td>Gender discrimination</td>
<td>19%</td>
</tr>
<tr>
<td>Malnutrition</td>
<td>18%</td>
</tr>
<tr>
<td>Education rate decreased</td>
<td>13%</td>
</tr>
<tr>
<td>Disaster related death increased</td>
<td>12%</td>
</tr>
<tr>
<td>Domestic violence increased</td>
<td>11%</td>
</tr>
</tbody>
</table>
Result and discussion

Climate induced disaster in the study area

- Cold wave: 9%
- Thunderstorm: 11%
- Heat stress: 22%
- Tidal inundation: 23%
- River bank erosion: 39%
- Water logging: 64%
- Salinity intrusion: 71%
- Storm surges: 71%
- Flood: 88%
- Cyclone: 99%
Result and discussion

Disaster vulnerability of Persons with Disabilities

Climate change and disability nexus

- Hearing disability: 3% (Increased), 4% (Disaster vulnerable)
- Intellectual disability: 2% (Increased), 4% (Disaster vulnerable)
- Deaf-blindness: 1% (Increased), 4% (Disaster vulnerable)
- Visual disability: 3% (Increased), 7% (Disaster vulnerable)
- Speech disability: 7% (Increased), 8% (Disaster vulnerable)
- Autism: 11% (Increased), 14% (Disaster vulnerable)
- Multiple disabilities: 6% (Increased), 15% (Disaster vulnerable)
- Mental illness: 26% (Increased), 14% (Disaster vulnerable)
- Physical disability: 26% (Increased), 26% (Disaster vulnerable)

Disaster vulnerable Persons with Disabilities

Increased Persons with Disabilities due to disaster
## Result and discussion

### Disaster vulnerability corresponding to housing structure

<table>
<thead>
<tr>
<th>Wall</th>
<th>Concrete</th>
<th>Tin</th>
<th>Hut</th>
<th>Floor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete</td>
<td>6.7%</td>
<td></td>
<td></td>
<td>Concrete</td>
</tr>
<tr>
<td>Tin</td>
<td>4.2%</td>
<td></td>
<td></td>
<td>Earthen</td>
</tr>
<tr>
<td>Tin</td>
<td></td>
<td>33.7%</td>
<td></td>
<td>Earthen</td>
</tr>
<tr>
<td>Hut</td>
<td></td>
<td></td>
<td>54.0%</td>
<td></td>
</tr>
</tbody>
</table>

### Legend
- **Low**
- **Moderate**
- **High**
- **Extreme**
Result and discussion

Disaster resilient housing

- Prepared wall and floor with bricks (36%)
- Used RCC pillar (41%)
- Raised plinth (23%)

Disaster Resilient Housing (6.9%)
Result and discussion

Persons with Disabilities friendly housing

- Ramp (27%)
- Independent moving with wheelchair (26%)
- Plinth considering road (47%)
- Accessible WASH (0%)
Result and discussion

Status of cyclone center

Available Cyclone shelter (50%)
- Below 500 m (24%)
- 500-1000 m (37%)
- 1000-1500 m (14%)
- 1500-2000 m (18%)
- Above 2000 m (7%)

Take shelter (85%)
- Broken and muddy road (5%)
- Unavailability of accessible transport (40%)
- Long distance (51%)
- Over flood during storm surges (2%)

PWD friendly cyclone shelter (46%)
- Absence of accessible WASH facilities (12.9)
- Lack of drinking water facilities (7.1%)
- Lack of food support (4.2%)
- Lack of medicine support in emergencies (4.9%)
- No privacy for adolescent, PWD and women (50.8%)
- Unfavorable for PWD (20%)
This study argues that although Bangladesh has enormous success in the field of development, in the field of infrastructure, the accessibility of the PWDs is yet to be addressed.

The study found that the PWDs are not getting adequate infrastructural support and are deprived of resilient infrastructure. In addition to disability-friendly policies and planning, we require rigorous implementation monitoring.

Community based, community managed and community-led disabled friendly cyclone shelter construction should be promoted.
References

- Bangladesh Bureau of Statistics (BBS) 2011, Statistics and Informatics Division, Ministry of Planning, Bangladesh.
Thanks to All
1st South Asian Conference 2023
UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENERIO
Social Science Faculty, Dhaka University, Bangladesh
26th November, 2023

Center for People & Environment

Arannayak Foundation, Oxfam, BARCIRK, LEDARS, CAPS, DIU, Faculty Graduate Studies
Escalating Climate Change Risks and The Plight of South Asian Climate Refugees

Sumaiya Islam
Mohammad Tawhidul Islam
The ecological and social fabric of South Asia is facing significant difficulties and taking many different forms due to the increasing hazards of climate change. These climate-induced changes contribute to a compounding crisis, prompting a growing number of climate refugees in South Asia.

Overview:

- This paper examines the escalating climate change risks in South Asia and their profound implications for the growing population of climate refugees in the region.
- It investigates the socioeconomic and environmental vulnerabilities faced by South Asian climate refugees, considering factors such as gender, age, income, and geographical location.
- It analyses existing legal frameworks and international agreements pertaining to climate-induced displacement in the South Asian context.
Background of the study:

South Asia has received international attention for being an extremely climate vulnerable region due to extremely high population density, high density of poverty (~700 million living on less than $1.25 per day) and lack of resources for climate adaptation.

• Extreme weather events in Pakistan, India, and Nepal and extreme deforestation in Afghanistan threaten the livability of many areas.

• The country of Maldives is continually threatened with extreme sea-level rise that will endanger the island nation.

• Finally, Bangladesh is threatened by all of the above, creating complex scenarios for those wishing to leave for climate reasons.

• The World Bank estimates that South Asia will face a crisis of 50 million climate refugees each year by 2050, resulting from both short-term natural disasters like floods and cyclones and slow-onset environmental changes such as sea-level rise, soil degradation, and desertification.
The objective of the Study:

• To Investigate the recent discourses on ‘climate change refugees’ and how they have been defended and adopted internationally as well as within South Asia.

• To examine how ‘climate change refugee’ discourses are perceived as relevant and alarmist regarding migration in South Asia.

• To analyse current international and regional laws and policies and how these have affected perceptions of and attitudes toward both climate change and migration.
Methods and methodology

Doctrinal Research Methodology

Primary research tools

Secondary research tools
1. Introduction
2. Climate Change Risks in South Asia
3. Environmental Displacement in South Asia
4. Legal Frameworks and International Agreements
5. Findings, Ways forward and Conclusion
Paragraph One explains:
• Global context of climate change
• Environmental impact on South Asian Countries
• Unique Challenges Faced by South Asian Countries
• Human Rights Concerns for Climate Refugees/Climate-induced people

Paragraph Two explains:
• Extreme Weather Events (Increased frequency and severity)
• Impact on agriculture and infrastructure
• Rising Sea Levels (Threats to low-lying coastal areas)
• Shifting Rainfall patterns (Effects on Water supply and agriculture)
Paragraph three explains -

• Overview of Climate-induced Migration
  ➢ Causes and Patterns
  ➢ Magnitude of displacement

• Challenges Faced by these communities
  ➢ Overcrowded and under-resourced camps
  ➢ Lack of necessities and healthcare

• Socioeconomic and Environmental Vulnerabilities of South Asian Climate Refugees.
  ➢ Impact on agriculture
  ➢ Disruption of ecosystem and biodiversity
  ➢ Impacts on Major River systems
  ➢ Water supply for millions
  ➢ potential conflicts
Paragraph four explains:

- Current Legal Landscape
  - National Laws and policies
  - International agreements related to climate-induced people

- Analysis of Existing Legal Protections
  - Refugee Convention as a potential framework
  - Applicability to South Asian climate refugees
  - Gaps and shortcomings

Paragraph five provides:

- Findings, Ways forward and Conclusion
• Climate change is clearly impacting South Asian communities’ livelihoods and safety and increasingly forcing them to migrate.

• There are clear gaps in ensuring the protection of climate refugees, and regional and international processes can play a key role in addressing these gaps.

• Above all, policies and practices must seek to illuminate the extent to which climate change is contributing to migration to develop more targeted policies that strengthen the resilience of communities and the protection of migrants in the face of climate change.
Thank you.
1st South Asian Conference 2023
UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENERIO
Social Science Faculty, Dhaka University, Bangladesh
26th November, 2023
From Crisis to Crisis: The Dual Burden of Legal Injustice and Humanitarian challenges on Climate Migrants in Bangladesh
Table of Contents

Introduction

Legal Framework

Humanitarian & Legal Challenges

Findings

Conclusion
Introduction
Overview of the Climate Migrants

Climate change poses a significant and urgent global problem that has wide-ranging consequences for millions of people worldwide. Among the regions most vulnerable to the impacts of climate change is Bangladesh, which frequently experiences natural disasters such as floods, cyclones, and rising sea levels. These environmental changes have resulted in the displacement of numerous individuals, causing both humanitarian and legal concerns. Bangladesh is recognized as one of the countries most affected by climate change, with a substantial population at risk of displacement due to environmental hazards. Consequently, the consequences of climate migration in Bangladesh are considerable, with affected individuals facing numerous challenges related to obtaining essential resources such as shelter, food, and water, as well as encountering risks of violence, exploitation, and social exclusion.

Climate migrants in Bangladesh confront lack legal protection, including access to justice, education, and healthcare. Moreover, the absence of a comprehensive legal framework specifically addressing the needs of climate migrants in Bangladesh compounds the challenges.
Objectives & Methodology

Primary Objectives

Assessment of Challenges

Identification of Core Needs

Policy and Program Proposal

Specific Objectives

Methodological Integration

Experiential Analysis

Service Access Challenges

Gender and Age-Specific Vulnerabilities

Immediate Action Advocacy
Climate migrants are people who must leave their homes and communities because of the effects of climate change and global warming. Climate migrants belong to a larger group of immigrants known as environmental refugees and climate refugees.
United Nations High Commissioner for Refugees (UNHCR) says 36 million people were displaced by natural disasters in 2009.

World Bank report, 2021 the amount of the climate refugees more than 200 million.

The Institute for Economics and Peace put the number of people at risk of displacement by 2050 at over 1 billion.
Legal framework for Climate Migrants

International human rights conventions
UDHR, ICCPR, ICESCR, CEDAW, UNCRC

Environmental conventions
UNFCCC, PARIS AGREEMENT, RIO CONVENTION, SANDAI & NANSEN INITIATIVES

Refugees Conventions
REFUGEE CONVENTION 1951 & ITS PROTOCOLS, IDP GUIDELINES

Regional Framework
1. The Pacific Islands Forum Declaration
2. EU Climate Change Adaptation Strategy
3. African Union’s Migration Policy Framework for Africa

National framework
2. National Plan for Disaster Management (NPDM)
3. The National Strategy for Sustainable Development (NSSD)
4. The Coastal Zone Policy
Humanitarian Challenges

The humanitarian challenges of climate migration in Bangladesh are vast, as it often leads to poverty, social exclusion, and displacement. Furthermore, climate migrants often face legal and institutional barriers that restrict their access to basic rights and services.

LEGAL INJUSTICE

A. Lack of access to basic necessities
B. Socio-economic challenges
C. Vulnerability of women and children
FINDINGS & RECOMMENDATIONS

- Introduce International Legal framework for Climate migrants
- Need to expand the scope and application of the refugee convention
- Regional such as SAARC cooperation should be initiated
- National policy should be reformed to protect the climate migrants rights
Conclusion

To address the challenges faced by climate migrants and ensure their legal status, a multi-faceted approach is required. This includes granting legal status, amending existing laws, establishing national legal frameworks, and developing a regional framework in South Asia. By implementing these recommendations, we can enhance the protection of climate migrants and uphold their basic human rights.
A. Conventions, Treaties and Act(s)

References

B. Guidelines and Handbooks
1. Intergovernmental Panel on Climate Change (IPCC). (2018), Chapter 3, p. 72.

C. Policy Documents and Declarations

C. Action Plans and Frameworks
E. Reports and Publications

F. Research Articles:


References

F. Research Articles:
Thank You

Do you have any questions?
Naeem Ahsan Talha
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1st South Asian Conference 2023
UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENERIO
Social Science Faculty, Dhaka University, Bangladesh
26th November, 2023
The wage dynamics in the climate vulnerable areas of Bangladesh: From the perspective of gender, age, and seasonality.

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Consultant, Jakleen Bangladesh, Swarna Bangladesh, and SRO foundation  
Cell: +8801706569297  
Mail: mrislamju2015@gmail.com

Fauzia Fariha  
Student, Department of Law and Human Rights, University of Asia Pacific  
Cell: +880 1771789003  
Mail: fauziafariha12@gmail.com
Introduction / Outline / Overview

Climate vulnerable areas

wage dynamics

• Gender,
• Age, and
• seasonality
Background of the study

Carbon emissions and average rainfall negatively impact agricultural production in the short run. (Ghosh, Eyasmin, and Adeleye, 2023)

Global warming is projected to reduce rice yield by 28% and wheat production by 66% if temperatures rise by 4°C, leading to substantial economic losses.

200,000 coastal farmers in Bangladesh might be forced inland due to the climate changed induced changes.

A loss of farming potential and a shift from traditional agriculture, like rice farming, to aquaculture.

Gender-specific vulnerabilities
Objective of the study

Climate vulnerable areas

wage dynamics

Gender,

Age, and

seasonality
Methods and methodology

Secondary data

- 40 communities
- 10 Responses per communities
- But totally to 379 for missing values

Descriptive statistics (segregated by tasks)

- Gender
- Ager (child)
- Seasonality

Inferential analysis

- Gender
- Ager (child)
- Seasonality
Results from descriptive statistics: Gender

Gender difference during Amon

- Male are getting more
- No change

<table>
<thead>
<tr>
<th>Activity</th>
<th>Male getting more</th>
<th>No change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvesting</td>
<td></td>
<td>38</td>
</tr>
<tr>
<td>Weeding</td>
<td>0</td>
<td>40</td>
</tr>
<tr>
<td>Applying fertilizer/pesticides</td>
<td>0</td>
<td>40</td>
</tr>
<tr>
<td>Transplanting</td>
<td>1</td>
<td>39</td>
</tr>
<tr>
<td>Seed broadcasting</td>
<td>0</td>
<td>40</td>
</tr>
<tr>
<td>Irrigation work</td>
<td>0</td>
<td>40</td>
</tr>
<tr>
<td>Planting</td>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td>Land preparation: persons bullock/cow for</td>
<td>0</td>
<td>28</td>
</tr>
<tr>
<td>ploughing/ladderin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land preparation: persons using tractors</td>
<td>0</td>
<td>40</td>
</tr>
<tr>
<td>Land preparation: manual</td>
<td>0</td>
<td>32</td>
</tr>
</tbody>
</table>

Gender difference during Boro

- Male getting more
- Equal
- Female getting more

<table>
<thead>
<tr>
<th>Activity</th>
<th>Male getting more</th>
<th>Equal</th>
<th>Female getting more</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvesting</td>
<td>3</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Weeding</td>
<td>0</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Applying fertilizer/pesticides</td>
<td>0</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Transplanting</td>
<td>1</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>Seed broadcasting</td>
<td>0</td>
<td>40</td>
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</tr>
<tr>
<td>Irrigation work</td>
<td>0</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Planting</td>
<td>2</td>
<td>37</td>
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<tr>
<td>Land preparation: persons bullock/cow for</td>
<td>0</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>ploughing/ladderin</td>
<td></td>
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<tr>
<td>Land preparation: persons using tractors</td>
<td>0</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Land preparation: manual</td>
<td>0</td>
<td>32</td>
<td></td>
</tr>
</tbody>
</table>
Results from descriptive statistics: age

- 0
- 5
- 10
- 15
- 20
- 25
- 30
- 35
- 40
- 45

- land preparation: manual
- land preparation: persons using tractors
- land preparation: bullock/cow for ploughing/ladder

Males are getting more
Child are getting more
No change
Child getting more
Males are getting more
Results from descriptive statistics: Seasonality (Boro vs Aman)

<table>
<thead>
<tr>
<th>Task</th>
<th>Amon is paid more</th>
<th>Equal</th>
<th>Boro is paid more</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land preparation: manual</td>
<td>3</td>
<td>15</td>
<td>14</td>
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<tr>
<td>Land preparation: persons using tractors</td>
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<td>11</td>
<td>17</td>
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<tr>
<td>Land preparation: persons bullock/cow for ploughing/laddering</td>
<td>0</td>
<td>11</td>
<td>17</td>
</tr>
<tr>
<td>Planting</td>
<td>2</td>
<td>19</td>
<td>18</td>
</tr>
<tr>
<td>Irrigation work</td>
<td>3</td>
<td>25</td>
<td>12</td>
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<tr>
<td>Seed broadcasting</td>
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<tr>
<td>Transplanting</td>
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<td>19</td>
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</tr>
<tr>
<td>Applying fertilizer/pesticides</td>
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<td>24</td>
<td>13</td>
</tr>
<tr>
<td>Weeding</td>
<td>5</td>
<td>21</td>
<td>14</td>
</tr>
<tr>
<td>Harvesting</td>
<td>3</td>
<td>18</td>
<td>19</td>
</tr>
</tbody>
</table>
Inferential statistics (Amon)

<table>
<thead>
<tr>
<th>Variable Label</th>
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<th>St.Err.</th>
<th>t-value</th>
<th>p-value</th>
<th>95% Conf. Interval</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>normal daily wages of adult male in amon season (taka)</td>
<td>0.359</td>
<td>0.03</td>
<td>11.8</td>
<td>0.0</td>
<td>0.299 to 0.419</td>
<td>***</td>
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<tr>
<td>normal daily wages of adult female in amon season (taka)</td>
<td>0.043</td>
<td>0.068</td>
<td>0.64</td>
<td>0.522</td>
<td>-0.09 to 0.177</td>
<td></td>
</tr>
<tr>
<td>normal daily wages of children ≤12 years in amon season (taka)</td>
<td>189.496</td>
<td>6.764</td>
<td>28.02</td>
<td>0.0</td>
<td>176.196 to 202.797</td>
<td>***</td>
</tr>
<tr>
<td>normal daily wages of adults above 12 years in amon season (taka)</td>
<td>-0.19</td>
<td>0.025</td>
<td>-7.51</td>
<td>0.0</td>
<td>-0.24 to -0.14</td>
<td>***</td>
</tr>
<tr>
<td>Constant</td>
<td>43.315</td>
<td>8.779</td>
<td>4.93</td>
<td>0.0</td>
<td>26.053 to 60.576</td>
<td>***</td>
</tr>
<tr>
<td>normal daily wages of children &lt;=12 years in amon season (taka)</td>
<td>0.025</td>
<td>0.039</td>
<td>0.64</td>
<td>0.522</td>
<td>-0.052 to 0.102</td>
<td></td>
</tr>
<tr>
<td>normal daily wages of adult male in amon season (taka)</td>
<td>0.189</td>
<td>0.041</td>
<td>4.61</td>
<td>0.0</td>
<td>0.108 to 0.269</td>
<td>***</td>
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<tr>
<td>normal daily wages of children above 12 years in amon season (taka)</td>
<td>-0.19</td>
<td>0.025</td>
<td>-7.51</td>
<td>0.0</td>
<td>-0.24 to -0.14</td>
<td>***</td>
</tr>
<tr>
<td>Constant</td>
<td>18.218</td>
<td>11.083</td>
<td>1.64</td>
<td>0.101</td>
<td>-3.574 to 40.011</td>
<td></td>
</tr>
<tr>
<td>normal daily wages of children above12 years in amon season (taka)</td>
<td>-0.688</td>
<td>0.092</td>
<td>-7.51</td>
<td>0.0</td>
<td>-0.868 to -0.508</td>
<td>***</td>
</tr>
<tr>
<td>normal daily wages of adult male in amon season (taka)</td>
<td>0.754</td>
<td>0.064</td>
<td>11.8</td>
<td>0.0</td>
<td>0.629 to 0.88</td>
<td>***</td>
</tr>
<tr>
<td>normal daily wages of adult female in amon season (taka)</td>
<td>0.137</td>
<td>0.08</td>
<td>1.72</td>
<td>0.087</td>
<td>-0.02 to 0.294</td>
<td>*</td>
</tr>
<tr>
<td>Constant</td>
<td>-14.924</td>
<td>17.22</td>
<td>-0.87</td>
<td>0.387</td>
<td>-48.785 to 18.937</td>
<td></td>
</tr>
</tbody>
</table>
## Inferential statistics (Boro)

