



Research article

## Climate Change Induced Vulnerabilities of Urban Poor in Small Coastal Towns: Experiences from the Mongla Port Municipality

Md Ashek Mahmud<sup>1</sup> and Md. Salauddin<sup>2\*</sup><sup>1</sup>*IOM-UN Migration, Rohingya Refugee Response-Cox's Bazar, Bangladesh*<sup>2</sup>*Urban and Rural Planning Discipline, Khulna University, Khulna, Khulna-9208, Bangladesh*

### ABSTRACT

Climate change is one of the most critical and alarming issues facing the world today, with Bangladesh being one of the most vulnerable countries. The rapid changes in weather patterns and related issues in the southern and southwestern regions of Bangladesh highlight the significant impact of climate change. While the effects on rural populations are well-documented, urban populations also face severe challenges, with the urban poor being particularly vulnerable. The dynamics vary widely and are different for small coastal cities than the large metropolitan cities. This study aims to understand the major challenges faced by urban poor populations and how these challenges are compounded by climate change in Mongla Port Municipality. It also seeks to explore their adaptation strategies, and the institutional structures supporting them. Mongla Port the second-largest seaport in Bangladesh, is taken as the case study. Primary data were collected through field surveys using random sampling methods. Five major categories of challenges—settlement, water and sanitation, road and drainage, health, and income with their micro-level difficulties were explored using the vulnerability framework that addresses individual, community and national level issues. Interviews with the relevant institutions were done to understand interventions to mitigate the challenges. The impact of climate change varies depending on their location, distance from the urban center, the status of the surrounding slums, and the availability of embankments. The intensity of different disasters also varies by location, influencing the different adaptation strategies used by the urban poor. Interventions by different government and non-government organizations have been found case and event-specific, while structural adjustment and flow of resources are being found irregular and scant.

### ARTICLE INFO

#### Article timeline:

Date of Submission:

17 July, 2024

Date of Acceptance:

29 July, 2025

Article available online:

06 August, 2025

#### Keywords:

Climate Change

Vulnerability

Urban Poor

Community-driven initiatives

Mongla

### Introduction

The effect of climate change on urban settlements and its residents are becoming more evident. This is particularly crucial for the increasing urban poor. Key risks include heat stress, extreme and unpredictable precipitation, inland and coastal flooding, landslides, air pollution, drought, and water scarcity. These hazards pose significant threats to people, assets, economies, and ecosystems in urban environments (IPCC, 2022; IPCC, 2014; Mamun and Pavel, 2014). For example, extreme heat events have been linked to increased mortality and morbidity in cities (WHO, 2024; Yadav et al., 2023; Arsad et al., 2022; Harlan & Ruddell, 2011). Similarly, urban flooding, exacerbated by climate change, disrupts transportation systems, damages infrastructure, and displaces residents, particularly affecting low-income populations

(Dharmarathne et al., 2024; Gough et al., 2019; Jha, Bloch, & Lamond, 2012; Salauddin and Ashikuzzaman, 2011).

Climate change is defined by the IPCC (2014) as a persistent change in the state of the climate, identifiable by alterations in the mean and variability of its properties, lasting for decades or longer. The primary factors of climate change include variations in temperature and precipitation, sea level rise, and storm surge. Additionally, non-climatic factors such as land cover changes, salinity intrusion, and population growth significantly influence these impacts (The World Bank, 2021; 2010). Urban areas are particularly vulnerable due to the high concentration of people and assets, as well as pre-existing social and economic inequalities that can exacerbate the effects of climate change (Dodman, 2009). Rapid urbanization

\*Corresponding author: [msalauddin@urp.ku.ac.bd](mailto:msalauddin@urp.ku.ac.bd)DOI: <https://doi.org/10.53808/KUS.2025.22.02.1240-se>

influence or encourage poor people to move urban area for better job opportunity. Generally urbanization has both positive and negative effect. The most positive effect of urbanization is to make better life for the residents, better job opportunity, better education and health facilities, reduce transport cost to go anywhere and get any service etc. In other hand, the most negative effects are giving very narrow space to live for rural people, unhygienic environment to live, environmental degradation, shortage of public transport, poverty etc. Basically urban poor people's are deprived from their basic need with other urban services because they are not capable to bare service charge (sometimes tenure security, informal settlements are also responsible for this).