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-value</th>
<th>p-value</th>
<th>95% Confidence Interval</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>normal daily wages of adult male in boro season (taka)</td>
<td>normal daily wages of adult female in boro season (taka)</td>
<td>0.023</td>
<td>0.061</td>
<td>0.38</td>
<td>0.707</td>
<td>[-.098, .144]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>normal daily wages of adult female in boro season (taka)</td>
<td>0.257</td>
<td>0.034</td>
<td>7.46</td>
<td>0</td>
<td>[0.189, .325]</td>
<td>***</td>
</tr>
<tr>
<td></td>
<td>normal daily wages of children above12 years in boro season (taka)</td>
<td>0.061</td>
<td>0.074</td>
<td>0.82</td>
<td>0.412</td>
<td>[-0.084, .206]</td>
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</tr>
<tr>
<td></td>
<td>Constant</td>
<td>213.953</td>
<td>8.05</td>
<td>26.58</td>
<td>0</td>
<td>[198.1, 229.9]</td>
<td>***</td>
</tr>
<tr>
<td>normal daily wages of adult female in boro season (taka)</td>
<td>normal daily wages of adult male in boro season (taka)</td>
<td>0.049</td>
<td>0.031</td>
<td>1.58</td>
<td>0.114</td>
<td>[-.012, .110]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>normal daily wages of children above12 years in boro season (taka)</td>
<td>0.318</td>
<td>0.06</td>
<td>5.31</td>
<td>0</td>
<td>[0.201, .436]</td>
<td>***</td>
</tr>
<tr>
<td></td>
<td>normal daily wages of children &lt;=12 years in boro season (taka)</td>
<td>0.016</td>
<td>0.043</td>
<td>0.38</td>
<td>0.707</td>
<td>[-.069, .102]</td>
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</tr>
<tr>
<td></td>
<td>Constant</td>
<td>13.112</td>
<td>11.482</td>
<td>1.14</td>
<td>0.254</td>
<td>[.254, 9.465, 35.688]</td>
<td></td>
</tr>
<tr>
<td>normal daily wages of children above12 years in boro season (taka)</td>
<td>normal daily wages of adult female in boro season (taka)</td>
<td>-0.84</td>
<td>0.094</td>
<td>-8.97</td>
<td>0</td>
<td>[-1.024, -.656]</td>
<td>***</td>
</tr>
<tr>
<td></td>
<td>normal daily wages of children &lt;=12 years in boro season (taka)</td>
<td>0.502</td>
<td>0.067</td>
<td>7.46</td>
<td>0</td>
<td>[.370, .634]</td>
<td>***</td>
</tr>
<tr>
<td></td>
<td>normal daily wages of adult male in boro season (taka)</td>
<td>0.135</td>
<td>0.085</td>
<td>1.58</td>
<td>0.114</td>
<td>[-.033, .303]</td>
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</tr>
<tr>
<td></td>
<td>Constant</td>
<td>55.797</td>
<td>18.885</td>
<td>2.95</td>
<td>0.003</td>
<td>[18.663, 92.931]</td>
<td>***</td>
</tr>
<tr>
<td>normal daily wages of children &lt;=12 years in boro season (taka)</td>
<td>normal daily wages of adults12 years in boro season (taka)</td>
<td>0.03</td>
<td>0.036</td>
<td>0.82</td>
<td>0.412</td>
<td>[-.041, .101]</td>
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</tr>
<tr>
<td></td>
<td>normal daily wages of adult male in boro season (taka)</td>
<td>0.22</td>
<td>0.041</td>
<td>5.31</td>
<td>0</td>
<td>[.139, .301]</td>
<td>***</td>
</tr>
<tr>
<td></td>
<td>normal daily wages of adult female in boro season (taka)</td>
<td>-0.21</td>
<td>0.023</td>
<td>-8.97</td>
<td>0</td>
<td>[-.256, -.164]</td>
<td>***</td>
</tr>
<tr>
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<td>Constant</td>
<td>47.561</td>
<td>9.237</td>
<td>5.15</td>
<td>0</td>
<td>[29.399, 65.724]</td>
<td>***</td>
</tr>
</tbody>
</table>
## Seasonality

<table>
<thead>
<tr>
<th></th>
<th>Coef.</th>
<th>St.Err.</th>
<th>t-value</th>
<th>p-value</th>
<th>[95% Conf Interval]</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Boro</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amon</td>
<td>0.933</td>
<td>0.018</td>
<td>50.59</td>
<td>0</td>
<td>0.897</td>
<td>0.969</td>
</tr>
<tr>
<td>Constant</td>
<td>14.15</td>
<td>2.312</td>
<td>6.12</td>
<td>0</td>
<td>9.605</td>
<td>18.696</td>
</tr>
<tr>
<td><strong>boroall</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>boroall</td>
<td>0.934</td>
<td>0.018</td>
<td>50.59</td>
<td>0</td>
<td>0.898</td>
<td>0.97</td>
</tr>
<tr>
<td><strong>Boro</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boro</td>
<td>1.659</td>
<td>2.424</td>
<td>0.68</td>
<td>0.494</td>
<td>-3.107</td>
<td>6.425</td>
</tr>
</tbody>
</table>
Findings

Gender, Age, and seasonality
Recommendation

- Resilience programs need to be
  - Gender centric intervention
    - Alternative IGA training
  - Seasonal impact to be minimized
    - Season neutral IGA accommodation

The climate induced more poverty could be avoided
And the women and girls can not be more victimized
Conclusion

The wages vary due to seasonality, gender and ages (underaged)

The resilience interventions need to consider those one

Limitations:

• A bit old data
• Alternative analysis methods
• To include more variables which can by turn more impactful for wage determinants.


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Social Science Faculty, Dhaka University, Bangladesh
26th November, 2023

CENTER FOR PEOPLE & ENVIRON

[Logos of various organizations]

[Image of a globe with wind turbines and industrial smokestacks]
Vulnerability Assessment of Environmental Migrants in Urban Slums in Bangladesh: A Case Study in Kalshi Slum, Mirpur, Dhaka.

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Iftehadul Islam
Student, Professional Master of Disaster Management, Institute of Disaster Management and Vulnerability Studies, University of Dhaka.

Co-authors

Advisor
Dr. Md. Mostafizur Rahman
Assistant Professor
Department of Disaster Management and Resilience
Bangladesh University of Professionals
Introduction

Dhaka's Development and Migration

- Rapid growth and urbanization at post-liberation.
- Attracts elite and educated citizens, also serving as a refuge for the poor.
- Majority of the poor reside in slums.

Environmental Shocks and Migration

- 70% of Dhaka's slum dwellers experience environmental shocks (IOM).
- Environmental migrants move to Dhaka seeking better livelihood and shelter.
- Nearly 5 lacs people migrate annually to Dhaka from rural areas due to natural hazards (Friedman, 2009).

Challenges Faced by Environmental Migrants in Slums

- Shelter, sanitation, education, and environmental problems.
- Lack of sufficient fresh water.
- Urban hazards like waterlogging and fire incidents.

Scope of the Study

- Explore shelter problems of environmental migrants in Dhaka's slums and assess the vulnerability.
- Assess vulnerability due to urban hazards faced by migrants.
- Understanding the social impact.
Background of the study

- Migration is an ancient phenomenon, driven by social, political, economic, climatic, and natural disaster-related factors.
- Environmental migrants are individuals compelled to leave their homes due to adverse environmental changes.
- In Bangladesh, severe flooding caused 3,000 people to leave their residences daily heading to Dhaka (Black et al, 2008).
- Dhaka's scarcity of land for shelter leads environmental migrants to seek refuge by roads, parks, under flyovers, foot over bridges, and notably in various slums, with 70% of slum dwellers experiencing environmental shocks (IOM).
- The main reason behind environmental migration is poverty (K.M. Mustafizur Rahman, 2012).
- Rural Bangladesh relies heavily on agriculture, but natural disasters and poverty force rural inhabitants to migrate, abandoning farming and disrupting the socio-economic balance. This migration poses a threat to the country's food security.
- Rural migrants seek better livelihoods in urban areas, they often encounter harsh realities, leading to a distressing life.
- This study seeks to assess the vulnerability of the environmental migrants in Kalshi Slum, Mirpur to understand the severity of the problem and think about the way forward for the upgradation of their life.
Objective of the study

This study aims to assess how vulnerable the environmental migrants are in Kulshi Slum. The goal is to understand the severity of their problems and think about to improve their lives. Here are the specific objectives:

- To explore the socio-economic condition of the environmental migrants of the study area.
- To assess the vulnerability of environmental migrants of the study area.
Methods and methodology

- Analysing Secondary Information
- Preliminary Concept Formation
- Finding out Research Objectives
- Development of Questionnaire
- Data Collection (Field Survey)
- Data Analysis
- Research Development
- Review the Research Work
- Major Findings
- Recommendations and Conclusion

Pressure and Release Model (PAR Model)

Root Causes → Dynamic Pressure → Unsafe Conditions → Risk = Hazard × Vulnerability → Hazard
Result and discussion

• Origin: Bhola, Borguna, Chandpur, Patuakhali, Comilla, Shirajganj
• Occupation:

<table>
<thead>
<tr>
<th>Before Migration</th>
<th>After Migration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmer</td>
<td>Shopkeeper</td>
</tr>
<tr>
<td>Fisherman</td>
<td>Carpenter</td>
</tr>
<tr>
<td>Boatman</td>
<td>Household Worker</td>
</tr>
<tr>
<td>Shopkeeper</td>
<td>Rickshaw Puller</td>
</tr>
<tr>
<td>Housewife</td>
<td>Driver</td>
</tr>
<tr>
<td></td>
<td>Business</td>
</tr>
<tr>
<td></td>
<td>Housewife</td>
</tr>
</tbody>
</table>

• Experienced Natural Hazards: Cyclone, Flood, River Erosion, Tidal Surge
• Impact by the experienced natural hazards: Loss of lives, resources, and shelter; Impact on Livelihood
Result and discussion

Living Condition of the Environmental Migrants in Kalshi Slum

- Household Condition
- Source of Cooking
- Sanitation
- Water and Electricity
- Waste Disposal System
- Sewerage System
- Living Environment and Safety
- Community Facilities
- Community Problems
Result and discussion

<table>
<thead>
<tr>
<th>Household Condition</th>
<th>Pucca</th>
<th>Semi-Pucca</th>
<th>Katcha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Responders</td>
<td>0</td>
<td>30</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source of Cooking</th>
<th>Cylinder Gas Supply</th>
<th>Wood and Mud Oven</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Responders</td>
<td>19</td>
<td>11</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Toilet Structure Type</th>
<th>Pit Latrine</th>
<th>Sanitary Latrine</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Responders</td>
<td>0</td>
<td>30</td>
<td>0</td>
</tr>
</tbody>
</table>
# Result and discussion

<table>
<thead>
<tr>
<th>Waste Disposal System</th>
<th>Community System</th>
<th>Dumped nearby the house</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Responders</td>
<td>14</td>
<td>16</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sewerage System feedback</th>
<th>Satisfactory</th>
<th>Un-satisfactory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Responders</td>
<td>0</td>
<td>30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Light Passing and Ventilation</th>
<th>Through Window</th>
<th>Through Ventilator</th>
<th>No Natural Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Passing</td>
<td>0</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>Ventilation</td>
<td>0</td>
<td>0</td>
<td>30</td>
</tr>
</tbody>
</table>
Result and discussion

Community Facilities

- Presence of primary school, madrasa, mosque, temple, and market
- Joint initiative of the Ministry of Women and Children Affairs and UNICEF for child education
- Grameen Phone distributed 100 SIM cards for mobile banking and communication
- Market serves as a recreational place and an earning source for slum dwellers
- Environmental migrants working part-time in the market as shop facilitators during night shifts, supplementing monthly income
- Tea stalls serve as gathering places for gossip
- Open spaces in the market used for indoor games like carom
- Local Community Organization: "Uttar Kalshi Bastohara Punorbashon Bohumukhi Shomobay Shomiti Ltd“, Established in 1997, Purpose is to provide shelter and rehabilitation for environmental migrants.
Result and discussion

Community Problems
- Only two gates for entry and exit in the slum, one gate connected to Mirpur DOHS, and another to Mirpur Ceramics Factory. People from both areas are financially and socially powerful, controlling entrance and exit timings
- No hospital near Kalshi slum, presence of pharmacies in the market offers a possibility for first aid, but not comprehensive medical assistance
- No fire service station near Kalshi slum, fire incident in 2017 highlighted challenges with the fire service response due to congested roads and houses
- Reports of various criminal activities in slums, including drug dealings, prostitution, murder, kidnap, and hijack. Confirmation from Pallabi Police Station about prostitution and drug dealings in Kalshi slum

Hazards in the Slum
- Fire Incident
- Water Logging
- Earthquake
Result and discussion

- **Root Causes**
  - Limited Access to
    - Resources
    - Livelihood Structure
    - Political Backup

- **Dynamic Pressure**
  - Lack of
    - Infrastructure
    - Emergency exposures to hazardous situation

- **Unsafe Conditions**
  - Dangerous Location
  - Disabled at Risk
  - Lack of Preparedness

- **Risk = Hazard X Vulnerability**

- **Disaster**

- **Hazard**
  - Cyclone
  - Flood
  - River Erosion
  - Storm Surge
## Result and discussion

<table>
<thead>
<tr>
<th>Assessment Factors</th>
<th>Vulnerability</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Origin</td>
<td>• Unplanned and poor housing system</td>
</tr>
<tr>
<td>• Occupation</td>
<td>• Unhygienic and dis-satisfactory sanitation system</td>
</tr>
<tr>
<td>• Experience of Facing Disaster in Root Locality</td>
<td>• Inadequate Water Supply</td>
</tr>
<tr>
<td>• Impacts of Experienced Disaster in Root Locality</td>
<td>• Poor Sewerage System</td>
</tr>
<tr>
<td>• Living Condition</td>
<td>• Unstructured Waste Disposal System</td>
</tr>
<tr>
<td>• Facing Hazards in the Slum</td>
<td>• Lack of knowledge about existing hazards and preparedness strategies</td>
</tr>
<tr>
<td></td>
<td>• Lack of Medical Services</td>
</tr>
<tr>
<td></td>
<td>• Lack of Police protection and Fire Service</td>
</tr>
<tr>
<td></td>
<td>• Criminal Activities</td>
</tr>
</tbody>
</table>
Dhaka, being the most developed city, attracts a large influx of environmental migrants seeking shelter and income, ending up in vulnerable slum conditions. This study focuses on assessing the vulnerability of these migrants within the socio-economic context. The intricate relationship between environmental changes and migration, especially in a developing country like Bangladesh, underscores the severity of displacement. The research emphasizes the multitude of challenges faced by migrants at every step of the migration process and advocates for an integrated approach to protect and enhance their lives and livelihoods. The study sheds light on the perpetual vulnerability experienced by environmental migrants, expenting a comprehensive national policy to address their well-being, particularly focusing on females and children. The study aims to contribute to academic understanding and urges policymakers to take immediate action for them.

“Environmental migrants were vulnerable in their locality; they moved to Dhaka with new hope and faced different levels of vulnerability. It seems like they are vulnerable forever. Let’s think, write, and do something to eradicate their vulnerability.”
Acknowledgments

A heartfelt thanks to Salim Bhai, a shopkeeper in Kalshi Slum, for his invaluable assistance in collecting data and providing insights into the situation of environmental migrants in the study area.
References


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Center for People & Environment

Partners:
- Arannayk Foundation
- OXFAM
- BARCIRK
- LEDARS
- Center for Atmospheric Pollution Studies
- DIU
- Faculty of Graduate Studies
THE IMPACT OF CLIMATE-INDUCED MIGRATION ON RURAL LIVELIHOODS IN BANGLADESH

Khadijatul Kubra
Overview

- It is already known that one of the biggest threats to developing nation’s ability to advance economically is climate change, which has a negative impact on people’s lives and means of livelihood globally. Bangladesh has been recognized as one of the nation’s most susceptible to the effects of climate change.

- With societal vulnerabilities and risk exposure, there is fear that climatic extremes and even a string of less extreme occurrences might endanger people’s lives and means of livelihood in rural areas.

- Through a comprehensive study, this paper provides an understanding of the number of migrants, their demographics, and the specific regions most affected in Bangladesh and uncover the strategies rural communities employ to adapt to climate change and mitigate the necessity for migration.
Background:

- In the rural landscape where agriculture forms the backbone of livelihoods, these environmental shifts disrupt traditional practices, leading to diminished crop yields, increased water scarcity, and heightened vulnerability to natural disasters.

- The exodus not only alters demographic patterns but also strains local resources and infrastructure. Fisheries, another critical livelihood sector, faces disruption due to changing water conditions.

- Understanding the intricate interplay between climate-induced migration and rural livelihoods in Bangladesh is imperative for crafting effective policies and interventions that address the immediate concerns of affected communities and promote sustainable development in the face of a changing climate.
Objective of the study

- To identify the vulnerabilities and challenges faced by rural communities in the context of climate-induced migration, considering environmental, economic, and social factors.

- To investigate the direct and indirect impacts of climate-induced migration on traditional rural livelihoods, with a particular focus on agriculture and fisheries.

- To propose recommendations and strategies for sustainable development that enhance the resilience of rural communities facing climate-induced migration, emphasizing long-term environmental and socio-economic sustainability.
Methods and methodology

- Analytical Research
- Primary and Secondary research tools
The vulnerability of Bangladesh to climate change is starkly evident in rising sea levels, erratic weather patterns, and extreme events. For a nation where a significant portion of the population relies on agriculture for their livelihoods, these environmental shifts pose a direct threat to the well-being of rural communities. Changing rainfall patterns and increased frequency of droughts disrupt agricultural cycles, leading to reduced crop yields and economic instability for farmers. The consequences are not confined to the agricultural sector alone; fisheries, another vital source of livelihood, face disruptions as water conditions change, affecting the abundance and distribution of aquatic resources.
The impacts of climate-induced migration are not limited to the communities directly affected. The remaining residents face challenges of resource scarcity, strained infrastructure, and altered community dynamics. The delicate balance between human activities and the environment is disrupted, and the once-predictable nature of rural life is replaced by uncertainty.
• Yet, amidst these challenges, rural communities in Bangladesh exhibit resilience and adaptability. Faced with the imperative to cope with changing circumstances, they develop innovative strategies. These range from the adoption of climate-resilient agricultural practices to the establishment of community-based initiatives that foster sustainability. The ability of these communities to adapt is crucial in the face of an evolving climate landscape.

• In addressing the challenges posed by climate-induced migration on rural livelihoods, a holistic approach is imperative. Sustainable development strategies must integrate environmental conservation with economic and social considerations. This involves not only adapting to current changes but also planning for the long-term, recognizing the dynamic nature of climate impacts.
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Center for People & Environment
URBAN TRANSFORMATION

Climate Crisis
Climate Justice
Climate Resilience

BARCIK
Urbanization and its Impacts

- Changed the ecosystem
- Changed livelihood
- Changed occupation
- Changed demography
- Changed local culture
- Increased discrimination, inequality, vulnerability
- Increased migration
Climate crisis in different areas of Bangladesh

**Coastal Climate Crisis**
- Uncertain flash flood
- Cold injury
- Land slide
- Irregular rain
- Thunderbolt
- Hailstorm

**Dry land crisis** (Barind tract)
- Draught
- Extreme heat
- Water scarcity
- Irregular rain
- Hailstorm
- Tornado

**Floodplain crisis**
- River erosion
- Intensity of flood
- Thunderbolt
Impacts of climate crisis

Changing livelihood

• New diseases
• Migration
• Involvement of risk jobs
• Water scarcity
• Food crisis
• Resource conflict
• Social instability
• Loss and damage
It is the snapshot of today’s one of the slums of Dhaka. Low income people are living here with the following climate crisis condition:

• Extreme heat wave
• Waterlogged
• Uneven weather
• Irregular rainfall
• Using plastic and corrugated tin sheets for housing
• New diseases
• Jobless
• Decrease income
• Plastic pollution
Climate refugee: a cruelest journey of struggle
Climate refugee in Bangladesh

- **6 Million climate migrants** have already displaced (Honorable PM of Bangladesh Speech in CoP-26)
- **1000-2000 people** migrate everyday (Environmental Justice Forum/EJF)
- 10,000 hectares of lands lost Every year(EJF)
- **19 million children** in Bangladesh are under climatic threat (UNICEF 2019).
Living condition in urban slum

Water scarcity

Water logging
Involvement of risk jobs
Toxic toys industry
Leather industry
Plastic industry
Battery crash
Chemical glue

LOST CHILDHOOD
Living with garbage
Development project with Misereor for Poverty reduction and Urban Resilience

Goal: The dignity of the urban poor is respected through full access to basic infrastructure and social protection systems.

Duration: 2018-2020, 2021-2023

Budget: EURO 1,72500 (2021 to 2023)

More than 4 million people live in Dhaka Slum


• Total Target slum population: 1200+3000=4200 families x5=21 000 Persons.

• Mostly migrated from Coastal, dryland barind tract and wetland areas

• Profession: Female Domestic Workers, Male are Rickshaw-Van Pullers (Manually Drive), Day labors, Cleaners, drivers, Garments workers, Child labors,

• Working with 5 adolescent groups and youths, 22 female groups, 3 male groups,

COVID-19 Pandemic Impact:

- About 600,000 domestic Worker lost jobs in Dhaka city.

- All drivers lost their income due to lockdown, Day labors lost their income, slum students stopped education, Faced food crisis, Got very little supports from Government: & Non- Government: Increased school dropout and child marriage.
BARCIK URBAN ACTION

EQUITY, LIVEABLE CITY, RESILIENCE, SDGs
BARCIK works with urban poor

• Climate adaptation
• Health security
• Food security
• Access to government support and service
• Housing for informal settler and urban poor.
• Awareness campaign on waste management, clean environment, Covid-19, stop domestic violence, child education and access to information
• Community leadership and community led development.
• Create space and hope for children of urban poor.
• Policy advocacy and Climate Justice.