Bangladesh is a prime example of a country highly vulnerable to climate change, as highlighted by the Intergovernmental Panel on Climate Change (IPCC, 2022). Despite Bangladesh's minimal contribution to global climate change, the country faces severe impacts from various climatic factors. These include sea level rise, temperature increases, enhanced evaporation, altered precipitation patterns, and changes in cross-boundary river flows, all of which pose significant threats to its natural, social, and economic systems (Huq et al., 2015). In urban areas, the poor are particularly affected by climate change, experiencing three major types of climatic problems: rapid onset events (such as floods, cyclones, and catastrophic river erosion), gradual onset events (such as coastal erosion, sea level rise, saltwater intrusion, and rising temperatures), and cascade effects (such as environmental degradation, increased urbanization, and reduced human security) (Roy et al., 2011). Small coastal cities in Bangladesh face significant challenges in addressing climate change vulnerabilities, especially for the urban poor. Limited financial resources and institutional capacities impede the effective implementation of climate adaptation and mitigation strategies (Rahman et al., 2014). Social and economic inequalities in these regions compound the vulnerabilities, making it challenging to build resilience among the most affected populations (Al Mamun and Uddin, 2021; Roy et al., 2013). Addressing these challenges requires comprehensive and inclusive urban planning, robust infrastructure development, and community engagement to enhance the resilience of small coastal cities and protect their most vulnerable residents.

This study focuses on the major problems faced by the urban poor in Mongla Port Municipality and how these issues are exacerbated by climate change. It aims to descriptively address the specific challenges encountered, such as inadequate housing, water and sanitation issues, road and drainage problems, health concerns, and income instability. Additionally, the study explores how the urban poor individually adapt to these challenges and examines the institutional structures that support their adaptation efforts. Emphasizing both individual and community adaptation techniques, the authors have provided policy recommendations to better assist the urban poor in coping with their vulnerabilities.

### **Climate change and Vulnerability: A review**

According to Bodansky (2001), the evolution of the global climate change regime in the late 1980s and early 1990s was propelled by a surge in environmental activism,