Health security
• Increasing communicable and non-communicable diseases
• Dengue, Chikunguniya
• Covid-19
• Diarrhea and dysentery
• Skin diseases
• No medical service
• Severe kidney and heart diseases

Food security
• Lack of safe and balanced food and diet
• Available expired food
• Available toxic cheap baby food (added extra hazardous color and flavor)
• Available toxic chicken item (found Mercury, Led and Cadmium)
Greening the hope ...
COVID-19 and URBAN CRISIS
Action with slum people during COVID pandemic
Acqua di Cristallo Tributo a Modigliani - the most expensive drinking water in the world.

In the urban slum poor people need to wait a long queue for a jar of 5 Litres.

Ironically acqua di cristallo drinkers and the slum people who are fighting for drinking water both of we are living in a same planet.

Drinking water
Life or Luxury?
Systematic discrimination and inequality in society boost up the climate crisis day by day...
Recycled life?
EDUCATION

SOLUTION

POLLUTION

What is missing?

YOU
Do the Global North Realize the climate crisis in urban slum?
How can you make the solidarity with them?

Urban slum children want to live in this planet without any fear and worries. They want to enjoy their childhood with hopes of colors and the puppies, NOT A CLIMATE REFUGEE.

- Global North should realize the extreme vulnerable situation of urban poor which is related to their uneven luxury and unlimited consumerism.
- Global North should be the part of global climate justice campaign.
- Mitigate the carbon emission considering the Paris agreement.
- Allocate the funds and resources for the climate vulnerable people and strengthen the global green climate fund.
- Ensure the housing, land and job for the climate refugees in Bangladesh.
- Strengthen the capacities and skills for the urban poor people.
- Ensure education, health and food security for the urban poor.
1st South Asian Conference 2023
UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENERIO
Social Science Faculty, Dhaka University, Bangladesh
26th November, 2023

Center for People & Environ
Assessing Urban Expansion and Land Use/Land Cover Changes for Sustainable Development in Gazipur City Corporation Area

Bustanul Zannat, Sinthia Silvi, Dr. Khandakar Hasan Mahmud, Dr. Bibi Hafsa,
Introduction

- Gazipur City Corporation is the largest city corporation in Bangladesh (Latif et al., 2014).
- Urban expansion leads to changes in land use land cover (LULC) due to population growth by replacing natural landscapes with impervious surfaces (Das & Angadi, 2021).
- Land use/land cover is essential to get the spatial information at a micro and global scale for understanding urban expansion and making future land use planning (Dwivedi, et al., 2005).
- During the last two centuries, the process of urbanization and industrialization has caused alterations in land use and land cover (LULC), resulting in a decline in sustainability for future generations (Abhijith & Saravanan, 2021).
Introduction

• The examination of land use/land cover change for the protection of natural areas at a local scale focuses on the Development Goals, which is SDG 2, SDG 6, SDG 11, SDG 12, SDG 13, and SDG 15.

• SDG 11, has direct relevance to the goals and objectives of the built-up land class.
Background of the study

• Urban expansion in major cities of Bangladesh is evident which have led to pollution, traffic congestion, power outages, and unplanned slums (Saqui, 2017).

• Temporal variations in land use, both qualitative and quantitative, are required for sustainable urban planning and management.

• GIS and RS have been utilized to obtain meaningful data from the electromagnetic spectrum and have enabled features to be measured in urban/built-up areas (Frimpong & Molkenthin, 2021).
Background of the study

• Rapid population growth has changed the goal of development, which has caused changes in land use and land cover (LULC) in Gazipur.

• Distance and directional assessment optimizes transportation networks by anticipating urban growth, planning efficient corridors, reducing congestion, and improves connectivity.
Objective of the study

The objectives of the study are-

• To detect land use/land cover (LULC) scenarios of 2000, 2010 and 2020.
• To compute the changes in urban areas in terms of direction.
• To assess the urban expansion in terms of distance.
Study Area

- Gazipur City Corporation is located between 23°51'0" N to 24°7'30" N and 90°17'0" E to 90°28'0".
- It is covering 321.90 sq.km.
Methods and Methodology

- Landsat 5 TM (2000)
- Landsat 8 OLI (2010)
- Landsat 8 OLI (2020)

Landsat 8 OLI (2010)

LULC Classification

Accuracy Assessment

Clipping by Study Area Boundary

Identify Urban Areas

Directional Distribution of Urban Expansion

Distance Assessment of Urban Expansion
**Result and Discussion**

<table>
<thead>
<tr>
<th></th>
<th>Agricultural land</th>
<th>Bare Land</th>
<th>Urban Area</th>
<th>Vegetation Cover</th>
<th>Waterbodies</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>29.36 km² 9.13%</td>
<td>122.80 km² 38.19%</td>
<td>62.92 km² 19.57%</td>
<td>48.63 km² 15.12%</td>
<td>57.82 km² 17.98%</td>
</tr>
<tr>
<td>2010</td>
<td>92.80 km² 28.86%</td>
<td>49.96 km² 15.54%</td>
<td>77.36 km² 24.06%</td>
<td>68.01 km² 21.15%</td>
<td>33.40 km² 10.39%</td>
</tr>
<tr>
<td>2020</td>
<td>28.50 km² 8.86%</td>
<td>21.77 km² 6.77%</td>
<td>154.50 km² 48.05%</td>
<td>95.42 km² 29.68%</td>
<td>21.35 km² 6.64%</td>
</tr>
</tbody>
</table>

Land Use and Land Cover Map of Gazipur City Corporation

Legend
- **Agricultural Land**
- **Bare Land**
- **Urban Area**
- **Vegetation Cover**
- **Waterbodies**

Dimensions: 960.0x540.0
Result and Discussion

[Map and Graph]

- **Legend**
  - Gazipur City Corporation
  - Urban Area 2000
  - Urban Area 2010
  - Urban Area 2020

- **Bar Chart**
  - **Year**: 2000, 2010, 2020
  - **Urban Area**
    - 2000: 19.57%
    - 2010: 24.06%
    - 2020: 48.05%
Result and Discussion

<table>
<thead>
<tr>
<th>Legend</th>
<th>Gaudapur City Corporation</th>
<th>Conversion of Urban Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Directional Assessment of Urban Expansion

<table>
<thead>
<tr>
<th>Direction</th>
<th>Area in km²</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>16.91</td>
</tr>
<tr>
<td>NE</td>
<td>12.51</td>
</tr>
<tr>
<td>E</td>
<td>9.54</td>
</tr>
<tr>
<td>SE</td>
<td>21.84</td>
</tr>
<tr>
<td>S</td>
<td>37.07</td>
</tr>
<tr>
<td>SW</td>
<td>10.04</td>
</tr>
<tr>
<td>W</td>
<td>30.00</td>
</tr>
<tr>
<td>NW</td>
<td>16.10</td>
</tr>
</tbody>
</table>

Kilometers

- 0
- 1.5
- 3
- 6
- 9
- 12

Dhaka, November 25-26
Result and Discussion

Legend
- Gazipur City Corporation
- Conversion of Urban Area

Distance Assessment of Urban Expansion

<table>
<thead>
<tr>
<th>Distance (km)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>67.26%</td>
</tr>
<tr>
<td>6</td>
<td>49.71%</td>
</tr>
<tr>
<td>9</td>
<td>47.86%</td>
</tr>
<tr>
<td>12</td>
<td>41.13%</td>
</tr>
<tr>
<td>15</td>
<td>40.89%</td>
</tr>
</tbody>
</table>
Result and Discussion
Conclusion

• Understanding urban expansion patterns aids city planning and management. It helps authorities predict growth, allocate resources, and build infrastructure for urban population.

• Urban expansion informs the development of sustainable infrastructure which is a key aspect of SDG 11.

• Understanding urban expansion's spatial extent aids in sustainable land use planning, preventing urban sprawl, preserving green spaces, and protecting ecosystems, for fostering resilient cities.

• Understanding urban expansion helps plan for informal settlements, sustainable housing, slum reduction, and basic services for all urban residents.
References


1st South Asian Conference 2023

UNFOLDING EMERGING ISSUES IN THE CONTEXT
OF CHANGING CLIMATIC SCENERIO

Social Science Faculty, Dhaka University, Bangladesh

26th November, 2023
Correlation between Land Surface Temperature (LST) and Major Air Pollutants (MAP) in Greater Dhaka Region: A Geospatial Approach

S M Sium, Afrin Sharabony, Hasibul Hasan, and Dr. Kazi Md. Fazlul Haq

Department of Geography and Environment, University of Dhaka, Shahbag, Dhaka – 1000.
Introduction

• Air quality pertains to the state of air purity in a defined area, indicating the concentration of diverse pollutants and contaminants in the atmosphere, which can originate from natural sources (EPA, 2021).

• The presence and concentration of elements such as PM$_{2.5}$, PM$_{10}$, ground-level O$_3$, NO$_2$, CO, SO$_2$ and volatile organic compounds are pivotal in determining air quality. This significantly influences public health, climate change, and overall quality of life (Mayer, 1999).

• PM$_{2.5}$ denotes fine particles measuring 2.5 micrometers or less in diameter, while PM$_{10}$ signifies particles with a diameter of 10 micrometers or less (Donaldson et al., 2006).

• Urbanization and changing land use significantly contribute to worsening air quality in global cities, with urban population growth and land use alterations identified as key factors driving these challenges (Mayer, 1999).
Background of the study

- Air pollution stands as a prominent concern as Bangladesh ranked 169th out of 178 countries on the Environmental Performance Index, specifically concerning Air Quality (Haque, et al., 2017).
- Dhaka ranked second in the list of cities worldwide with the worst air quality in 2023 (Prothom Alo, 2023).
- Scientists from the Bangladesh Atomic Energy Commission found that Dhaka city emits roughly 50 tons of lead annually, peaking during the dry season (November-January). During this period, the airborne particulate matter density exceeds 463 micrograms per cubic meter (µg/m³) (Air Pollution Reduction Strategy for Bangladesh, Final Report, 2012; DOE, 2015).
Objective of the study

The study examines the 34-year correlation between land surface temperature (LST) and major air pollutants (MAP) in Greater Dhaka.
Methods and methodology

- Landsat imagery for 1989 and 2022 were used to determine the land surface temperature of Dhaka.

- Concurrently, air quality data were acquired during post-monsoon conditions from 24 designated sites located across Gazipur, Dhaka, and Narayanganj.

- The data collection involved the use of a portable Aeroqual Series 500 air quality monitor to assess and record various air quality parameters at these specific locations.

Figure 02: Location from sample collection
Methods and methodology

Data Collection
Methods and methodology

Figure 04: Workflow to determine the relation between LST and MAP
Result and discussion

- According to the LST map, it is evident that in 1989, the majority of the study area had temperatures ranging between 25°C to 27°C, denoted by the sky blue color.

- However, there has been a dramatic change in Land Surface Temperature (LST) in 2023, with most of Dhaka experiencing temperatures around 31°C to more than 33°C, indicated by the yellow to red color gradient.

Figure 05: LST of Dhaka Region
The study revealed that the land surface temperature (LST) of Dhaka has increased as the high value jumped from 32.05°C in 1989 to 38.78°C in 2022.

Gulistan, Farmgate, Gabtuli and Joydebpur had a rise of land surface temperature more than 6°C.

Jirani Bazar, Fuldi Bazar, and Savar had land surface temperatures that rose by nearly 6.5°C in the last three decades.

Figure 06: Locations for sample collection
## Result and discussion

### Land Surface Temperature Change

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Zone Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Section 4, Lalbag</td>
<td>Emerging Urban Area</td>
</tr>
<tr>
<td>11</td>
<td>Uttara Chattar</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Mogbazar Mor</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Salna Bazar</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Genda, Savar</td>
<td>Emerging Urban Area</td>
</tr>
<tr>
<td>1</td>
<td>New Market</td>
<td>Market Zones</td>
</tr>
<tr>
<td>2</td>
<td>Gulistan</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Mirpur 10</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Farmgate</td>
<td>Recreation Sites</td>
</tr>
<tr>
<td>5</td>
<td>Konakhola Upazila Bazar</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Zinda Park</td>
<td>Recreation Sites</td>
</tr>
<tr>
<td>19</td>
<td>Daripara</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Panam City</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Kadamtuli</td>
<td>Near to Industry Zone</td>
</tr>
<tr>
<td>13</td>
<td>Baipail Bus stand</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Jirani Bazar</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>kachpur Bridge</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Madanpur Bazar</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Bandar</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Jurain Medical</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Chandana Bazar, Chawrasta</td>
<td>Mass Hub of Transportation</td>
</tr>
<tr>
<td>16</td>
<td>Gabtuli Darus-salam</td>
<td>Hub of Transportation</td>
</tr>
<tr>
<td>17</td>
<td>Joydebpur Rail station</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Sign Board</td>
<td>Near to Industry Zone</td>
</tr>
</tbody>
</table>
## Result and discussion

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<td>25</td>
<td>Salna Bazar</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Genda, Savar</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>New Market</td>
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<td>Mirpur10</td>
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<td>Konakhola Upazila Bazar</td>
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<td>7</td>
<td>Bandar</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Jurain Medical</td>
<td></td>
</tr>
</tbody>
</table>

### Temperature Increase Trend

<table>
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<tr>
<th>ID</th>
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<th>Zone</th>
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</thead>
<tbody>
<tr>
<td>12</td>
<td>Chandana Bazar, Chawrasta</td>
<td>Hub of Transportation</td>
</tr>
<tr>
<td>16</td>
<td>Gabtuli Darus-salam</td>
<td>Hub of Transportation</td>
</tr>
<tr>
<td>17</td>
<td>Joydebpur Rail station</td>
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</tr>
<tr>
<td>14</td>
<td>Sign Board</td>
<td>Hub of Transportation</td>
</tr>
</tbody>
</table>
Result and discussion

- The study found that Gulistan, Mirpur 10, Gabtuli Darus-salam, Farmgate and Savar have the highest amount of NO₂ which are 0.084 ppm, 0.089 ppm, 0.134 ppm, 0.090 and 0.099 ppm, respectively but the standard value is **0.053 ppm**.

- Gulistan and Fuldi Bazar had the highest amount of SO₂, 0.3 ppm and 0.2 ppm, respectively.
New Market, a hub for the middle-class population, is grappling with congested traffic, leading to elevated pollution levels and a rapid increase in temperature, the area had CH$_4$ (11 ppm) and CO$_2$ (614 ppm) which is above the standard level. Zinda Park (55 ppm) and Jirani Bazar (54 ppm) had the highest concentrations of CH$_4$, while Mogbazar (938 ppm) and Fuldi Bazar (770 ppm) exhibited the highest levels of CO$_2$. 
Result and discussion

The annual mean particulate pollution level of the nation's established standard is 15 ppm. The Joydebpur rail station recorded a PM\textsubscript{10} concentration of 1130 ppm, exceeding the national standard level by over 75 times.

Again Jirani Bazar (415 ppm) and Farmgate (497 ppm) had high amount of PM\textsubscript{10}. Conversely, Kadamtuli, Joydebpur Rail Station, and Genda had the highest levels of PM\textsubscript{2.5}, measuring 108 ppm, 151 ppm, and 125 ppm, respectively.
Summary

The study indicates a correlation between elevated land surface temperatures and areas characterized as air pollution hotspots, predominantly attributed to human-induced activities and existing regulatory deficiencies across the larger Dhaka region.

- From the above discussion it can be noted that, Joydebpur Rail Station in 2022 had an LST of 30.51°C and a PM$_{10}$ concentration of 1130 ppm, which is notably high compared to other locations.

- Gabtuli registered an LST increase of 6.06°C between 1989 and 2022, where the value of Nitrogen Dioxide is 0.134 ppm in post monsoon of 2023.

- Similarly, places like Gulistan, Mirpur10, and New Market, with traffic-related factors, showed increased levels of pollutants with relatively high temperatures.

These findings offer crucial insights that could prove instrumental for local, national, and international entities in formulating strategies and policies aimed at addressing the pervasive challenges associated with air pollution.
Conclusion

The study indicates a correlation between elevated land surface temperatures and areas characterized as air pollution hotspots, predominantly attributed to human-induced activities and existing regulatory deficiencies across the larger Dhaka region.

These findings offer crucial insights that could prove instrumental for local, national, and international entities in formulating strategies and policies aimed at addressing the pervasive challenges associated with air pollution.


Thank you so much!
1st South Asian Conference 2023

UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENERIO

Social Science Faculty, Dhaka University, Bangladesh

26th November, 2023
Geospatial Modeling for Air Quality Mapping of Dhaka City

Presented By

Ehasan Reza
Research Consultant
Remote Sensing Division
Center for Environmental and Geographic Information Services

Supervised By

Prof. Dr. Khandakar Hasan Mahmud
Department of Geography and Environment
Jahangirnagar University
Savar, Dhaka-1340.
Air pollution

Dhaka air 3rd most polluted in the world: AQI

UNB, Dhaka
Tue Aug 2, 2022 11:27 AM Last update on: Tue Aug 2, 2022 01:26 PM

Dhaka air once again world’s most polluted

Prothom Alo English Desk
Updated: 35 Dec 2022, 11:56 PM
Aim

The broad aim of this research work is to develop a geostatistic based geospatial model for the distribution pattern of air quality in Dhaka City.

Objectives

1. To identify and make list of major nodal point of Dhaka City.
2. To measure and collect air quality parameter values at the said nodal points.
3. To assess the hot and cold spot zones in relation to urban congestion.
4. To prepare a geostatistics based geospatial model for interpolation of the collected air quality data.
Methods and Findings

Objectives
1. To identify and make list of major nodal point of Dhaka City.

Required Data
- City Corporation Database

Data Sources and Type
- Secondary Data Source
- Ordinal Data

Tools and Methodology
- Confusion Matrix
- Network Analyst
- Proximity Analysis

Expected Result
- A list of nodal point of Dhaka City.
Objectives
1. To identify and make list of major nodal point of Dhaka City.

Required Data
• City Corporation Database

Data Sources and Type
• Secondary Data Source
• Ordinal Data

Tools and Methodology
• Confusion Matrix
• Network Analyst
• Proximity Analysis

Expected Result
• A list of nodal point of Dhaka City.

### Methods and Findings

#### Confusion Matrix

<table>
<thead>
<tr>
<th>Test Outcome</th>
<th>Condition Determined By Nodal Points</th>
<th>Total Population</th>
<th>Condition Positive</th>
<th>Condition Negative</th>
<th>Prevalence= Condition Positive/Total Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Positive</td>
<td>TP=100</td>
<td>FP=7</td>
<td></td>
<td></td>
<td>Precision 0.93 False Discovery Rate 0.07</td>
</tr>
<tr>
<td>Test Negative</td>
<td>FN=3</td>
<td>TN=70</td>
<td></td>
<td></td>
<td>False Omission Rate 0.04 Negative Predictive Value 0.96</td>
</tr>
</tbody>
</table>

**Accuracy=94%**

- Sensitivity 0.97 False Positive Rate 0.09
- Positive Likelihood Ration 10.68 Diagnostic Odds Ratio0.34
- False Negative Rate 0.03 True Negative Rate 0.91
- Negative Likelihood Ration 31.21

- Precision: \[ \frac{TP}{TP+FP} \]
- False Discovery Rate: \[ \frac{FP}{TP+FP} \]
- False Omission Rate: \[ \frac{FN}{FN+TN} \]
- Negative Predictive Value: \[ \frac{TN}{FN+TN} \]
- Accuracy: \[ \frac{TP+TN}{TP+FP+FN+TN} \]
- Sensitivity (SN): \[ \frac{TP}{TP+FN} \]
- Specificity (SP): \[ \frac{TN}{TN+FP} \]
- Positive Likelihood Ration (PLR): \[ \frac{TPR}{FPR} \]
- Negative Likelihood Ration (NLR): \[ \frac{FPR}{TPR} \]
- Diagnostic Odds Ratio (DOR): \[ \frac{PLR}{NLR} \]

\[
d = \sqrt{(x_1 - x_0)^2 + (y_1 - y_0)^2 + (z_1 - z_0)^2}
\]
Methods and Findings

Objectives
2. To measure and collect air quality parameter values at the said points.

Required Data
- Temperature
- Relative Humidity
- Particulate Matter
- TVOC
- HCHO

Data Sources and Type
- Primary Data Source
- Nominal Data
- Ratio Scale

Tools and Methodology
- Field Survey
- Air Quality Detector
- Elitech Data Logger

Expected Result
A list of air quality parameter values at the said points.

\[ I_p = \frac{I_{Hi} - I_{Lo}}{BP_{Hi} - BP_{Lo}} \times (C_p - BP_{Lo}) + I_{Lo} \]

\[ \text{Arithmetic Mean} = \frac{\sum_{n=0}^{\infty} f_i \times x_i}{f_i} \]

<table>
<thead>
<tr>
<th>Name</th>
<th>16_8_10_P M 1</th>
<th>16_8_10_PM 2.5</th>
<th>16_8_10_P M 10</th>
<th>16_8_10_HCH O</th>
<th>16_8_10_TV OC</th>
<th>16 8 10 Temperature (°C)</th>
<th>16 8 10 Humidity (%)</th>
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<td>28</td>
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<tr>
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<td>279</td>
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<table>
<thead>
<tr>
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<th>16_GM_PM 10</th>
<th>16_GM_HC O</th>
<th>16_GM_TV OC</th>
<th>16_GM_Temperature (°C)</th>
<th>16_GM_Humidity (%)</th>
<th>16_IP 2.5</th>
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</table>
Objectives
2. To measure and collect air quality parameter values at the said points.

Required Data
• Temperature
• Relative Humidity
• Particulate Matter
• TVOC
• HCHO

Data Sources and Type
• Primary Data Source
• Nominal Data
• Ratio Scale

Tools and Methodology
• Field Survey
• Air Quality Detector
• Elitech Data Logger

Expected Result
A list of air quality parameter values at the said points.

<table>
<thead>
<tr>
<th>Name</th>
<th>16_AQI</th>
<th>17_AQI</th>
<th>18_AQI</th>
<th>19_AQI</th>
<th>20_AQI</th>
<th>21_AQI</th>
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<td>327.42</td>
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<td>316.25</td>
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<tr>
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<td>500</td>
<td>500</td>
<td>500</td>
<td>500</td>
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Source: US EPA

Methods and Findings

<table>
<thead>
<tr>
<th>AQI Category</th>
<th>PM 2.5</th>
<th>PM 10</th>
<th>Health Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good [0-50]</td>
<td>0-30</td>
<td>0-50</td>
<td>Minimal</td>
</tr>
<tr>
<td>Satisfactory [51-100]</td>
<td>31-60</td>
<td>51-100</td>
<td>Minor Breathing Discomfort to sensitive people</td>
</tr>
<tr>
<td>Moderately Polluted [101-200]</td>
<td>61-90</td>
<td>101-250</td>
<td>Minor Breathing Discomfort to asthma patients, children and elders</td>
</tr>
<tr>
<td>Poor [201-300]</td>
<td>91-120</td>
<td>251-350</td>
<td>Breathing Discomfort to all</td>
</tr>
<tr>
<td>Very Poor [301-400]</td>
<td>121-250</td>
<td>351-430</td>
<td>Respiratory illness on prolonged exposure</td>
</tr>
<tr>
<td>Severe [401-500]</td>
<td>250+</td>
<td>430+</td>
<td>Health Impact even on light physical work</td>
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</table>
**Objectives**
3. To assess the hot and cold spot zones in relation to urban congestion.

**Required Data**
- Population Density
- Housing Density
- Roads and Highways database

**Data Sources and Type**
- Secondary Data Source
- Interval Data
- Ratio Scale

**Tools and Methodology**
- Coefficient Analysis
- Regression Analysis

**Expected Result**
A negatively correlation of urban congestion with hot and cold spot zones.

### Confidence Level

<table>
<thead>
<tr>
<th>Confidence Level</th>
<th>Nodal Point</th>
<th>Thana</th>
<th>Ward</th>
<th>DCC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hot Spot 99%</strong></td>
<td>House Building</td>
<td>Uttara Purba</td>
<td>Ward No-1</td>
<td>North</td>
</tr>
<tr>
<td><strong>Hot Spot 95%</strong></td>
<td>Jasim Uddin Road</td>
<td>Uttara Purba</td>
<td>Ward No-1</td>
<td>North</td>
</tr>
<tr>
<td></td>
<td>Airport</td>
<td>Biman Bandar</td>
<td>Ward No-1</td>
<td>North</td>
</tr>
<tr>
<td></td>
<td>Jatrabari</td>
<td>Demra</td>
<td>Ward No-66</td>
<td>South</td>
</tr>
<tr>
<td><strong>Hot Spot 90%</strong></td>
<td>Jurain</td>
<td>Shyampur</td>
<td>Ward No-54</td>
<td>South</td>
</tr>
<tr>
<td></td>
<td>Shahbagh</td>
<td>Shahbagh</td>
<td>Ward No-26</td>
<td>South</td>
</tr>
<tr>
<td></td>
<td>Kakrail</td>
<td>Ramna</td>
<td>Ward No-53</td>
<td>South</td>
</tr>
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<td></td>
<td>Sluice Gate</td>
<td>Uttara Purba</td>
<td>Ward No-1</td>
<td>North</td>
</tr>
<tr>
<td><strong>Not Significant</strong></td>
<td>Sign Board</td>
<td>Demra</td>
<td>Ward No-66</td>
<td>South</td>
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<tr>
<td><strong>Cold Spot 90%</strong></td>
<td>Tejgaon</td>
<td>Tejgaon</td>
<td>Ward No-45</td>
<td>South</td>
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<tr>
<td></td>
<td>Natun Bazar</td>
<td>Bhatara</td>
<td>Ward No-18</td>
<td>North</td>
</tr>
<tr>
<td><strong>Cold Spot 95%</strong></td>
<td>Demra Circle Bus Stand</td>
<td>Demra</td>
<td>Ward No-27</td>
<td>South</td>
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<td></td>
<td>Shadhinota Sarani</td>
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<td>Gulshan-2</td>
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<td>Gulshan-2</td>
<td>Gulshan-2</td>
<td>Ward No-19</td>
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</table>
Objectives

4. To prepare a geostatistics based geospatial model for interpolation of the collected air quality data.

Required Data

Outcome of objective 2

Data Sources and Type

- Secondary Data Source
- Interval Data
- Ratio Scale

Tools and Methodology

- Inverse Distance Weighting (IDW)
- Natural Neighbor Method
- Zonal Statistics

Expected Result

A geostatistical probabilistic model which will be interpolated with the collected air quality data.
Objectives
4. To prepare a geostatistics based geospatial model for interpolation of the collected air quality data.

Required Data
Outcome of objective 2

Data Sources and Type
- Secondary Data Source
- Interval Data
- Ratio Scale

Tools and Methodology
- Inverse Distance Weighting (IDW)
- Natural Neighbor Method
- Zonal Statistics

Expected Result
A geostatistical probabilistic model which will be interpolated with the collected air quality data.

<table>
<thead>
<tr>
<th>Station</th>
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<th>Ward</th>
<th>AQI</th>
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<td>Gabtoli</td>
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<td>Ward No-9</td>
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<tr>
<td>Sluice Gate</td>
<td>Uttara Purba</td>
<td>Ward No-1</td>
<td>500</td>
</tr>
<tr>
<td>Airport</td>
<td>Biman Bandar</td>
<td>Ward No-1</td>
<td>500</td>
</tr>
<tr>
<td>House Building</td>
<td>Uttara Purba</td>
<td>Ward No-1</td>
<td>500</td>
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<tr>
<td>Azimpur</td>
<td>Lalbagh</td>
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<td>Khilkhet</td>
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<tr>
<td>Jurain</td>
<td>Shyampur</td>
<td>Ward No-54</td>
<td>500</td>
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</table>

Methods and Findings
Hazardous condition of Air Quality and people living in this area are highly vulnerable

\[
\hat{V}_1 = \frac{1}{\sum \frac{1}{d_{ij}^p}} \frac{1}{\sum \frac{1}{d_{ij}^p}} V_i
\]
Objectives

4. To prepare a geostatistics based geospatial model for interpolation of the collected air quality data.

Required Data

Outcome of objective 2

Data Sources and Type

- Secondary Data Source
- Interval Data
- Ratio Scale

Tools and Methodology

- Inverse Distance Weighting (IDW)
- Natural Neighbor Method
- Zonal Statistics

Expected Result

A geostatistical probabilistic model which will be interpolated with the collected air quality data.

Methods and Findings

<table>
<thead>
<tr>
<th>Rank</th>
<th>DCC</th>
<th>Ward no.</th>
<th>MIN</th>
<th>MAX</th>
<th>RANGE</th>
<th>MEAN</th>
<th>STD</th>
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<tbody>
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</table>
Objectives
4. To prepare a geostatistics-based geospatial model for interpolation of the collected air quality data.

Required Data
Outcome of objective 2

Data Sources and Type
• Secondary Data Source
• Interval Data
• Ratio Scale

Tools and Methodology
• Inverse Distance Weighting (IDW)
• Natural Neighbor Method
• Zonal Statistics

Expected Result
A geostatistical probabilistic model which will be interpolated with the collected air quality data.

### Methods and Findings

<table>
<thead>
<tr>
<th>Rank</th>
<th>THAN</th>
<th>MIN</th>
<th>MAX</th>
<th>RANGE</th>
<th>MEAN</th>
<th>STD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jatrabari</td>
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<td>47.57</td>
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</tr>
</tbody>
</table>

![Map of Dhaka City Corporation](image)
Discussion

A. Challenges and Factors Contributing to Private Vehicle Dominance:

• Substantial contrast with private means of transportation like cars, jeeps, and motorcycles.
• Quick expansion attributed to rising incomes, absence of reasonable public transport alternatives, and significant subsidies (especially for fuel and parking).
• Extensive availability of bank loans contributing to the explosive growth of private vehicles.

B. Proposed Solutions for Public Transportation Improvement:

• Development of an integrated, centralized, and interconnected network.
• Enhancement of public transport quality through:
  • High-quality mass transit systems.
  • Well-designed shelters and terminals with effective control.
  • Implementation of advanced passenger data management.
  • Introduction of integrated ticketing systems.
• Priority measures for buses to improve efficiency:
  • Designated traffic lanes for buses.
  • Prioritized signals at level crossings.
  • Implementation of "queue-jumps" and other traffic management techniques.
• Concrete steps to encourage bus usage as a viable alternative.
As air pollution becomes highly focused in Dhaka City, the accurate identification of its influencing factors is critical for achieving effective control and targeted environmental governance. Land-use distribution is one of the key factors affecting air quality, and research on the impact of land-use distribution on air pollution has drawn wide attention.
1st South Asian Conference 2023
UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENERIO
Social Science Faculty, Dhaka University, Bangladesh
26th November, 2023
ANALYSIS OF SELECTED AIR QUALITY INDEX PARAMETERS BEFORE, DURING AND POST COVID 19 IN DHAKA District USING GOOGLE EARTH ENGINE

Presented by

Sumaiya Zakir

Roll: 1029

Session: 2020-2021

Supervisor
Professor Dr. Mohammad Nayeem Aziz Ansari

Department of Geography and Environment

Jahangirnagar University
Background of the Study:

Bangladesh has the most polluted air in the world, Dhaka city has been ranked first in 2020; During the lockdown period, human activities like industrial activities, traffic congestion, and population density were less. According to a study, the concentrations of NO2, SO2, and CO in Dhaka City decreased by 30, 07 and 07% respectively, during the lockdown.
• Sentinel 5 is focused on air quality and composition-climate interaction with the main data products being NO2, SO2, CO etc.

• Fuels containing sulfur, such as coal-fired power plants, electric utilities, etc., produce SO2. Higher automobiles, fossil fuel is mainly the source of Carbon monoxide (CO)

• Air pollution causes many respiratory diseases particularly high concentration of NO2 is mostly responsible for it, even causes death.
Aim and Objective

Aim: Studies of air pollution usually deal with identification of pollutants and their affecting patterns on environment. The aim of this research is to analyze the air quality index in the concomitant covid19 situation in Dhaka district.

• Objective:

• To map the air pollutant parameters NO2, So2, and CO concentration of pre, during and post covid19 disaster;

• To compare it with the pandemic and normal conditions in the years between 2020 and 2022.
Study area

• The latitude and longitude of Dhaka district are respectively 23.8105° N, 90.3372° E.

• Dhaka District shares borders with Gazipur and Tangail to the North, Munshiganj and Rajbari to the South, Narayanganj to the East and Manikganj to the West.
Methodology
The research methodology is based on secondary data which will be collected from google earth engine and statistical analysis will be done in the same platform. The procedure is written below:

<table>
<thead>
<tr>
<th>Objective</th>
<th>Methods of data collection</th>
<th>Data analytical procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>To map the air pollutant parameters NO2, So2, and CO concentration of pre, during and post covid19 disaster</td>
<td>JavaScript-based codes to access the Sentinel-5p data.</td>
<td>Maps for pollutant parameter analysis of 2019, 2020 and 2021 using Google Earth Engine.</td>
</tr>
</tbody>
</table>
Result and discussion:
Result and Discussion continues..
Result and Discussion continues..

• Before covid19 pandemic, the overall scenario of Dhaka district is highly concentrated with NO2 air parameter;

• During the pandemic as the lockdown took place least concentration of NO2 has been noticed in the month of June, 2020.

• Moderate concentration is seen in the post covid19 situation as there was still lockdown effect overall the district in 2022;

• This result shows Dhaka mega city is the hot spots of air pollution is in the pandemic and even in normal period within the Dhaka district area.
Result and Discussion continues..
Result and Discussion continues..

• In the year of 2020, CO concentration start falling from the lockdown month April to July and again start rising in August at Kawran Bazar;

• Even though there was a rise of NO2 concentration in the lockdown timeline of March there was also decline in June-July, which did not exceeded 0.0000750 µg/m^2 in the year of 2020;

• As per third chart, in October 2021 when situation was normal the highest concentration was recorded 0.0000820 µg/m^2.
Concept slide

• Google Earth Engine utilizes Sentinel-5P satellite data to monitor air quality parameters. Leveraging JavaScript, it enables seamless analysis and visualization of Atmospheric Quality Index (AQI) metrics.

• Transforming raw satellite data into actionable intelligence, it contributes to better understanding and management of air quality on a global scale.
Conclusion

- We got a good sense of the relationship between pollution concentration and COVID19 mandated lockdowns from the concentration of the AQI parameters fluctuation;
- It can be concluded that, anthropogenic effect causes adverse environmental conditions;
- We found effective data (based on real satellite mission sources) on the concentration of air parameters which is a base and strong platform to pursue future research and studies.
Thank you
1st South Asian Conference 2023
UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENERIO
Social Science Faculty, Dhaka University, Bangladesh
26th November, 2023
Riverbank Erosion Impact Assessment of Rural Households with Morpho-hydrological Analysis and Main Adaptation Barriers in Northern Part of Bangladesh

Umma Salma
Supervisor: Dr. Farzana Raihan
Forestry and Environmental Science
Shahjalal University of Science and Technology, Sylhet -3100, Bangladesh
Introduction

• Riverbank erosion is an endemic and recurrent natural hazards in Bangladesh.

• It is estimated that about 5% of total flood plain of Bangladesh is directly affected and seen that riverbank erosion is taking place 94 out of 489 Upazilas.

• It contributes to the loss of both physical and material endowments and thus threatening their livelihood status.
Objectives

Main Objectives:

• To understand the overall trend and consequences of the riverbank erosion of that study area.

This research is intended to achieve following objectives:

• To understand socio-economic impacts of riverbank erosion.

• To assess the present hydrological and morphological characteristics of adjacent river based on historical data.

• To assess the effects of main barriers of taking adaptations
Methodology

Study area:
- Saghatta and Fulchari Union, Gaibandha, Rangpur, Bangladesh
- It is positioned along the Brahmaputra river basin

Sample size:
- Total 120 respondents (five villages)

Data collection:
- **Primary data**: Questionnaire survey
  - Purposive random sampling procedure was used for data collection
- **Secondary data**: water level data (1991-2021) (BWDB)
  - Satellite images from USGS
Methods

Socio-demographic analysis

- Perception based socio-demographic condition assessment (Excel)

Morphological analysis:

- Overlay analysis and calculation of erosion and accretion over 30 years

Hydrological analysis

- Statistical analysis of historical recorded data over 30 years

Adaptation barriers analysis:

- Logit Regression model (STATA)
Key Findings (Socio-Demographic)

Amount of Cultivable Lands Lost

- No loss: 8.33
- 10-400 (decimal): 46.67
- 401-600 (decimal): 29.17
- 601-900 (decimal): 15.83

Amount of Homestead Land Lost

- No loss: 39.17
- 10-20 (decimal): 18.33
- 21-40 (decimal): 24.17
- 41 (decimal): 18.33
Key Findings (Socio-Demographic)
Key Findings (Morphology)
Key Findings (Morphology)
Key Findings (Hydrology)

**Annual**
- Max value: 18.85
  - Year: 2017
- Min value: 14.85
  - Year: 2001

**Monsoon**
- Max value: 18.85
  - Year: 2017
- Min value: 16.42
  - Year: 2001

**Dry**
- Max value: 15.09
  - Year: 2000
- Min value: 10.83
  - Year: 2003
Key Findings (Adaptation barriers)

Diversified_Crops

\[ Y_i = \beta_0 + \beta_1 i X_i + \beta_2 i Z_i + \beta_3 i P_i + e_i \]

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Coefficient</th>
<th>Marginal effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>gender</td>
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<td>-0.409</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td>(0.019)</td>
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<tr>
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<td>-0.209</td>
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<td>(0.067)</td>
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<tr>
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<td>-.519</td>
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<td>(0.000)</td>
</tr>
<tr>
<td>Number of obs</td>
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</tr>
<tr>
<td>Log likelihood</td>
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<td></td>
</tr>
<tr>
<td>Pseudo R2</td>
<td>0.360</td>
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</tr>
</tbody>
</table>
### Key Findings (Adaptation barriers)  
### Diversified Income

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<th>Explanatory Variables</th>
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<td></td>
<td>-.519***</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
</tr>
</tbody>
</table>

- Number of obs: 120
- Log likelihood: -53.189
- Pseudo R2: 0.360
Conclusion

- Riverbank erosion making life more vulnerable
- Rightwards shifting of channel during 30 years
- Understand the water level variation during 30 years
- Gender, Land size, family income etc. are the main influencing variables to adaptations
Limitations

- Bias information from respondents
- Could not cover to assess all the influencing factors of impact erosion
- Funding constraints
Recommendations

- Government should take permanent measures to resist riverbank erosion
- Floodplain zoning is essential
- Government should bottom up nature
- Early weather forecasting
- Plantation practice should apply to reduce riverbank erosion
Scope for Future Research

More variables can analyze using current data

Several methods can merge for better understanding of riverbank erosion
Acknowledgements

• Dr. Farzana Raihan
  Professor,
  Department of Forestry and Environmental Science, Shahjalal University of Science and Technology

• Monir Uddin Ahmed
  Assistant Professor,
  Department of Economics, Shahjalal University of Science and Technology

• Mohammad
  Ex Student, Department of Forestry and Environmental Science, Shahjalal University of Science and Technology
References

References


- Rennell, J., 1776. An actual survey of the Provinces of Bengal, Bahar &c. by major James Rennell, Engineer, Survey General to the Honourable the East India Company. Published by Permission of the Court of Directors, from a drawing in their possession; by A. Dury.


Thank you
Forest Landscape Restoration Planning and Piloting in Chittagong Hill Tracts: Arannayk Foundation’s Experience and Way Forward

Dr. Mohd Abdul Quddus
Arannayk Foundation
26 November 2023
Content

1. FLR – Definition & characteristics
2. Importance of FLR in CHT
3. Arannayk Experiences in FLR Planning and Piloting
   Case 1: FLR Planning and Piloting in Rowangchari, Bandarban
   Case 2: FLR Planning for Reinkhyong Reserved Forest & Surrounding Landscape
4. Lessons Learned
5. Challenges
6. Way Forward
Forest Landscape Restoration (FLR)

FLR is the long-term process of regaining ecological functionality and enhancing human well-being across deforested or degraded forest landscapes.