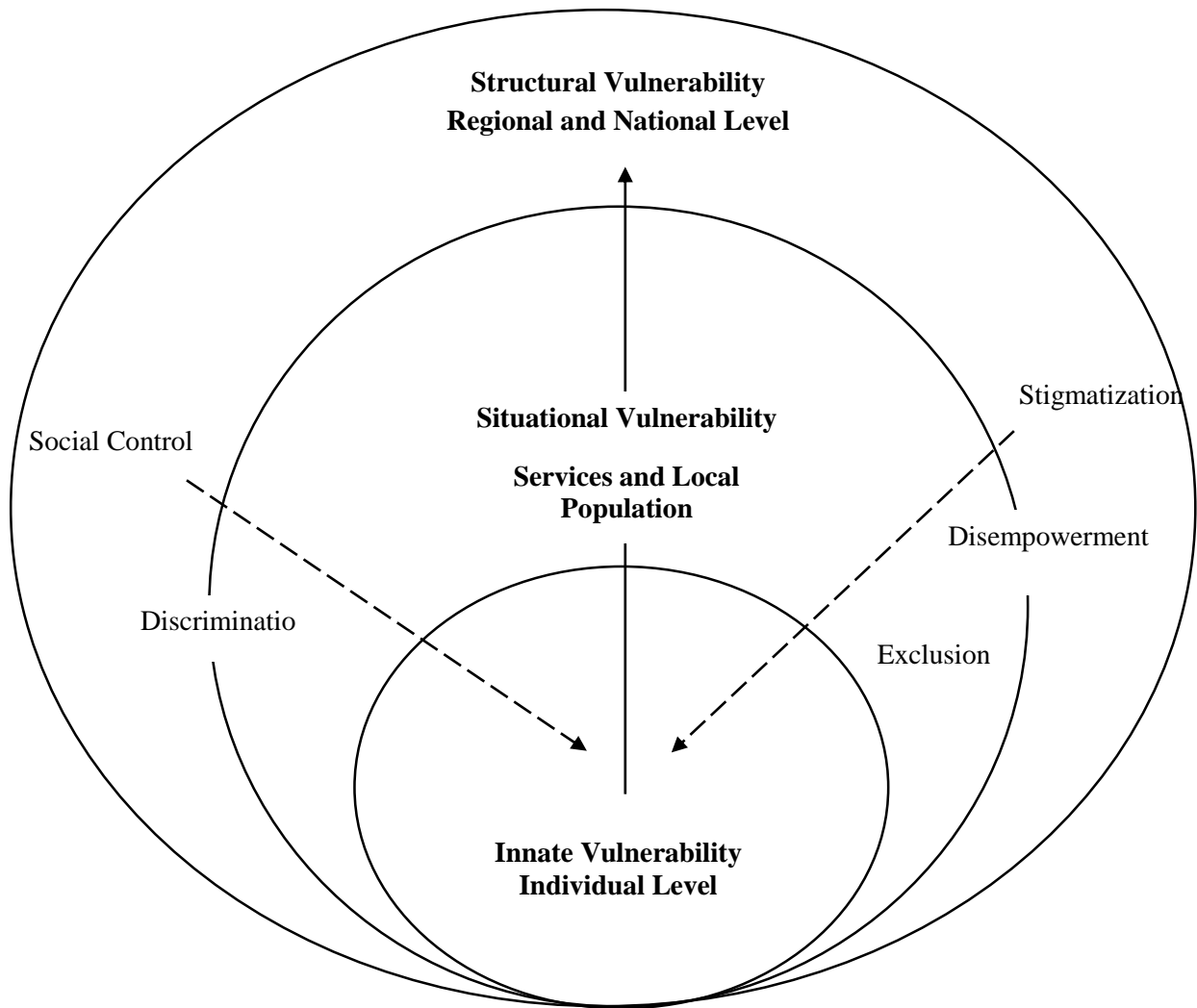
sparked initially by the discovery of the stratospheric ozone hole in 1987. This milestone followed decades after the invention of chlorofluorocarbons (CFCs), which, as highlighted by Fleming (1998), raised concerns about their detrimental impact on the ozone layer. The development of the climate change regime during this period can be delineated into several phases: a foundational period characterized by mounting scientific concern over global warming; an agenda-setting phase from 1985 to 1988, where climate change transformed from a scientific issue to a global policy priority; a pre-negotiation period from 1988 to 1990, marked by intensified government engagement; the formal intergovernmental negotiations phase culminating in the adoption of the Framework Convention on Climate Change (FCCC) in May 1992; and a subsequent post-agreement phase focused on elaborating and implementing the FCCC, alongside negotiations for additional commitments leading to the adoption of the Kyoto Protocol in December 1997.

Bangladesh has substantially reduced disaster death tolls and damage through the Cyclone Preparedness Programme (CPP) with its 76,000+ volunteers. But – as the government's own climate and development policies make clear – adapting to climate change will take more than simply disaster preparedness and response. Effective adaptation requires engaging with at-risk communities across the country to understand the specific climate-driven hazards they face and the resources they need to protect themselves and adopt new ways of living and working. Effective adaptation requires vulnerability assessment of the households and at the individual levels. From the economic point of view, it's about how vulnerable a livelihood is to certain risks and how capable it is of recovering from adverse events. Improving and maintaining ways people earn a living are closely linked with reducing poverty (De Zeeuw & Reeman, 2024). Poverty as we know is multidimensional and are linked with several individual, household-level as well as external issues.