Characteristics of FLR
1. Focus on landscape
2. Restoration of ecosystem functionality
3. Conserve natural ecosystem
4. Multiple benefits from the ecosystem
5. Participatory planning and management
6. Local conditions taken into account
7. Adaptive management for long-term resilience
Importance of FLR Program in CHT

- CHT contains 1.1 million ha forest land (43% total forest land of Bangladesh), but with large-scale deforestation and degradation
  - 144,800 ha (14%) area lost tree cover between 2001 and 2019
  - 5,444 ha of primary forests lost
- Impacts of deforestation and degradation of the forests (increased soil erosion and landslide, reduced soil fertility and low yield of crops, reduced stream flow and scarcity of water, reduced availability of NTFPs, etc.) are aggravating poverty, reduced adaptation capacity
- FLR in CHT is crucial for achieving Bangladesh’s forestry sector targets:
  - SDG-15 target: 18% forest cover by 2025, 20% by 2030
  - 8<sup>th</sup> FYP Target: 130,580 ha hill forests to be planted to bring 24% land of the country under tree cover by 2025.
  - Bonn Challenge Commitment: 0.75 M ha area restoration by 2030
- CHT contains at least 66 nationally threatened and 33 globally threatened species of wild vertebrate animals
Case 1
FLR Planning and Piloting at Rowangchari, Bandarban

Project: CHT Communities Forest Landscape Management (CHT-FLR) Project (a component of Compass project)
Implementing Partners: USFS-IP and Tahzingdong
Donor: USAID/USFS
Timeline: 2021-22 to 2023-24
Restoration Opportunities Assessment Methodology (ROAM)

- Literature review
  - Contextualizing the landscape problem
  - Land use and land cover analysis
- Stakeholder prioritization
  - Stakeholder discussion
  - Understanding the FLR need
  - Designing FLR options
- FLR option Prioritization
  - Prioritizing the FLR options
  - Economic analysis
  - Drafting the FLR plan
  - Validating FLR plan
- Workshop
  - Finalizing the FLR plan

Supporting analyses:
- Vegetation & Faunal Surveys
- Satellite image analysis
- Drone image analysis
- FGD and KII
- Market survey
- Cost-Benefit Analysis
LULC situation in Rowangchari

<table>
<thead>
<tr>
<th>S N</th>
<th>LULC Classes</th>
<th>Distribution of land area (ha) under different topographic conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Slope ≤30°</td>
</tr>
<tr>
<td>1</td>
<td>Agricultural Crop Land</td>
<td>1,276.0</td>
</tr>
<tr>
<td>2</td>
<td>Bamboo Forest</td>
<td>161.9</td>
</tr>
<tr>
<td>3</td>
<td>Bare Soil</td>
<td>152.8</td>
</tr>
<tr>
<td>4</td>
<td>Brickfield</td>
<td>12.0</td>
</tr>
<tr>
<td>5</td>
<td>Built-Up Non-Linear</td>
<td>161.6</td>
</tr>
<tr>
<td>6</td>
<td>Hill Forest (FH) Tree Cover 10-25%</td>
<td>4,849.8</td>
</tr>
<tr>
<td>7</td>
<td>Hill Forest (FH) Tree Cover 25-50%</td>
<td>4,125.7</td>
</tr>
<tr>
<td>8</td>
<td>Hill Forest (FH) Tree Cover 50-75%</td>
<td>6,116.3</td>
</tr>
<tr>
<td>9</td>
<td>Hill Forest (FH) Tree Cover 75-100%</td>
<td>5,054.4</td>
</tr>
<tr>
<td>10</td>
<td>Orchards and Other Plantations (Trees)</td>
<td>2,620.5</td>
</tr>
<tr>
<td>11</td>
<td>Ponds/Lake</td>
<td>56.1</td>
</tr>
<tr>
<td>12</td>
<td>Rivers and Khals</td>
<td>276.0</td>
</tr>
<tr>
<td>13</td>
<td>Rural Settlement</td>
<td>472.0</td>
</tr>
<tr>
<td>14</td>
<td>Shifting Cultivation</td>
<td>2,258.2</td>
</tr>
<tr>
<td>15</td>
<td>Shrubs with scattered trees</td>
<td>7,565.0</td>
</tr>
<tr>
<td>16</td>
<td><strong>Grand Total</strong></td>
<td><strong>35,158.3</strong></td>
</tr>
</tbody>
</table>

Derived through feature extraction/supervised classification from ESRI Wayback Imagery of 2020
FGDs and KIIIs
Vegetation & Regeneration Survey
Faunal Survey
FLR Options Identification & Prioritization Workshop
### Economic feasibility of the prioritized FLR options

<table>
<thead>
<tr>
<th>SL #</th>
<th>Landuse</th>
<th>Forest Landscape Restoration (FLR) alternatives</th>
<th>NPV (BDT/ha)</th>
<th>NPV of total landuse (mill BDT)</th>
<th>Benefit cost ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Village common forest (VCF)</td>
<td>Do nothing/No additional intervention</td>
<td>8,185,048</td>
<td>2,292</td>
<td>10</td>
</tr>
<tr>
<td>1.1</td>
<td></td>
<td>Added Protection and minimal silvicultural tweaking</td>
<td>8,201,429</td>
<td>2,296</td>
<td>10</td>
</tr>
<tr>
<td>1.2</td>
<td></td>
<td>Buffer area creation to increase the size and recruitment</td>
<td>12,528,100</td>
<td>3,581</td>
<td>15</td>
</tr>
<tr>
<td>2.0</td>
<td>VCF adjoining sacred land</td>
<td>Do nothing/No additional intervention</td>
<td>348,913</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>2.1</td>
<td></td>
<td>Increasing the size of VCF by using such land as buffer area</td>
<td>527,567</td>
<td>13</td>
<td>18</td>
</tr>
<tr>
<td>3.0</td>
<td>Homesteads</td>
<td>Do nothing/No additional intervention</td>
<td>53,368</td>
<td>19</td>
<td>5</td>
</tr>
<tr>
<td>3.1</td>
<td></td>
<td>Enrichment of Homestead agroforestry</td>
<td>106,307</td>
<td>39</td>
<td>8</td>
</tr>
<tr>
<td>3.2</td>
<td></td>
<td>Permaculture homestead</td>
<td>122,124</td>
<td>44</td>
<td>9</td>
</tr>
<tr>
<td>4.0</td>
<td>Kheyang/religious places</td>
<td>Do nothing/No additional intervention</td>
<td>300,023</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>4.1</td>
<td></td>
<td>Conserving and improving the surrounding vegetative areas</td>
<td>260,468</td>
<td>52</td>
<td>2</td>
</tr>
<tr>
<td>4.2</td>
<td></td>
<td>Greening available areas around Kheyang and church</td>
<td>327,823</td>
<td>66</td>
<td>3</td>
</tr>
<tr>
<td>5.0</td>
<td>Shifting cultivation</td>
<td>Do nothing/No additional intervention</td>
<td>1,892,775</td>
<td>45</td>
<td>3</td>
</tr>
</tbody>
</table>
## Economic feasibility of the prioritized FLR options

<table>
<thead>
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<th>Benefit cost ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.0</td>
<td>Timber plantations</td>
<td>Do nothing/No additional intervention</td>
<td>336,504</td>
<td>1,020</td>
<td>4</td>
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<tr>
<td>7.1</td>
<td></td>
<td>Enhance natural regeneration below teak/other mono-plantation by thinning</td>
<td>1,533,169</td>
<td>4,646</td>
<td>34</td>
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<tr>
<td>8.0</td>
<td>Stream side corridor</td>
<td>Do nothing/No additional intervention</td>
<td>300,023</td>
<td>257</td>
<td></td>
</tr>
<tr>
<td>8.1</td>
<td></td>
<td>Stream side conservation</td>
<td>260,468</td>
<td>223</td>
<td>2</td>
</tr>
<tr>
<td>8.2</td>
<td></td>
<td>Wildlife corridor by creating 30 feet wide forest cover on both sides of the stream</td>
<td>327,823</td>
<td>281</td>
<td>3</td>
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<tr>
<td>9.0</td>
<td>Shrub with scattered trees</td>
<td>Do nothing/No additional intervention</td>
<td>95,214</td>
<td>939</td>
<td></td>
</tr>
<tr>
<td>9.1</td>
<td></td>
<td>ANR with enrichment plantation</td>
<td>422,332</td>
<td>4,164</td>
<td>10</td>
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<tr>
<td>9.2</td>
<td></td>
<td>Enrichment plantation</td>
<td>448,336</td>
<td>4,421</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>Hill forest tree cover 10-25%</td>
<td>Do nothing/No additional intervention</td>
<td>252,550</td>
<td>1,765</td>
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<tr>
<td>10.1</td>
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<td>ANR with enrichment plantation</td>
<td>801,250</td>
<td>5,601</td>
<td>18</td>
</tr>
<tr>
<td>10.2</td>
<td></td>
<td>Enrichment plantation</td>
<td>821,446</td>
<td>5,742</td>
<td>18</td>
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</tbody>
</table>
## Recommended Restoration Plan for Rowangchari Upazila, Bandarban

<table>
<thead>
<tr>
<th>FLR Option/Recommendation</th>
<th>Union and Upazila wise area (Hectare)</th>
<th>Alikhong</th>
<th>Nowa Patang</th>
<th>Rowangchari</th>
<th>Taracha</th>
<th>Total Upazila</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shrubs with scattered trees areas: ANR with enrichment plantation</td>
<td></td>
<td>3,089</td>
<td>1,328</td>
<td>1,347</td>
<td>1,762</td>
<td>7,526</td>
</tr>
<tr>
<td>Hill forest with 10-25% tree cover: ANR with enrichment plantation</td>
<td></td>
<td>1,868</td>
<td>922</td>
<td>1,138</td>
<td>887</td>
<td>4,815</td>
</tr>
<tr>
<td>Shifting cultivation areas: Improved agroforestry</td>
<td></td>
<td>900</td>
<td>239</td>
<td>414</td>
<td>699</td>
<td>2,252</td>
</tr>
<tr>
<td>Village Common Forests (VCF): Buffer area plantation</td>
<td></td>
<td>14</td>
<td>-</td>
<td>91</td>
<td>-</td>
<td>105</td>
</tr>
<tr>
<td>Wildlife corridor (10 meter)</td>
<td></td>
<td>73</td>
<td>71</td>
<td>109</td>
<td>125</td>
<td>378</td>
</tr>
<tr>
<td>Orchards/Woodlots: Improved management</td>
<td></td>
<td>662</td>
<td>566</td>
<td>718</td>
<td>663</td>
<td>2,609</td>
</tr>
<tr>
<td>Homesteads: Permaculture/Improved agroforestry</td>
<td></td>
<td>91</td>
<td>93</td>
<td>128</td>
<td>154</td>
<td>466</td>
</tr>
<tr>
<td>Total area</td>
<td></td>
<td>6,699</td>
<td>3,219</td>
<td>3,944</td>
<td>4,289</td>
<td>18,151</td>
</tr>
</tbody>
</table>

- Total area of Rowangchari Upazila: 48,217 ha. So, 42% area needs restoration treatment
- Restoration interventions suggested for lands with less than 30° slope
### Degraded Hill Forests
- Enrichment Planting + ANR
- 100-500 seedlings/ha planted
- Major species: Garjan, Telsur, Boilam, Chapalish, Kalo jam, Chikrashi, Kath Badam
- Minor species: Shil koiri, Amloki, Arjun, civit, Dhaki jam, Gutgutiya, Kao, Buddho Narikel, Neem, Chatian, Kanjal Bhadi, Uri Aam

### Riparian Areas
- Enrichment Planting + ANR
- 1,000-2,500 plants/ha planted
- Major Species: Jarul, Kadam, Hijol, Fig (big fruit)
- Minor species: Arjun, Chalta, Chapalish

### Jhum Fields
- Agroforestry: 400 fruit trees (inside) & 100 timber trees (boundary)/ha
- Fruit Species: Mango, Litchi, Jujube, Malta, Lotkon, Sapota, Lemon
- Forest Species: Champa, Dhaki jam, Shil koori, Boilam
## Restoration Models for Different LULC Classes

<table>
<thead>
<tr>
<th>Degraded Areas of VCFs</th>
<th>Wildlife Corridor</th>
<th>Degraded Orchards</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Enrichment Planting + ANR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 100-500 seedlings/ha planted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Major species: Garjan, Chapalish, Champa, Shil Koroi, Boilam, Arjun</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Minor species: Dharmara, Dakrum, Gutguitta, Civit, Bohera, Chatian</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Enrichment Planting + ANR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 1000 seedlings/ha planted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Major species: Chapalish, Amloki, Hortitoki, Bohrea, Polash, Chatian, Kanjal bhadi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Minor species: Garjan, Dhaki jam, Chalta, Buddha Narikel, Uri Aam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Improved management: Recommended fertilizer management (organic manure)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Pruning after fruit harvest</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Institutional Arrangement for FLR Program Implementation in Rowangchari, Bandarban
Nursery Supply Chain Establishment

• GreenSpace specialized nursery of endangered native tree species established by Arannayk Foundation

• 8 community-based nurseries

• Seedling landing stations established near restoration sites
Restoration Accomplishments (2021-2023)

<table>
<thead>
<tr>
<th>Mosaic</th>
<th>No. of Parcel</th>
<th>Area (Ha)</th>
<th>No. of seedings established*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Planted</td>
</tr>
<tr>
<td>Jhum field</td>
<td>499</td>
<td>336.85</td>
<td>49,900</td>
</tr>
<tr>
<td>Degraded Hill Forest</td>
<td>180</td>
<td>324.08</td>
<td>101,752</td>
</tr>
<tr>
<td>Wildlife Corridor</td>
<td>67</td>
<td>148.40</td>
<td>54,316</td>
</tr>
<tr>
<td>Riparian area</td>
<td>132</td>
<td>90.61</td>
<td>46,359</td>
</tr>
<tr>
<td>VCF</td>
<td>9</td>
<td>108.48</td>
<td>36,603</td>
</tr>
<tr>
<td>Orchard</td>
<td>64</td>
<td>67.12</td>
<td>4,700</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>951</strong></td>
<td><strong>1,075.54</strong></td>
<td><strong>293,630</strong></td>
</tr>
</tbody>
</table>

*Additional 41,500 seedlings planted for gap filling
Post-planting care and maintenance of planted seedlings

Post planting silviculture training for FLR Participants at Khabre Para (Nov 2022)

Weeding at FY2022 plantation in Riparian mosaic, Rowanchari Notun para

Fencing of riparian plantation at Tulachari para
Demonstration of Soil Erosion Control Measures

10 brush wood and bamboo check dams established at Bangchari Para, Tulachari Para, Khabre Para and Talukder Para in Rowangchari Sadar Union.
Restoration Monitoring

- 20 Youth Conservation Volunteers and 15 PIC members trained in Participatory Restoration Monitoring Tools (PRMT)
- YCVs regularly visit restoration sites and interact with PIC members and FLR participants
- YCV members collect monitoring data and submit to project team
- Arannayk Foundation has established an online geo-spatial database for restoration monitoring and reporting
- Oversight stakeholders (Representatives from BHD, Rowangchari Upazila Council, Union Councils, Headmen, Karbaries) were kept informed and they visited restoration sites
Livelihood Development

Beneficiary:
Vegetable 131,
Poultry 65,
Agroforestry 500

Vegetables cultivation training at Bangchari Para (Dec 16-31)

Poultry rearing training at Tulachari Para (Dec 1-14, 2022)

Vegetable cultivation on trellis

Poultry rearing
FLR Planning for Reinkhyong Reserved Forest

Project Title: Landscape Modelling and Planning for Reinkhyong Reserved Forest
Timeline: 2022-23
Funding: WB/PROGREEN
Rangkhiang RF + 5.0 km Buffer Zone Area

Reserved Forest: **75,942 ha**  
Buffer zone (USF): **67,851 ha**  
Total area: **143,793 ha**

<table>
<thead>
<tr>
<th>District</th>
<th>Upazila</th>
<th>Union</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rangamati</td>
<td>Belaichari</td>
<td>Belaichari</td>
</tr>
<tr>
<td></td>
<td>Farua</td>
<td>Kangara Chari</td>
</tr>
<tr>
<td></td>
<td>Jurai Chari</td>
<td>Maidang</td>
</tr>
<tr>
<td></td>
<td>Rajasthali</td>
<td>Gainda</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ghila Chhari</td>
</tr>
<tr>
<td></td>
<td>Rangamati Sadar</td>
<td>Balukhali</td>
</tr>
<tr>
<td>Bandarban</td>
<td>Rowangchhari</td>
<td>Alikhong</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nowa Patang</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rowangchhari</td>
</tr>
<tr>
<td></td>
<td>Ruma</td>
<td>Paindu</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remakri Pransa</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ruma</td>
</tr>
<tr>
<td></td>
<td>Thanchi</td>
<td>Thanchi</td>
</tr>
</tbody>
</table>
Methodology: Flow Chart

Communication & outreach activities: Website, blogs, newspaper articles, networking, community meetings, posters, “Day” celebration

- Landscape characterization and classification (bio-physical):
  - LULC Analysis (RS)
  - DEM analysis
  - Composite map preparation

- Present land-use and other bio-physical maps

- Social history and culture analysis:
  - Secondary information review
  - KII

- Policy, institutional and legal framework analysis:
  - Secondary information review
  - KII

- Biodiversity assessment:
  - Secondary information review
  - Vegetation survey
  - KII

- Local communities’ livelihood practices and needs analysis:
  - Household survey
  - FGD
  - KII

- Multi-criteria land-use and management planning:
  - Participatory mapping
  - Land-use decision model development
  - Model solving
  - Validation by stakeholders

- Stakeholder’s capacity building needs assessment:
  - FGD
  - Workshop

- Regional and national Validation workshop:
  - Workshop
  - Adaptation

- Landscape management plan

- Capacity development plan

- M&E Plan

- Final Report

- Summary for Policy Makers

- Land-use planning units

- Criteria for land-use planning
  - Ecological: Tree cover, biodiversity, carbon, soil & water conservation
  - Economic: Livelihood, forest goods and services, revenue
  - Social: ownership, governance, cultural heritage, customary rights

- Communication & outreach activities: Website, blogs, newspaper articles, networking, community meetings, posters, “Day” celebration
LULC Classification

1. Hill Forest
2. Bamboo Forest
3. Shrubs with Scattered Trees
4. Banana Plantation
5. Orchard and Other Plantation
6. Agricultural Land
7. Shifting Cultivation (New)
8. Rural Settlement
9. River and Khal
10. Lake and Pond
11. Bare Soil

NDVI

1(a) Hill Forest (Low-density)
1(b) Hill Forest (High-density)

Post Classification Correction

Accuracy Assessment

Final LULC Map

5 and 9 digitized from Google Earth Imagery

5 Km Buffered Boundary of Rankhuan RF

Vegetated Area

Non-vegetated Area

Supervised Classification

NDVI

Image Preprocessing

Subset Image

Sentinel-2 Level 1C Image

Training & Validation Data

Field Data

Virtual Data

Field Data

Virtual Data

Replot
### LULC Map and Statistics

#### Overview

This map shows the Land Use and Land Cover (LULC) of the Reinkhyong Reserved Forest and Buffer Area. The map includes various land use classes such as reserve forest, buffer area, and different types of land cover.

#### Table: LULC Class Statistics

<table>
<thead>
<tr>
<th>SN</th>
<th>Class Name</th>
<th>Reserve forest</th>
<th>Buffer Area</th>
<th>Total (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Area (ha)</td>
<td>Area %</td>
<td>Area (ha)</td>
</tr>
<tr>
<td>1</td>
<td>Hill Forest (Moderate to High-density)</td>
<td>21,798</td>
<td>28.70</td>
<td>14,569</td>
</tr>
<tr>
<td>2</td>
<td>Hill Forest (Low-density)</td>
<td>8,392</td>
<td>11.05</td>
<td>7,894</td>
</tr>
<tr>
<td>3</td>
<td>Bamboo Plantation</td>
<td>5,826</td>
<td>7.67</td>
<td>4,135</td>
</tr>
<tr>
<td>4</td>
<td>Banana Plantation</td>
<td>762</td>
<td>1.00</td>
<td>705</td>
</tr>
<tr>
<td>5</td>
<td>Orchard and Other Plantation</td>
<td>575</td>
<td>0.76</td>
<td>629</td>
</tr>
<tr>
<td>6</td>
<td>Shrubs with Scattered Trees</td>
<td>13,483</td>
<td>17.75</td>
<td>16,822</td>
</tr>
<tr>
<td>7</td>
<td>Agricultural Land</td>
<td>1,134</td>
<td>1.49</td>
<td>805</td>
</tr>
<tr>
<td>8</td>
<td>Shifting Cultivation (New)</td>
<td>12,964</td>
<td>17.07</td>
<td>14,537</td>
</tr>
<tr>
<td>9</td>
<td>Shifting Cultivation (Fallow)</td>
<td>9,712</td>
<td>12.79</td>
<td>6,371</td>
</tr>
<tr>
<td>10</td>
<td>Rural Settlement</td>
<td>370</td>
<td>0.49</td>
<td>446</td>
</tr>
<tr>
<td>11</td>
<td>Bare Soil</td>
<td>130</td>
<td>0.17</td>
<td>19</td>
</tr>
<tr>
<td>12</td>
<td>River and Khal</td>
<td>653</td>
<td>0.86</td>
<td>429</td>
</tr>
<tr>
<td>13</td>
<td>Lake and Ponds</td>
<td>55</td>
<td>0.07</td>
<td>457</td>
</tr>
<tr>
<td>14</td>
<td>Built up Linear</td>
<td>88</td>
<td>0.12</td>
<td>33</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>75,942</strong></td>
<td><strong>100</strong></td>
<td><strong>67,851</strong></td>
</tr>
</tbody>
</table>
LULC change: 2001-2022

<table>
<thead>
<tr>
<th>Class Name</th>
<th>2001</th>
<th>2022</th>
<th>Change (2001-2022)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hill Forest (Moderate to High-density)</td>
<td>73,884</td>
<td>42,477</td>
<td>-43%</td>
</tr>
<tr>
<td>Hill Forest (Low-density)</td>
<td>36,075</td>
<td>22,745</td>
<td>-37%</td>
</tr>
<tr>
<td>Shrubs with scattered trees</td>
<td>15,926</td>
<td>48,595</td>
<td>205%</td>
</tr>
<tr>
<td>Shifting Cultivation</td>
<td>12,191</td>
<td>23,380</td>
<td>92%</td>
</tr>
<tr>
<td>Settlement</td>
<td>927</td>
<td>1,805</td>
<td>95%</td>
</tr>
</tbody>
</table>
Condition of the Reingkhyong RF and Surrounding Landscape (USF)

Chart 1: LULC Distribution in Reinkhyang Reserved Forest

Chart 2: LULC Distribution in the 5.6 km Buffer Area of Reinkhyang Reserved Forest
Meeting with Government Officials
Surveys, FGDs and Consultations
STAKEHOLDER MAPPING

POWER / INFLUENCE

Low

High

INTEREST

Low

High

KEEP SATISFIED

High Power & Low Interest
- Circle Chief
- Hill Dist. Council
- CHT Regional Council
- Local Government