Vulnerability is defined as the susceptibility to hazard of a community and prevailing factors—socio-economic, political, and physical—that negatively affect the capability to respond to a disaster (Nur and Shrestha, 2017). Vulnerability is a complex and dynamic concept frequently used in migration, climate change, and socio-political studies. It is often categorized into three types: innate, situational, and structural vulnerability. Innate vulnerability refers to inherent characteristics such as age, gender, or health status that make individuals or groups more susceptible to harm. This approach has been widely applied in identifying vulnerable populations in policy documents, such as children or elderly individuals (Gilodi et al., 2022). Situational vulnerability, on the other hand, arises from specific circumstances, such as homelessness, natural disasters, or displacement. It highlights the potential for change and intervention to reduce vulnerability (Gilodi et al., 2022). Finally, structural vulnerability links systemic inequalities and socio-political conditions to the creation and perpetuation of vulnerabilities. This perspective emphasizes how unequal access to resources and structural discrimination produce vulnerability. Climate change impacts are felt globally, affecting both developed and developing nations, albeit

with varying degrees of vulnerability. Developed countries possess greater technological resources and innovation capacity to mitigate and adapt to these effects. The United Nations Framework Convention on Climate Change (UNFCCC) underscores the disproportionate vulnerability of developing countries to the economic impacts of climate change and their limited adaptive capacity (UNFCCC, n.d.). Reynolds et al. (2002) highlight that climate change affects multiple sectors including water resources, agriculture, food security, ecosystems, biodiversity, human health, and coastal zones, amplifying existing vulnerabilities in developing countries like Bangladesh.

rise is particularly severe in Bangladesh. Chowdhury et al. (2007) reports a temperature increase of approximately 0.5°C over the past century and a sea-level rise of about 0.5 meters in the Bay of Bengal. In the southwestern Khulna region, sea levels are rising at a rate of 5.18 mm/year, potentially reaching 85 cm by 2050. The World Bank estimates that a 100 cm sea-level rise within the next century could inundate 15 to 17 percent of Bangladesh's land area, displacing up to 20 million people as environmental refugees (World Bank, 2007).



**Figure 1: Conceptual Framework of Vulnerability**

Bangladesh, situated in a low-lying deltaic region, faces pronounced climate vulnerabilities. The Comprehensive Disaster Management Program (CDMP) by the Bangladesh Government emphasizes the country's historical susceptibility to climate variability, with coastal areas experiencing heightened impacts due to their geographical and socio-political contexts (Climate Change Cell, Bangladesh Government.). The impact of sea-level

Population growth significantly contributes to climate change by escalating demand for resources such as energy, food, and water, and increasing the volume of waste generated. This trend poses a particular challenge in regions already grappling with resource scarcity, where urbanization exacerbates vulnerability factors (UN-Habitat, 2011). In Bangladesh, urban areas are confronted with numerous climate change vulnerabilities, The urban

poor bear the brunt of these challenges, categorized into three main types of climate impacts.

Households both in urban and rural areas have been using adaptation techniques but these has been expedite with the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) in 2009. Central to these efforts is the, which outlines strategies for enhancing resilience across various sectors (Government of Bangladesh, 2019). Emphasizing decentralized planning, the BCCSAP encourages local governments to integrate climate considerations into urban planning and development processes. They oversee initiatives like climate-resilient infrastructure development, disaster preparedness, and community-based adaptation projects, which are essential for enhancing the resilience of small towns (Kalam et al., 2024; Chowdhury et al., 2022). Bangladesh is also a member of the Climate Vulnerable Forum (CVF) a platform of the 55 most climate-vulnerable countries. Adaptive and building resilience have been given importance in the Delta Plan 2100. Non-governmental organizations (NGOs) and community-based organizations (CBOs) complement government efforts by providing direct support to communities. Organizations such as BRAC and Grameen Bank engage with local populations, offering microfinance for climate-resilient livelihoods, promoting sustainable agriculture, and supporting small-scale enterprises (BRAC, 2021). These initiatives reduce dependency on climate-sensitive livelihoods and strengthen community resilience against climate impacts. Community-level infrastructure projects, often implemented through participatory approaches, involve local communities in decision-making processes and ensure that interventions meet their specific needs and priorities.