KEEP INFORMED

Low Power & High interest
- Development Partners
- CBOs
- DAE
- NGOs

MANAGE CLOSELY

High Power & High interest
- Forest Dept. Ministries
- Headmen & Karbaries
- Security Forces
- Communities

MONITOR

Low Power & Low Interest
- Settlers
- KPM
- Religious leaders
- DLS

Local Government
- Circle Chief
- CHTDB
- District Commissioner
- HLM

District
- Hill Dist. Council
- CHT Regional Council
- Local Government

High

Low
SOCIAL NETWORK ANALYSIS

✓ Who are the “power players” in the network?
✓ How resources circulate?
✓ Who performs “bridge work” between main actors?
✓ Why/When individuals or organizations do or do not collaborate with one another
Multi-level inter-institutional gaps are preventing sustainable landscape management in CHT.
Landscape Modeling Framework

1. Developing land suitability maps to justify land use interventions
2. Defining and developing land use scenarios with specific intervention types and area of allocation
3. Developing land use scenario maps
4. Management Plan

Analytical Hierarchy Process
Goal programming
Analytical Hierarchy Process

1. Define problem
2. Develop hierarchical framework
3. Construct pairwise comparison matrix
4. Perform judgment for pairwise comparisons
5. Synthesize pairwise comparisons
6. Check for consistency
7. Perform steps (3-6) for all levels in the hierarchy
8. Develop overall priority ranking
9. Select best alternative

Criteria for Determining Land Use Intervention Suitability (LUIS)
# Zonation with Areas (ha) based on LUIS from AHP

<table>
<thead>
<tr>
<th>Class Name</th>
<th>Zone 1 Least Suitable Area (ha)</th>
<th>Zone 2 Moderate Suitable (ha)</th>
<th>Zone 3 Most Suitable (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hill Forest (Moderate to High density)</td>
<td>10160.6</td>
<td>9012.8</td>
<td>2142.3</td>
</tr>
<tr>
<td>Hill Forest (Low density)</td>
<td>4063.9</td>
<td>2900.1</td>
<td>1276.1</td>
</tr>
<tr>
<td>Bamboo Forest</td>
<td>2682.0</td>
<td>2219.9</td>
<td>606.5</td>
</tr>
<tr>
<td>Banana Plantation</td>
<td>206.0</td>
<td>437.7</td>
<td>109.6</td>
</tr>
<tr>
<td>Orchard and Others Plantation</td>
<td>171.5</td>
<td>323.9</td>
<td>73.6</td>
</tr>
<tr>
<td>Degraded Forest</td>
<td>3685.0</td>
<td>7476.4</td>
<td>2087.1</td>
</tr>
<tr>
<td>Agricultural Land</td>
<td>258.9</td>
<td>529.3</td>
<td>331.2</td>
</tr>
<tr>
<td>Shifting Cultivation</td>
<td>6659.5</td>
<td>12159.2</td>
<td>3385.5</td>
</tr>
<tr>
<td>Rural Settlement</td>
<td>83.8</td>
<td>172.6</td>
<td>108.2</td>
</tr>
<tr>
<td>Bare Soil</td>
<td>40.2</td>
<td>59.4</td>
<td>29.9</td>
</tr>
<tr>
<td>River and Khal</td>
<td>207.09</td>
<td>321.97</td>
<td>324.05</td>
</tr>
<tr>
<td>Lake and Ponds</td>
<td>9.26</td>
<td>39.14</td>
<td>83.29</td>
</tr>
<tr>
<td>Built up Linear</td>
<td>24.23</td>
<td>49.53</td>
<td>34.19</td>
</tr>
</tbody>
</table>
Goal Programming

Minimize: \( Z = \sum_{i=1}^{m} (d_i^+ + d_i^-) \)

Subject to the linear constraints:

Goal constraints: \( \sum_{j=1}^{n} a_{ij} x_j - d_i^+ + d_i^- = b_i \), for \( i = 1, ..., m \)

System constraints: \( \sum_{j=1}^{n} a_{ij} x_j = b_i \), for \( i = m+1, ..., m + p \)

with \( d_i^+, d_i^-, x_j \geq 0 \), for \( i = 1, ..., m \); for \( j = 1, ..., n \)

where there are \( m \) goals, \( p \) system constraints and \( n \) decision variables

\( Z \) = objective function = Summation of all deviations

\( a_{ij} \) = the coefficient associated with variable \( j \) in the \( i^{th} \) goal

\( x_j \) = the \( j^{th} \) decision variable

\( b_i \) = the associated right hand side value

\( d_i^- \) = negative deviational variable from the \( i^{th} \) goal (underachievement)

\( d_i^+ \) = positive deviational variable from the \( i^{th} \) goal (overachievement).

Goals:

- Timber (poles/yr.) 1,000
- Fuel (ton/yr.) 4,464
- Rice (ton/yr.) 2,232
- Bamboo (culms/yr.) 100,062
- Fruit (ton/yr.) 1,116
- Vegetables (ton/yr.) 4,464
- Spice (ton/yr.) 1,116
- Carbon Séquestration (ton/ha/yr.) 100
- Canopy Cover (% land area) 90
- Annual Income (Million Tk/yr.) 30
- Ground water (mm/yr.) 1,000

System Constraints:

Available area suitable for the proposed land-use within each LULC Class
<table>
<thead>
<tr>
<th>Land use practices</th>
<th>Current Scenario (Reserve)</th>
<th>Scenario A (Balanced)</th>
<th>Land Allocation (ha)</th>
<th>Scenario B (Livelihood Centric)</th>
<th>Land Allocation (ha)</th>
<th>Scenario C (Restoration Centric)</th>
<th>Land Allocation (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hill Forest (Moderate – High Density)</td>
<td>21798</td>
<td>Existing Practice (--)</td>
<td>21798</td>
<td>--</td>
<td>21798</td>
<td>--</td>
<td>21798</td>
</tr>
<tr>
<td>Hill Forest (Low Density)</td>
<td>8392</td>
<td>ANR + Enrichment Plantation Enrichment Plantation</td>
<td>1842 2950 3600</td>
<td>ANR + Enrichment Plantation</td>
<td>392 4000</td>
<td>ANR + Enrichment Plantation</td>
<td>242 3550</td>
</tr>
<tr>
<td>Bamboo</td>
<td>5826</td>
<td>ANR for bamboo</td>
<td>1746 4080</td>
<td>--</td>
<td>0</td>
<td>ANR for bamboo</td>
<td>746 5080</td>
</tr>
<tr>
<td>Banana Plantation</td>
<td>762</td>
<td>Mixed Orchard</td>
<td>230 532</td>
<td>Mixed Orchard</td>
<td>230 532</td>
<td>Mixed Orchard</td>
<td>130 632</td>
</tr>
<tr>
<td>Orchards</td>
<td>575</td>
<td>Timber Plantation (SR) Mixed Orchard</td>
<td>170 115 290</td>
<td>Timber Plantation (SR) Mixed Orchard</td>
<td>50 100 425</td>
<td>Timber Plantation (SR) Mixed Orchard</td>
<td>70 315 190</td>
</tr>
<tr>
<td>Shrub With Scattered Trees</td>
<td>13483</td>
<td>Timber Plantation (SR) Mixed Orchard</td>
<td>2703 4040 6740</td>
<td>Mixed Orchard</td>
<td>0</td>
<td>Mixed Plantation (LR)</td>
<td>503 5413 7540</td>
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<tr>
<td>Agriculture</td>
<td>1134</td>
<td>Agroforestry</td>
<td>565 569</td>
<td>Mixed Orchard</td>
<td>765 369</td>
<td>Mixed Plantation (LR)</td>
<td>400 734</td>
</tr>
<tr>
<td>Shifting Cultivation</td>
<td>22676</td>
<td>Strip Plantation with Jhum Agroforestry Based Jhum</td>
<td>8000 7800 6876</td>
<td>Strip Plantation with Jhum</td>
<td>10070 6800 5806</td>
<td>Strip Plantation with Jhum</td>
<td>5000 9870 7806</td>
</tr>
<tr>
<td>Rural Settlements</td>
<td>370</td>
<td>Homestead Forestry</td>
<td>250 120</td>
<td>Homestead Forestry</td>
<td>370 0</td>
<td>Homestead Forestry</td>
<td>0 370</td>
</tr>
<tr>
<td>Bare land</td>
<td>130</td>
<td>Mixed Assam Bondi</td>
<td>0 0</td>
<td>Exis</td>
<td>5</td>
<td>Mixed Assam Bondi</td>
<td>0 0</td>
</tr>
</tbody>
</table>
Multi-Stakeholder Consultation Workshops
Recommended Land Use Plan for the RRF (Balanced Scenario)
### Estimated Outputs of the Proposed Land-use Plan for the RRF

<table>
<thead>
<tr>
<th>Achievement Items</th>
<th>Target</th>
<th>Expected output</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timber (poles/yr.)</td>
<td>1000</td>
<td>459</td>
<td>46</td>
</tr>
<tr>
<td>Fuel (ton/yr.)</td>
<td>4464</td>
<td>4622</td>
<td>103</td>
</tr>
<tr>
<td>Rice (ton/yr.)</td>
<td>2232</td>
<td>2448</td>
<td>110</td>
</tr>
<tr>
<td>Bamboo (culms/yr.)</td>
<td>100062</td>
<td>153862</td>
<td>154</td>
</tr>
<tr>
<td>Fruit (ton/yr.)</td>
<td>1116</td>
<td>1145</td>
<td>103</td>
</tr>
<tr>
<td>Vegetables (ton/yr.)</td>
<td>4464</td>
<td>3930</td>
<td>88</td>
</tr>
<tr>
<td>Spice (ton/yr.)</td>
<td>1116</td>
<td>2409</td>
<td>216</td>
</tr>
<tr>
<td>Carbon Séquestration (ton/ha/yr.)</td>
<td>100</td>
<td>73</td>
<td>73</td>
</tr>
<tr>
<td>Canopy Cover (% land area)</td>
<td>90</td>
<td>67</td>
<td>74</td>
</tr>
<tr>
<td>Annual Income (Million Tk/yr.)</td>
<td>30</td>
<td>28</td>
<td>93</td>
</tr>
<tr>
<td>Ground water (mm/yr.)</td>
<td>1000</td>
<td>631</td>
<td>63</td>
</tr>
</tbody>
</table>

**Estimated Net Carbon Sequestration Potential over a Period of 20 Years:**

- **Recommended land-use:** 669.02 - 672.09 Ggr CO$_2$
- **Business as Usual:** 86.58 Ggr CO$_2$
- **Additional:** 582.44 - 585.51 Ggr CO$_2$

(Calculations made using “IPCC Inventory Software” version 2.691)
Recommended Land Use Plan for 5-Km Buffer Zone of RRF (Balanced Scenario)
## Restoration plan for the buffer zone of RRF (USF lands)

<table>
<thead>
<tr>
<th>LULC Class</th>
<th>Area (Ha)</th>
<th>Prescribed Land Use</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hill Forest (Moderate to High density)</td>
<td>14,569</td>
<td>Existing Practice</td>
<td>14,569</td>
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<tr>
<td>Hill Forest (Low Density)</td>
<td>7,894</td>
<td>Assisted Natural Regeneration (ANR) + Enrichment Plantation (ENP)</td>
<td>4,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bamboo plantation</td>
<td>3,402</td>
</tr>
<tr>
<td>Bamboo</td>
<td>4,135</td>
<td>ANR for bamboo</td>
<td>4,135</td>
</tr>
<tr>
<td>Banana Plantation</td>
<td>705</td>
<td>Mixed Orchard</td>
<td>500</td>
</tr>
<tr>
<td>Orchards</td>
<td>629</td>
<td>Existing Practice</td>
<td>151</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Timber Plantation (Short rotation)</td>
<td>203</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mixed Orchard</td>
<td>275</td>
</tr>
<tr>
<td>Degraded Hill Forest</td>
<td>16,822</td>
<td>Mixed Orchard</td>
<td>8,500</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bamboo plantation</td>
<td>8,322</td>
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<tr>
<td>Agriculture</td>
<td>805</td>
<td>Existing Practice</td>
<td>665</td>
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<tr>
<td></td>
<td></td>
<td>Mixed Orchard</td>
<td>140</td>
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<tr>
<td>Shifting Cultivation</td>
<td>20,908</td>
<td>Existing Practice</td>
<td>11,070</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Boundary Plantation with Jhum</td>
<td>7,800</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Agroforestry Based Jhum</td>
<td>2,038</td>
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<tr>
<td>Rural Settlements</td>
<td>446</td>
<td>Existing Practice</td>
<td>446</td>
</tr>
<tr>
<td>Bare land</td>
<td>19</td>
<td>Agroforestry</td>
<td>19</td>
</tr>
<tr>
<td><strong>Total (ha)</strong></td>
<td><strong>66,932</strong></td>
<td><strong>Existing Practice</strong></td>
<td><strong>66,932</strong></td>
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</tbody>
</table>
### Expected Outputs of the Proposed Land Use Plan for the Buffer Zone of RRF

<table>
<thead>
<tr>
<th>Achievement Items</th>
<th>Target (Buffer)</th>
<th>Achievement</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timber (poles/yr.)</td>
<td>800</td>
<td>1360</td>
<td>170</td>
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<tr>
<td>Fuel (ton/yr.)</td>
<td>5000</td>
<td>11321</td>
<td>226</td>
</tr>
<tr>
<td>Rice (ton/yr.)</td>
<td>3000</td>
<td>2524</td>
<td>84</td>
</tr>
<tr>
<td>Bamboo (culms/yr.)</td>
<td>100000</td>
<td>213524</td>
<td>214</td>
</tr>
<tr>
<td>Fruit (ton/yr.)</td>
<td>1000</td>
<td>1000</td>
<td>100</td>
</tr>
<tr>
<td>Vegetables (ton/yr.)</td>
<td>5000</td>
<td>4672</td>
<td>93</td>
</tr>
<tr>
<td>Spices (ton/yr.)</td>
<td>1000</td>
<td>2780</td>
<td>278</td>
</tr>
<tr>
<td>Carbon Séquestration (ton/ha/yr.)</td>
<td>40</td>
<td>42</td>
<td>105</td>
</tr>
<tr>
<td>Canopy Cover (% land area)</td>
<td>50</td>
<td>43</td>
<td>86</td>
</tr>
<tr>
<td>Annual Income (Million/yr.)</td>
<td>50</td>
<td>26.5</td>
<td>53</td>
</tr>
<tr>
<td>Ground water (mm/yr.)</td>
<td>800</td>
<td>467</td>
<td>58</td>
</tr>
</tbody>
</table>

**Estimated Net Carbon Sequestration Potential over a Period of 20 Years:**

- **Recommended land-use:** 874.37 - 876.94 Ggr CO₂
- **Business as Usual:** 78.54 Ggr CO₂
- **Additional:** 795.83 - 798.40 Ggr CO₂

(Calculations made using “IPCC Inventory Software” version 2.691)
Guidelines Provided for the Implementation of the Recommended Management Plan for the RRF and its Buffer Zone

1. Preparation of Site-Specific Plan
2. Community Organizing & Formation of Forest Conservation Committees (FCC)
3. Community Training and Awareness Raising
4. Development of Communication Strategy
5. Local Community Motivation Plan
6. Seedling Supply System
7. Plantation Maintenance
8. Forest Protection
9. Biodiversity and Wildlife Conservation
10. Benefit Sharing Arrangement
11. Transportation Facilities
12. Livelihood Development
13. Organizational Set-up for Restoration Program Management
14. Engagement of NGOs
15. Collaboration with Other Agencies
16. Emergency Response
17. Mitigation of Risks and Challenges
18. Implementation Schedule
19. Monitoring Indicators
20. Cost estimate

Estimated cost for 5 years (for RRF): BDT 47,38.61 crore (90.52% for restoration activities, 4.44% for stakeholders’ capacity building, and 5.04% for community development (livelihood and common facilities).

Economic efficiency and viability: NPV (@ 12% discount rate) = BDT 2,343.13, BCR = 1.31; IRR = 21.46%.
Lessons Learned

1. Interest for FLR is high among the key stakeholders.
2. Illegal occupants in RF lands are willing to cooperate with FD in forest restoration in lieu of security of tenure over certain amount of land under their possession.
3. Planning through a combination of modern scientific tools, local knowledge and community participation provides effective models for FLR.
4. Engagement of local youths as volunteers (YCVs) and establishment of community-based program implementation committees (PICs) with necessary capacity building is the key to successful implementation of FLR program in CHT.
5. Degraded hill forests in CHT still has good natural regeneration ability. So, a combination of ANR and enrichment planting (≤500 seedlings) may provide successful restoration.
6. Agroforestry in jhum fields is the most preferred FLR option to the CHT communities and it encourages their participation in restoration interventions in other LULC classes.
7. Establishment of seedling supply system for native tree species is a critical factor for successful implementation of restoration plan.
8. For short-term income generation, rearing of local poultry with improved management practices and cultivation of vegetables in trellises are very effective.
9. Awareness raising among social and religious leaders and campaigns involving schoolchildren and college students facilitates community participation in participatory FLR activities.
10. Oversight role of the concerned government agencies, local government institutions, and community leaders is essential for successful implementation of community-based FLR programs.
Challenges

1. Complex governance of USF lands, difficult working conditions, law & order situation.
2. Rapid transition from traditional jhum to horticultural farming.
4. Encroachment in Reserved Forests (around 3,000 households in Farua Range of RRF)
5. Use of agrochemicals in orchards and crop fields in the watershed ecosystem - detrimental to public health and for aquatic and amphibian animals.
6. Lack of (or insufficient) availability of seedlings of endangered native tree species in CHT
7. Quarrying of stones from the streams and canals
8. Lack of coordination among different agencies associated with NRM and livelihood development (horticultural expansion vs. forest conservation is a key issue).
9. Widespread forest fire associated with land preparation for jhum cultivation.
10. Bamboo forests are decreasing in CHT since KPM has stopped procuring bamboo. Local communities are converting the bamboo forests to jhum fields or fruit orchards.
Way Forward

1. Strengthening community-based restoration efforts by BFD involving other stakeholders.
2. Community awareness raising about negative impacts of short-rotation jhum, stone quarrying from the stream beds and hunting of wild animals, etc. and about improved land use options.
3. Capacity development of the stakeholders including increasing staff strength of BFD and technical skills of the hill farmers in sustainable and climate smart agricultural practices.
4. Strengthening forest extension services by BFD and NGOs, including training and advice to private nurseries for production of quality planting materials of local trees species.
5. Strengthening coordination between District Administration, BFD, DAE, Hill District Councils and CHTDB in planning, implementation, monitoring and evaluation of development projects.
6. Creating and supporting youth volunteer groups for community-based forest and biodiversity conservation activities.
7. Creation of new VCFs through joint initiative by BFD, Hill District Councils and district civil administration involving mauza headmen and para karbaries (village heads).
8. The community-based (collaborative) forest management system and the landscape restoration plan developed under the PROGREEN activity should be piloted in RRF and other RFs.
9. Efforts to be strengthened by higher levels of the government to resolve the land settlement issues and effective coordination among different agencies in CHT.
1st South Asian Conference 2023
UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENERIO
Social Science Faculty, Dhaka University, Bangladesh
26th November, 2023

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Center for Atmospheric Pollution Studies
DIU
Faculty Graduate Studies
A Review on the status of Fish Diversity and Its Degradation in Cholon Beel

Farjana Khatun and Ummul Khayer Salma Keya

Institute of Remote Sensing and GIS, Jahangirnagar University, Savar, Dhaka, 1342, Savar, Bangladesh
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- Introduction
- Background of the study
- Objectives of the study
- Methods and methodology
- Result and discussion
- Conclusion
- References
Introduction

❖ The Chalan beel is a large low-lying wetland area in Bangladesh, located between the Barind tract and the Ganges river flood plains.
❖ It is the largest beel in the country and covers an area of 375 km² during the monsoon season and 52-78 km² during the dry season.
❖ The Chalan beel was formed when the Old Brahmaputra diverted its water into the new channel of the Jamuna.
❖ It is a confluence for numerous smaller water ways and is drained by channels that flow south, eventually discharging into the Padma and Brahmaputra.
The Chalan beel is enriched with fish diversity, with 260 species of freshwater indigenous fin fish belonging to 55 families.

This fish diversity is degrading due to habitat degradation and overexploitation.

This degradation is primarily driven by increased siltation rates, construction of flood control embankments and roads, uncontrolled pesticide usage, excessive removal of surface water, and unregulated discharge of untreated industrial and aquafarm effluents.

The Chalan beel plays a vital role in the agro-based economy of Bangladesh and is directly dependent on the livelihood of many people.
Objective of the study

The objectives of this study were,

➢ Assessment of the fish diversity in Chalan beel
➢ Assessment of the causes of fish diversity degradation in Chalan beel.
Methods and methodology

Research Design:

1. Problems identification and Title selection
2. Study area selection
3. Fixed objectives
4. Literature Review
5. Data collection
6. Data analysis
7. Result and discussion
8. Present the research paper
Methods and methodology

Data Collection Methods:

❖ This study was performed through obtaining information from secondary literatures.
❖ The literature search was conducted with internet browsing from Google Scholar data base, Sciencedirect.com, Research gate data base and the university library database.
❖ The research papers related to the fish diversity of Chalan beel were downloaded using suitable search terms (Chalan beel, fish diversity, diversity indices of Chalan beel, degradation of fish diversity etc).
❖ We found some papers relevant to the fish diversity and the degradation of fish diversity of Chalan beel.
❖ The numbers of studies were 32 papers for this work.
Methods and methodology

Data Analysis techniques:

❖ The data for the assessment of fish diversity in Chalan beel was analyzed using published papers.
❖ A complete list of order and family-based fish species was prepared.
❖ An order-based relative abundance of fish species was calculated using the formula.
❖ An order-based distribution and seasonal availability of fish species was also calculated.
❖ Fish diversity indices were prepared using the Shannon-Weiner index and compared with the diversity indices prepared by Siddique et al. (2016).
❖ The study also assessed the causes of fish diversity degradation in Chalan beel through data and information collection through several published papers.
### Fish diversity data from different sources:

<table>
<thead>
<tr>
<th>Sources</th>
<th>Species</th>
<th>Order</th>
<th>Family</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hossain et al., 2009</td>
<td>114</td>
<td>9</td>
<td>29</td>
</tr>
<tr>
<td>Kostori et al., 2011</td>
<td>82</td>
<td>10</td>
<td>22</td>
</tr>
<tr>
<td>Siddique et al. 2016</td>
<td>78</td>
<td>10</td>
<td>26</td>
</tr>
<tr>
<td>Rahman et al. 2017</td>
<td>66</td>
<td>8</td>
<td>23</td>
</tr>
<tr>
<td>Mohsin et al., 2009</td>
<td>81</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>
### Result and discussion

Status of order based fish species abundant and seasonal availability in Chalan beel according to Kostori et al. (2011) and Rahman et al. (2017):

<table>
<thead>
<tr>
<th>Order</th>
<th>Scientific name</th>
<th>Local name</th>
<th>Abundance</th>
<th>Seasonal availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beloniformes</td>
<td><em>Xenentodon cancila</em></td>
<td>Kakila</td>
<td>C</td>
<td>M</td>
</tr>
<tr>
<td>Channiformes</td>
<td><em>Channa punctatus</em></td>
<td>Taki</td>
<td>VC</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td><em>C. orientalis</em></td>
<td>Chaitan</td>
<td>C</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td><em>C. gachua</em></td>
<td>Cheng</td>
<td>C</td>
<td>W</td>
</tr>
<tr>
<td>Clupeiformes</td>
<td><em>Corica soborna</em></td>
<td>Kachki</td>
<td>C</td>
<td>PM</td>
</tr>
<tr>
<td></td>
<td><em>Gudusia chapra</em></td>
<td>Chapila</td>
<td>VC</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td><em>G. variegate</em></td>
<td>Hilsha</td>
<td>F</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td><em>Setipinna phasa</em></td>
<td>Phasa</td>
<td>R</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td><em>S. taty</em></td>
<td>Teli phasa</td>
<td>R</td>
<td>M</td>
</tr>
</tbody>
</table>
## Result and discussion

<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
<th>Location</th>
<th>Gender</th>
<th>Size</th>
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</thead>
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<td><em>Botia dayi</em></td>
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<td>W</td>
</tr>
<tr>
<td></td>
<td><em>B. lohachata</em></td>
<td>Beti</td>
<td>R</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td><em>Lepidocephalichthys guntea</em></td>
<td>Gutum</td>
<td>VC</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td><em>L. berdmorei</em></td>
<td>Puiya</td>
<td>R</td>
<td>A</td>
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<tr>
<td></td>
<td><em>Acanthophthalmus pangia</em></td>
<td>Balichata</td>
<td>F</td>
<td>A</td>
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<tr>
<td></td>
<td><em>Nemachilus botia</em></td>
<td>Shavon</td>
<td>R</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td><em>N. savona</em></td>
<td>Khorka</td>
<td>R</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td><em>Amblypharyngodon microlepis</em></td>
<td>Moya</td>
<td>VC</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td><em>Aspidoparia jaya</em></td>
<td>Mola</td>
<td>F</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td><em>A. morar</em></td>
<td>Piale</td>
<td>F</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td><em>Cirrhinus reba</em></td>
<td>Morar piale</td>
<td>F</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td><em>Labeo bata</em></td>
<td>Rayek</td>
<td>F</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td><em>L. gonius</em></td>
<td>Bata</td>
<td>F</td>
<td>M</td>
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</table>
## Result and discussion

<table>
<thead>
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<th>Species</th>
<th>Location</th>
<th>Sex</th>
<th>Abbreviation</th>
</tr>
</thead>
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<tr>
<td><strong>L. boga</strong></td>
<td>Bhangon</td>
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<td>M</td>
<td></td>
</tr>
<tr>
<td>Osteobrama cotio</td>
<td>Moa</td>
<td>F</td>
<td>M</td>
<td></td>
</tr>
<tr>
<td><strong>Puntius chola</strong></td>
<td>Chola punti</td>
<td>VR</td>
<td>M</td>
<td></td>
</tr>
<tr>
<td><strong>P. conchonius</strong></td>
<td>Kanchan punti</td>
<td>F</td>
<td>PM</td>
<td></td>
</tr>
<tr>
<td><strong>P. phutunio</strong></td>
<td>Futani puti</td>
<td>VC</td>
<td>W</td>
<td></td>
</tr>
<tr>
<td><strong>P. sarana</strong></td>
<td>Shor punti</td>
<td>F</td>
<td>PM</td>
<td></td>
</tr>
<tr>
<td>Rasbora rasbora</td>
<td>Leaza darika</td>
<td>C</td>
<td>M</td>
<td></td>
</tr>
<tr>
<td><strong>P. sophore</strong></td>
<td>Jat punti</td>
<td>R</td>
<td>PM</td>
<td></td>
</tr>
<tr>
<td><strong>P. ticto</strong></td>
<td>Tit punti</td>
<td>VC</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td><strong>P. terio</strong></td>
<td>Teri punti</td>
<td>VC</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Chela cachius</td>
<td>Chap chela</td>
<td>F</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td><strong>C. laubuca</strong></td>
<td>Kash khaira</td>
<td>C</td>
<td>PM</td>
<td></td>
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<td>Salmostoma bacaila</td>
<td>Katari chela</td>
<td>F</td>
<td>PM</td>
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<td>Phul chela</td>
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<td><strong>S. gora</strong></td>
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<td><strong>Cyprinodontiformes</strong></td>
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<td><strong>Kan pona</strong></td>
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### Result and discussion

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<td>Sada guchi</td>
<td>VC</td>
<td>M</td>
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<tr>
<td><strong>Perciformes</strong></td>
<td><strong>Anabas testudineus</strong></td>
<td><strong>Koi</strong></td>
<td><strong>C</strong></td>
<td><strong>W</strong></td>
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<tr>
<td></td>
<td><strong>Badis badis</strong></td>
<td><strong>Napti koi</strong></td>
<td><strong>VR</strong></td>
<td><strong>W</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Colisa fasciata</strong></td>
<td><strong>Bari kholisa</strong></td>
<td><strong>C</strong></td>
<td><strong>W</strong></td>
</tr>
<tr>
<td></td>
<td><strong>C. sota</strong></td>
<td><strong>Kholisa</strong></td>
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<tr>
<td></td>
<td><strong>C. lalia</strong></td>
<td><strong>Lal kholisa</strong></td>
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<td><strong>Glossogobius giuris</strong></td>
<td><strong>Baila</strong></td>
<td><strong>F</strong></td>
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<td></td>
<td><strong>Chanda nama</strong></td>
<td><strong>Sada chanda</strong></td>
<td><strong>VC</strong></td>
<td><strong>PM</strong></td>
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<td></td>
<td><strong>Nandus nandus</strong></td>
<td><strong>Bheda</strong></td>
<td><strong>F</strong></td>
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### Result and discussion

<table>
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<th>Tetradontiformes</th>
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<tr>
<td><em>Mystus vittatus</em></td>
<td><em>Tetraodon notopterus</em></td>
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<tr>
<td><em>Gulsa tengra</em></td>
<td><em>Potka</em></td>
</tr>
<tr>
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<td><em>F</em></td>
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<td><em>A</em></td>
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<tr>
<td><em>M. tengara</em></td>
<td><em>T. patoca</em></td>
</tr>
<tr>
<td><em>Chutta tengra</em></td>
<td><em>F</em></td>
</tr>
<tr>
<td><em>VC</em></td>
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<td><em>M. menoda</em></td>
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<tr>
<td><em>Gang Magur</em></td>
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<td><em>R</em></td>
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<td><em>Chandramara chandramara</em></td>
<td><em>Magur</em></td>
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<tr>
<td><em>Tengra</em></td>
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<td><em>Cenia</em></td>
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<td><em>R</em></td>
<td><em>W</em></td>
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<tr>
<td><em>Ompok pabda</em></td>
<td><em>Baspata</em></td>
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<tr>
<td><em>Pabda</em></td>
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<td><em>F</em></td>
<td><em>W</em></td>
</tr>
<tr>
<td><em>A</em></td>
<td></td>
</tr>
<tr>
<td><em>O. bimaculatis</em></td>
<td><em>Kajuli</em></td>
</tr>
<tr>
<td><em>Kani</em></td>
<td><em>F</em></td>
</tr>
<tr>
<td><em>M</em></td>
<td><em>W</em></td>
</tr>
<tr>
<td><em>A</em></td>
<td></td>
</tr>
<tr>
<td><em>Chaca chaca</em></td>
<td><em>Chega</em></td>
</tr>
<tr>
<td><em>Chega</em></td>
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<td><em>M</em></td>
<td><em>W</em></td>
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<tr>
<td><em>A</em></td>
<td></td>
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<tr>
<td><em>Clarias batrachus</em></td>
<td><em>Magur</em></td>
</tr>
<tr>
<td><em>Magur</em></td>
<td><em>C</em></td>
</tr>
<tr>
<td><em>M</em></td>
<td><em>A</em></td>
</tr>
<tr>
<td><em>A</em></td>
<td></td>
</tr>
<tr>
<td><em>Clupisoma garua</em></td>
<td><em>Gharia</em></td>
</tr>
<tr>
<td><em>Gharia</em></td>
<td><em>F</em></td>
</tr>
<tr>
<td><em>W</em></td>
<td></td>
</tr>
<tr>
<td><em>A</em></td>
<td></td>
</tr>
<tr>
<td><em>Silonia silondia</em></td>
<td><em>Silong</em></td>
</tr>
<tr>
<td><em>Silong</em></td>
<td><em>VR</em></td>
</tr>
<tr>
<td><em>W</em></td>
<td></td>
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<tr>
<td><em>A</em></td>
<td></td>
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<tr>
<td><em>Ailia colia</em></td>
<td><em>Baspata</em></td>
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<tr>
<td><em>Baspata</em></td>
<td><em>F</em></td>
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<td><em>W</em></td>
<td></td>
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<tr>
<td><em>A</em></td>
<td></td>
</tr>
<tr>
<td><em>Ailiichthys punctate</em></td>
<td><em>Kajuli</em></td>
</tr>
<tr>
<td><em>Kajuli</em></td>
<td><em>F</em></td>
</tr>
<tr>
<td><em>W</em></td>
<td></td>
</tr>
<tr>
<td><em>A</em></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** VR=very rare, R=Rare, VC=Very common, C=Common, M= Monsoon, PM= Post Monsoon, A= All season, W=Winter (Kostori et al., 2011; Rahman et al., 2017)
Result and discussion

Figure: Order based distribution of fish species in Chalan beel

- Siluriformes
- Channiformes
- Beloniformes
- Oteglosiformes
- Clupeiformes
- Tetradontiformes
- Cyprindontiformes
- Cypriniformes
- Perciformes
Result and discussion

Relative abundance of fish species

Among the fish species, 43.86% are common, 21.66% are rare, 15.34% are very common and 19.14% are very rare.
Result and discussion

Seasonal availability of fish species

Winter is the most dominant season on the basis of seasonal availability of the fish species that occupies 31.89% followed by Post Monsoon 23.19% and Monsoon 17.39%. About 27.53% species are found throughout the year.
Result and discussion

Fish diversity indices (Shannon-Weiner, 1949) at different locations of Chalan beel

<table>
<thead>
<tr>
<th>Location</th>
<th>Monsoon</th>
<th>Post Monsoon</th>
<th>Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bhangura</td>
<td>2.4</td>
<td>2.8</td>
<td>3.2</td>
</tr>
<tr>
<td>Atrai</td>
<td>2.6</td>
<td>3.0</td>
<td>3.2</td>
</tr>
<tr>
<td>Chatmohar</td>
<td>2.6</td>
<td>2.8</td>
<td>3.0</td>
</tr>
<tr>
<td>Tarash</td>
<td>2.8</td>
<td>2.6</td>
<td>2.4</td>
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</tbody>
</table>

Season: Monsoon, Post Monsoon, Winter
Result and discussion

Fish production trends in Chalan beel over time

<table>
<thead>
<tr>
<th>Year</th>
<th>Fish production (MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982</td>
<td>30000</td>
</tr>
<tr>
<td>1987</td>
<td>25000</td>
</tr>
<tr>
<td>1992</td>
<td>20000</td>
</tr>
<tr>
<td>1997</td>
<td>15000</td>
</tr>
<tr>
<td>2002</td>
<td>10000</td>
</tr>
<tr>
<td>2006</td>
<td>5000</td>
</tr>
<tr>
<td>2011</td>
<td>0</td>
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## Result and discussion

### Responsible key factors for the degradation of Chalan beel fisheries

<table>
<thead>
<tr>
<th>Area</th>
<th>Key factors</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gumani river, Gurudaspur, Natore, Baral river, Chatmohar, Pabna Katagang river, Tarash, Sirajganj</td>
<td>Habitat degradation and over exploitation</td>
<td>Hossain et al., 2009</td>
</tr>
<tr>
<td>Adjacent upazilas of Chalan beel (Gurudaspur, Tarash, Ullahpara, Chatmohar, Bhangura, Atrai)</td>
<td>Increased siltation rates, discharge of untreated effluents, usage of harmful pesticides and chemical fertilizers, construction of flood control roads and embankments</td>
<td>Shahnaz, 2005</td>
</tr>
</tbody>
</table>
## Result and discussion
### Responsible key factors for the degradation of Chalan beel fisheries

<table>
<thead>
<tr>
<th>Area</th>
<th>Key factors</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surrounding upazilas of Chalan beel (Gurudaspur, Singra, Baraigram, Chatmohar, Bhangura, Tarash, Ullahpara, Atrai)</td>
<td>Resudues of harmful pesticides, usage of harmful modern fishing gears</td>
<td>Sayeed et al., 2015</td>
</tr>
<tr>
<td>Natore Sadar, Singra, Gurudaspur, Baraigram</td>
<td>Indiscriminate small catching of fishes</td>
<td>Sultana and Islam, 2016</td>
</tr>
<tr>
<td>Gumani river, Gurudaspur, Natore Baral river, Chatmohar, Pabna Katagang river, Tarash, Sirajganj</td>
<td>Usage of excessive banned pesticides</td>
<td>Hossain and Halder, 1996</td>
</tr>
</tbody>
</table>
Result and discussion

Comparison of fish diversity indices of Chalan beel with Siddique et al. (2016)

<table>
<thead>
<tr>
<th>Season</th>
<th>Fish diversity indices from this study</th>
<th>Fish diversity indices from Siddique et al. (2016)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monsoon</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Post Monsoon</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Winter</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
Result and discussion

Trends of fish production and pesticide usage in Chalan beel (Sayeed et al., 2015)
Major findings

The major findings of this study are mentioned below:

❖ 66 native fish species were found in Chalan beel under 23 families and 9 orders. Among them, Cypriniformes was found to be the most dominant order. Among the species, 19.14% was very rare on the basis of relative abundance of the fish species. Winter was found to be the most dominant season on the basis of seasonal availability of fish species in Chalan beel.

❖ The Shannon-Weiner diversity index value, $H'$ falls between 2.40 to 3.05 at different locations of Chalan beel during the time period June, 2014 to December, 2016. Highest species richness was found as 3.04 at Atrai during Post Monsoon and the lowest value was found as 2.44 at Chatmohar during Monsoon.

❖ The fish diversity of Chalan beel is degrading day by day. Gradual habitat degradation through discharging of untreated effluents, uncontrolled usage of chemical fertilizers and pesticides and indiscriminate killing of immature fish species as well as overexploitation are the key factors for the degradation of the fish species of Chalan beel.
Conclusion

❖ This study informs about 66 native fish species in Chalan beel.

❖ The number is not quite satisfactory with respect to the total number of freshwater fish species (260) found in Bangladesh.

❖ The value of Shannon-Weiner diversity indices, H’ indicates moderate richness of fish species at different locations of Chalan beel area during the time period June, 2014 to December 2016.

❖ The fish diversity of Chalan beel is notably degrading day by day with the increasing rate of overexploitation, uncontrolled usage of pesticides and chemical fertilizers, discharge of untreated effluents and indiscriminate killing of premature fish species.

❖ The list of existing fish species and their conservation status needs to be updated on a regular basis for the future management of fish diversity in Chalan beel.

❖ Necessary steps should also be taken to restrict fishing during the reproductive season of fish species.
References:


References:


References:


References:


References:


1st South Asian Conference 2023
UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENERIO
Social Science Faculty, Dhaka University, Bangladesh
26th November, 2023
Environmental Education for Nature-based Solutions

Anusree Ghosh, Nahid Morshed, Tapas Ranjan Chakraborty, Moniruzzaman Khan and Dr. Liakath Ali

Climate Change Programme, BRAC
• For the fragile ecosystem, Nature-based Solutions are the most required climate action.

• The fast development growth interferes the environmental well-being, to minimize the environmental risks holistic management along with sustainable use of natural resources is necessary.

• Key goals of environmental education as awareness, knowledge, attitude, skills and participation (UNESCO, 1997).

• There is a need to bring a change in the knowledge, attitude and practices to recognize the significance of the environment which depends on the survival of the human race and ecology (CEE, 2013)
Background of the study

• BRAC initiated a mangrove plantation on the Mirsarai coast of Chattogram. A newly accredited 22 hectares of land has been planted by 72000 saplings, there is natural growth of mangroves observed.

• Environmental Education in 10 Schools in Mirsarai and 3 Schools in Chattogram City Corporation.

• Objective the environmental education:
  • Students understand the cause and impact of climate change;
  • Understand the importance of plantation and ecosystem value;
  • Describe the importance of Nature-based Solutions
Objective of the study

• To identify an easy and effective arrangement of environmental education for secondary-level students that will make them active towards Nature-based Solutions;

by, detailing the environmental education intervention of the Climate Change Programme, BRAC
Method and Methodology

• Analyzing the process of developing the environmental education method and materials;
• Learning impact review;
• State of engagement of the students in the learning process;
• Feedback of the faculty members.
## Result and discussion

### State of Env. Education Bangladesh

<table>
<thead>
<tr>
<th>Class</th>
<th>Book</th>
<th>Chapter</th>
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<tr>
<td>SIX</td>
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<td>04 Agriculture and Climate</td>
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<tr>
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<td>03 Bangladesh in The Global Geographical Environment</td>
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<td></td>
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<td>Science</td>
<td>14 Environmental Balance and Our Life</td>
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<tr>
<td>SEVEN</td>
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<td>04 Agriculture and Climate</td>
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<td>14 Change of Climate</td>
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<tr>
<td>EIGHT</td>
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<td>04 Agriculture and Climate</td>
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# State of Env. Education Bangladesh

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<td>Biology</td>
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<td>02 Water for Life</td>
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<td></td>
<td>06 Polymer</td>
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<td></td>
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<td>08 Our Resources</td>
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<td>09 Living with Disaster</td>
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<td>01 Geography and Environment</td>
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<td>05 Atmosphere</td>
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<td>09 Resources and Economic Activities</td>
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<td>10 Geographical Description of Bangladesh</td>
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<td></td>
<td></td>
<td>11 Resources and Industries of Bangladesh</td>
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<tr>
<td></td>
<td></td>
<td>13 Development Activities &amp; Environmental Balance</td>
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<tr>
<td></td>
<td>Bangladesh and Global Studies</td>
<td>04 Land and Climate of Bangladesh</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>Agriculture Studies</td>
<td>06 Forestry</td>
</tr>
</tbody>
</table>
State of Env. Education Bangladesh

Text Book
In Secondary Schools
State of Non-formal Env. Education

NGOs

- Bangladesh POUŞH
- AOSED
- Bangladesh Centre for Advanced Studies
- Ain o Salish Kendro
- CAMPE
Env Education Content Development and Learning Method

Textbook content → NbS Action required knowledge on...

No formal Environmental Education

Learning method:
- Time available
- Communication
- Budget

Environmental Education Curriculum:
- Flipchart
- Rapid Reader
- Day Celebration
- Club
Learning by Day celebration

Celebrating World Environment Day, 5 June in Chattogram

Chattogram Government Girls High School

Dr. Khastagir Government Girls' High School

- I will plant more trees and will take care of those.
- Prevent the misuse of water.
- Plant more trees and increase the number of trees.
- I hope to avoid plastic.
- I will plant trees and will protest people cutting trees.
- I will plant trees in my Verandah and yard.
- I will not through garbage, I will put it in a specific space.
- I will protest the misuse of water.
Learning by Day celebration

- I will plant more trees and will take care of those.
- Prevent the misuse of water.
- Plant more trees and increase the number of trees.
- I hope to avoid plastic.
- I will plant trees and will protest people cutting trees.
- I will plant trees in my Verandah and yard.
- I will not through garbage, I will put it in a specific space.
- I will protest the misuse of water.

Fast, short time, more students, linking with external, action-driven, cost-effective, Authorities willing
Short time, a small group of students, one way mostly, moderate cost, orientation of teacher
Rapid Reader

Self-reading
~40 min of reading
4 Chapter
  Our Environment
  Climate Change
  Mangrove Plantation to cope with Climate Change
  Climate Change and Wise use of water
Pictorial

Material development takes time, expensive, easy to read, wider coverage, less human resource effort, not a new/additional to students, not-time bound
Environmental Club

Environmental Club in William Carey Academy

Time requirement is high, close supervision, needs action to keep active
Result and discussion

• Though the textbook curriculum has covered the elements of environment, ecosystem and climate change the non-formal or co-curricular education on environment will make the students more pro-active towards climate action.

• According to the two-third secondary level student plantation is the best climate action whereas the rest assumed that is waste management.

• No significant variance in suggested actions was found in urban and rural contexts.

• Understanding Nature-based Solutions requires the understanding of energy flow in the process of ecosystem and environment.
Env. Edu for NbS

Climate Action: cause, effect, adaptation, mitigation
DRR: hazards, preparedness
Economic & Social Dev.: income generation
Human health: Medicinal plant, pollution control
Food security: Pollination
Water security: Rain, ground water, water conservation
Env & Biodiversity: Carrying capacity, Food chain

Adopt a tree/ plantation, 3R, Water conservation
Conclusion

- Towards climate action (specifically for Nature-based Solutions) environmental Education can play a very important role;
- South Asian experiences with Nature-based Solutions by mangrove vegetation can help in developing the learning materials.
- Since the native language in Sundarbans areas is the same there is the scope of using a unique “ParibhAshA” for the Bangla language.
Acknowledgments

The authors would like to thank HSBC Bank and Chattogram WASA for being partners of the environmental education intervention.
References


Thank you!
1st South Asian Conference 2023

UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENARIO

Social Science Faculty, Dhaka University, Bangladesh

26th November, 2023
Soil Carbon Stock and CO2 mitigation potential and impact on environment in the Ratargul Swamp Forest of Sylhet, Bangladesh

Presented by
Sahanaz Popy
Umme Hani Asha

Department of Environmental Science and Resource Management
Mawlana Bhashani Science and Technology University, Tangail-1902
Carbon stock in soils is a climate change-mitigating agent, based on the assumption that the movement, or flux, of carbon from the air to the soil can be increased while the release of carbon from the soil back to the atmosphere is decreased.

Figure 1. Ratargul Swamp Forest
Forests comprise the largest C pool of all terrestrial ecosystems and the annual gross exchange of CO₂ between forests and the atmosphere exceeds the anthropogenic release of CO₂ due to the combustion of fossil fuels more than seven times.

Obviously, forest C dynamics cannot be ignored when ways to mitigate climate change are sought.

Ratargul swamp forest is the only terrestrial reserve forest in Bangladesh enriched with biodiversity.
Objectives

➢ To determine the concentration of carbon in the sediment of the Ratargul swamp forest.

➢ To determine the physicochemical property of the sediment of the Ratargul swamp forest.

➢ To determine the CO_2_ mitigation potential of the forest land.
Methodology

- Literature review
- Sample collection
- Data collection
- Process parameter analysis
- Statistical analysis
Figure 2. Collection of sediment from Ratargul swamp forest.
Figure 3. Sampling location of Ratargul swamp forest.
Figure 8. Total Nitrogen was determined by Kjeldahl method.
### Result and Discussion

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Mean ± Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total organic carbon</td>
<td>0.52 ± 0.12</td>
</tr>
<tr>
<td>Soil organic matter</td>
<td>0.83 ± 0.20</td>
</tr>
<tr>
<td>Total nitrogen</td>
<td>0.07 ± 0.019</td>
</tr>
<tr>
<td>Soil carbon sequestration</td>
<td>1.98 ± 0.553</td>
</tr>
<tr>
<td>CO$_2$ mitigation potential</td>
<td>6.50 ± 1.53</td>
</tr>
</tbody>
</table>
Total Organic Carbon

Sampling stations

Top soil  Sub soil

Sampling Stations
Soil Organic Matter (SOM)

Sampling stations
- Top soil
- Sub soil

Sampling Stations
Total Nitrogen

Total nitrogen (%)

Sampling stations

Top soil  Sub soil
Soil Carbon Stock (SOC)

Sampling stations

- Top soil
- Sub soil

Soil carbon stock (t/ha)
CO$_2$ Mitigation Potential

CO$_2$ mitigation potential (t/ha)

Sampling stations

Top soil  Sub soil
Key findings

❖ Total organic carbon (TOC) ranged from 0.34 to 0.69%.

❖ Soil organic matter (SOM) recorded between 0.61 to 1.19%.

❖ Total nitrogen (TN) ranged from 1.35 to 2.54 t/ha.

❖ Soil carbon sequestration varied from 4.95 to 8.89 t/ha.

❖ Excellent soil CO₂ mitigation potential observed.
The Ratargul swamp forest can stock high amount of carbon and has significant mitigation potential of CO₂.

This study has showed a pathway for mitigating climate change.
Acknowledgement

Department of Environmental Science and Resource Management
Mawlana Bhashani Science and Technology University, Tangail-1902
Thank You

Any Question?
1st South Asian Conference 2023

UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENERIO

Social Science Faculty, Dhaka University, Bangladesh

26th November, 2023

Center for People & Environment

[Logos of various organizations]
Nepal's Mountain Tourism: A Beacon of Climate Resilience for South Asia

Shanti Tamang
South Asian University, LL.M.
Tribhuvan University, BA.LLB.
Introduction

• Nepal - Home to 8 the fourteen 8000 meters above sea level summits

• 1,310 peaks taller than 6000 meters

• Since 1949 A.D., the peaks and mountains have been open for climbing

• The government of Nepal has opened 419 peaks for mountaineering activities
Introduction

- Essential for environmental balance
- Biodiversity Hotspot
- A living laboratory for climate resilience
- A source of water resources
- Offers an opportunity for scientific research
- Contributes to the National economy
- Provides employment opportunities
- Hydropower, agriculture and pharmaceutical discoveries
Background of the Study

Himalayan Landscapes Facing Climate Change Paradox- Glacial Lake Outburst Floods, Flash Floods and Landslides, Vulnerability of Mountain Communities

Way forward?

Tourism as a Driver of Climate Resilience and Sustainable Development
• Regional Impact
• Legal Frameworks
• Balancing Conservation and Development
Objective of the study

• To investigate the impact of climate change on mountain ecosystems and communities in Nepal

• Critically Analyze Legal and Policy Frameworks Governing Mountain Tourism In Nepal

• To assess the potential of mountain tourism to promote climate resilience and sustainable development in Nepal and across the South Asian expanse

• Contribute In-depth Insights to the Broader Discourse on Climate Resilience and Sustainable Development in South Asia
Methodology

Literature Review

Qualitative Research- legal and policy frameworks governing tourism in Nepal's mountain regions

Quantitative research- collection and analysis of numerical data related to tourism, climate change impacts, and other relevant factors of existing datasets

Limitations in primary research
Findings and Results

Objective 1: Investigate the Impact of Climate Change on Mountain Ecosystems and Communities in Nepal

• Climate Trends: Rising temperatures and changing precipitation patterns observed in Nepal's mountain regions, recent studies by the Asian Development Bank suggested Nepal faces losing 2.2% of annual GDP due to climate change by 2050

• Ecological Impacts: Decline in biodiversity, with species migrating to higher elevations, Glacier melt, altered vegetation zones, and shifts in monsoon timing

• Socio-economic Consequences: Decreased agricultural yields, water scarcity, and increased vulnerability to extreme weather events
Findings and Results

Figure 1: Comparison of satellite imagery before (a) and after (b) the glacial lake outburst flood of the Langmale Glacial Lake in the Barun valley of the eastern Nepal. A focused outwash plain with sediment deposits from the April 20, 2017 GLLOF (Beyer et al., 2018) is shown in (c) (Source: GoogleEarth, 2020).

Figure 2: (a) Tsho Rolpa Glacial Lake, b) Comparison of lower part of the lake, showing that the lake elevation has increased in recent year. Small permanent islands in the middle of the lake are submerged under the water, and c) The lake is expanding toward the northeast by melting the glacier ice (Source: GoogleEarth, 2020).
Findings and Results

Objective 2: Critically Analyze Legal and Policy Frameworks Governing Mountain Tourism in Nepal

• 11 national policies and legal arrangements are in place

• Implementation Challenges: Varying success in promoting responsible tourism; Gaps in addressing climate change impacts and ensuring equitable benefits.

• Shortcomings: Limited community involvement, insufficient enforcement, and inadequate monitoring of the environmental impact of tourism activities, inadequate monitoring
Findings and Results

Objective 3: Assess the Potential of Mountain Tourism to Promote Climate Resilience and Sustainable Development in Nepal and Across the South Asian Expanse

- substantial contribution to the national economy - about 6.7 percent to Nepal's GDP, while its total impact was US$2.2 billion (World Bank Report, 2022)

- supported over one million direct and indirect jobs, or 6.7 percent of total employment

- 30% of mountaineering royalties are allocated to the local area through local government bodies
Findings and Results

Objective 3: Assess the Potential of Mountain Tourism to Promote Climate Resilience and Sustainable Development in Nepal and Across the South Asian Expanse

- Need for community-based pro-poor tourism identified (examples like Ghalegaon, and Tamang Heritage Trail et al.)

- Positive impacts of community-based ecotourism and responsible trekking programs

- Enhanced conservation efforts, income diversification, and improved infrastructure
Findings and Results

Objective 4: Contribute In-depth Insights to the Broader Discourse on Climate Resilience and Sustainable Development in South Asia

• lessons including the importance of adaptive strategies, community involvement, and the integration of traditional knowledge with modern approaches offer valuable insights for other South Asian countries facing similar climate challenges

• Knowledge-sharing platforms, joint research initiatives, and partnerships with global organizations can facilitate the exchange of best practices and contribute to a more comprehensive approach to climate resilience and sustainable development in mountain ecosystems across South Asia.
Conclusions

Nepal's mountain tourism emerges as a linchpin for climate resilience and sustainable development. The study sheds light on the challenges posed by climate change, nuances in legal frameworks, and the transformative impact of tourism on Nepal's economy.

As a beacon for South Asia, the findings emphasize the need for adaptive strategies and comprehensive, community-centric approaches. The study envisions Nepal's experience as a blueprint for the region, advocating for knowledge exchange and collaborative efforts to build a resilient future for mountain ecosystems across South Asia.
Acknowledgements

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References

Books

• Facilitating Sustainable Mountain Tourism; Kruk, E.; Hummel, J.; Banskota K. eds.; International Centre for Integrated Mountain Development (ICIMOD); Kathmandu, Nepal, 2007; Vol- I.

• Kotru, R. Tourism in Mountain Regions: Hopes, Fears and Realities; Debarbieux, B., OiryVaracca, M., Rudaz, G., Maselli, D., Kohler, T., & Jurek, M. eds.; UNIGE, CDE, SDC: Switzerland, 2014; p 108


Journals


References

Journals


References

Journals


References

Journals


Theses

• Francois, C., Master of Science in Environmental Science and Policy, Johns Hopkins University (Baltimore, Maryland) December 2020.

• Makun, K.; and Jayaraman, T.K., MPRA Paper, The University of the South Pacific, University of Tunku Abdul Rahman (Munich, Germany) January 2022.

Website


References

Websites


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UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENERIO
Social Science Faculty, Dhaka University, Bangladesh
26th November, 2023
Transition from Linear Economy to Circular Economy: A Prospect of Minimizing Economic and Environmental Cost

Ikhtiarul Arefeen and Md. Bodiujjaman
Introduction

• Bangladesh’s huge economic growth coincides with severe environmental challenges.
• Linear model of economy makes its growth costly.
• Positive effects: gain of wealth and achievement of growth
• Negative effects: carbon emission and environmental loss
• Risk of economic and environmental loss and damage
• “To what extent climate change will change the world is still unclear, but one thing is certain: businesses can no longer grow at the cost of the environment. The decisions taken now and in the coming years will affect the planet.”-BGMEA President
Background of the study

• Bangladesh is one of the fastest growing economies, despite of its natural and environmental vulnerabilities.
• There are numerous man-made and natural challenges and calamities.
• Burgeoning economy and gigantic development losses its value due to the following of linear economy model.
• Climate change and its impacts put pressure on all kind of industries in Bangladesh.
• Lack of energy efficiency: power generation to feed the development activities and growing household demands
• Q: What are the prospects of circular economy in minimizing the environmental and economic cost if it transitions from the linear economy model?
Objective of the study

• Aims to present the prospects and importance of circular economy

• It proposes circular economy model because it will work like a double dividend method where investments and employment generations would be ensured while protecting the environment by reducing different forms of degradation by individuals and firms.
Methodology

• Qualitative study
• Systematic literature review
• Descriptive narrative review- recent and relevant articles
• RQ: What are the prospects for minimizing the economic and environmental cost in the transition from linear to circular economy in Bangladesh
• Study plan: RQ and problem identification -> thematic team review -> synthesis of findings
• Focus on the best practices: OECD and EU countries
Result and Discussion

• Double dividend approach
  • innovative and sustainable model of development

• 3R approach (Reducing, Reusing, and Recycling)-
  • A new business model
  • decoupling of economy

• Energy Efficiency

• Global best practices-
  • sustainable public procurement: green and energy efficient technology
  • sustainable green manufacturing: green industries
  • corrective and progressive taxation
    • Pigouvian tax to impose penalty on the polluters
    • Progressive taxation to make the rate of tax increase alongside with the increase in the taxable amount, here it can be referred to as pollution.
Result and discussion

• Environmental benefits
  • Resource efficiency
  • Waste reduction
  • Carbon omission reduction

• Economic benefits
  • Cost saving
  • Job creation
  • Innovation and competitiveness
Conclusion

• Bangladesh’s growing businesses and industries are going to contribute to the economy through a linear model, where the protection of environment is not guaranteed.

• As the country is vulnerable to climate change and natural disasters, the linear model will keep incurring damages and losses on the economy and environment.

• Governmental strategies are promoting the circular economy; however, they remain largely unfollowed.

• Circular economy model promises a lot of opportunities and competitiveness in the global market, which should be taken into serious consideration by a labor-intensive country, like Bangladesh.

• More and more studies by the scholars and stakeholders are encouraged to unpack the extended benefits of circular economy promising the minimization of environmental and economic costs.
References


References


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UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENERIO
Social Science Faculty, Dhaka University, Bangladesh
26th November, 2023
Climate Justice in Nepal: Exploring Equity and Sustainability in a Developing Nation

Prakriti Adhikari
Introduction

Nepal, a Himalayan country, is developing but dealing with big climate issues.

Mountain Challenges: Nepal's mountains worsen climate problems.
Nature at Risk: Diverse wildlife in danger from climate change.
Farmers' Hardship: Many farm and climate change hurts their work.
Water Issues: Depend on rivers and glaciers; climate change affects water.
Remote Struggles: Far-off places suffer the most, lacking resources to cope.
Main Causes of Climate Issues:

Melting Glaciers: Himalayan ice melting affects water and floods.

Unpredictable Rain: Erratic rains disrupt farming and water.

Extreme Weather: More floods and landslides from frequent intense events.

Warming: Gradual temperature rise harms ecosystems, farming, and water.

Deforestation Impact: Losing Himalayan forests worsens climate effects, like soil erosion.
Importance of the study

• Protecting Biodiversity: Climate justice secures Nepal's unique and endangered species.
• Strengthening Ecosystems: Climate justice supports fragile ecosystems, preserving their roles for communities.
• Agricultural Support: Climate justice is vital for farmers' livelihoods and food security in an agrarian society.
• Community Welfare: Focusing on climate justice boosts sustainable development and community well-being.
• Ethical Duty: Acknowledging climate justice in Nepal is an ethical responsibility, ensuring fair global solutions.
Framework

Climate Justice Emphasis: The research focuses on fair treatment for all in climate matters.

Fair Share: Stresses the importance of distributing climate-related benefits and burdens equitably.

Sustainability Integration: Highlights including sustainability principles in policies for long-term environmental well-being.
Objectives

**Equity Identification:**
Explore and identify the disproportionate burdens marginalized communities face in Nepal due to climate challenges.

**Strategy Formulation:**
Develop concrete strategies for equitable and sustainable solutions, emphasizing inclusive policy-making, gender-responsive approaches, and integrating sustainability principles into national policies.
Disproportionate Burden

• Struggling Groups: Face a more significant challenge in Nepal's climate issues.
• Short on Resources: Lack of what's needed to fight climate change effectively.
• Injustice Reminder: Stresses the importance of fair sharing in climate matters.
• Noticing Differences: Points out that marginalized groups lack ways to tackle climate change well.
• Push for Fairness: Highlights the need to include fairness in climate strategies for justice.
Strategies

All-Inclusive Policies: Make policies involving everyone, considering diverse views.

Gender-Focused Plans: Create strategies for different genders' climate challenges, promoting inclusivity and empowerment.

Sustainability Integration: Include sustainability in national policies for lasting environmental health.

Local Solutions: Customize strategies to local community needs, encouraging ownership and participation.

Fair Climate Policies: Ensure national policies align with climate justice principles, emphasizing fairness in benefits and burdens.
Methodology

• Data Gathering Method: Use interviews, document analysis, case studies, and comparisons for a complete understanding.

• Insight Creation: Analyze collected data to create insights and recommendations for climate justice, community empowerment, and reducing disparities.

• Governance Inclusion: Include effective governance methods, learning from successful practices in other developing nations to shape policy recommendations for Nepal.
Gathering Evidence

Real-World Proof: Gather concrete data from firsthand experiences and actual examples.

Varied Viewpoints: Include a variety of opinions to fully grasp climate justice challenges.

Importance of Qualitative Methods: Emphasize the vital role of qualitative methods in revealing detailed insights, human stories, and context-specific factors.
Key Findings:
• Marginalized groups face more climate challenges.
• Limited resources make it hard to fight climate change effectively.

Insights:
• Including fairness is crucial for just climate strategies.
• Learn from effective governance methods in other nations.

Recommendations:
• Give importance to inclusive policies and gender-responsive approaches.
• Support sustainability principles in national policies.
• Empower communities, reduce differences, and strengthen resilience for a sustainable future in Nepal.
Integration of Equity

Equity Integration: Ensure fair distribution of climate benefits and burdens.

Justice Promotion: Fosters equal opportunities, addressing disparities in climate impacts.

Reducing Differences: Integrate fairness to provide resources and representation to marginalized communities, lessening climate-related disparities.
Effective Governance

Key to Climate Success: Effective governance is crucial for climate action and justice.

Customize for Nepal: Adapt governance methods to fit Nepal's context for impactful climate strategies.
Contribution

Understanding Climate Justice: Reveals the details of climate justice in Nepal.

Policy Insights: Gives practical insights for creating policies.

Guiding Fair Policies: Helps shape just and effective climate policies for Nepal.
Conclusions

Fair Future Priority: Put fairness first for all communities in Nepal's climate future.

Eco-Friendly Policies: Make sure policies support long-term environmental health.

Shared Duty: Strive for a future where equity and sustainability go hand in hand for a resilient Nepal.
Thank you.
1st South Asian Conference 2023
UNFOLDING EMERGING ISSUES IN THE CONTEXT OF CHANGING CLIMATIC SCENERIO
Social Science Faculty, Dhaka University, Bangladesh
26th November, 2023
South Asian Research Hub
Objective of the South Asian Research Hub

• To promote climate resilience in South Asian Countries by generating, disseminating scientific evidence.
• To build capacity of early and mid-career researchers on South Asian Common Agenda of climate change.
Thematic area of South Asian Research Hub

• Sea level rise and coastal ecosystem
• Nature-based solutions
• Local-led adaptation
• Climate migration and human security
• Climate and health nexus
• Biodiversity and food security nexus
• Resilient Cities
Governance Structure

• Advisory Committee
  • Chief Advisor
  • Seven Thematic Advisor (One from each South Asian Country)

• Management Committee
  • Hub Leader
  • Seven Thematic Area Leader (One from each South Asian Country)
Governance Mechanism

• Each December, thematic management committee will sit together to endorse yearly work plan, budget as Annual General Meeting.

• The AGM will be held in South Asian Countries by rotation.

• In each Jun, the management committee will revise the work plan, budget and also will review progress of the Hub.

• The Chief Advisor and Thematic Advisors will review, and endorse yearly work plan, budget, and develop scientific direction of the Hub.
Activities of the South Asian Research Hub

• Skill development of early and mid-career research on thematic issues, scientific publication, networking, and collaboration.
• Knowledge co-creation on thematic issues.
• Science-policy integration in South Asian Common Agenda.