Local knowledge systems are integrated with scientific expertise to develop adaptive strategies that build on traditional practices while embracing innovative solutions (Al Mamum and Pavel, 2014). Moreover, Government agencies, NGOs, and research institutions collaborate to raise awareness about climate change impacts, disaster preparedness, and sustainable practices among community members. Training programs for local leaders, women's groups, and youth organizations empower them to take proactive measures in responding to climate hazards (Rahman et al., 2018). Community members, including marginalized groups such as women and ethnic minorities, actively participate in identifying vulnerabilities, assessing risks, and designing interventions.

However, the effects of the initiatives and interventions are circumscribed due to the lack of coordination among government agencies, NGOs, and local communities. Institutional fragmentation, bureaucratic hurdles, and overlapping mandates often hinder coordination efforts (ADB, 2021). Urban areas have received investment and community engagement in building access roads, water and sanitation, health and small-scale investment for livelihood support. Though poverty has decreased in both urban and rural areas,

inequality has increased in urban areas. The participatory approaches have been argued as not so much participatory as the urban poor are observed more relying on informal networks rather than the formal service providing organizations. Nevertheless, resource distribution follow two separate channel where the urban poor still relying on the foreign aid, community organizations couldnot work properly with the support from NGOs. Swapan (2016) argued that a patron-client relationship exists in the urban poor settlements. As a result, the vulnerabilities and adaptative are dynamic and hence require an investigation.

Climate migrants migrate into the urban areas with limited financial, physical assets and extremely limited human capital and social networking, consequently they face numerous problems including unemployment, underemployment, tenure-related and insecurity. Studies found that climate migrants are engaged in informal sector employment and informal sector business is highly labor based, and transient thus, their income is very limited (Afrin, 2020; Sowgat, 2022). Mongla however offers opportunity for people with increased economic activities. Study asserts that workers in businesses and industries in Mongla are significantly climate migrants. Mongla, being the first city to adopt the ICCCAD recommendations, that suggested to connect climate migrants to the export processing zone or nearby economic hubs (Davison, 2022). However, as the conceptual framework of this study suggests, vulnerability can exist in a 'employment for all situation' as the discrimination, disempower and absence of a formal authority with service provision can exacerbate the vulnerability situation in a community.

### Materials and Method

This study is based on a household survey of four different locations in Mongla Port Municipality. The locations are Burirdanga in ward number 4, Balur Math in ward 5, Ratarati Colony in ward 6 and Chorkana in ward 9. A total of 170 questionnaire surveys has been administered (95% confidence level, 5% error margin).

Secondary data were collected from relevant books, journals, and published and unpublished documents from government and non-government organizations. Six interviews are conducted with government organizations, NGOs and community leaders. Vulnerabilities and adaptation strategies have been explored descriptively and emphasis has been given to the 'what' question. Vulnerabilities have been explored from three dimensions: innate, situational and structural.

This study gives considerable emphasis on describing the major problems which are compounded with climate change of urban poor in Mongla Port Municipality and aims to know the 'what' questions in a descriptive manner. This study also explores the institutional structure that help urban poor peoples to adapt with climate change effect. Descriptive analysis and thematic analysis from interviews have been conducted to attain the objectives. Document and policy review have also been done to supplement the findings from the field.

**Table 1:** Major indicators of innate, situational and structural vulnerability

| Major component           | Sub-component                | Explanation of indicators   |
|---------------------------|------------------------------|---|
| Innate vulnerability      | Dependent family members     |   |
|                           | Household size               |   |
|                           | Disability                   | Households that report family members disable.  |
|                           | Chronic medical conditions   | Households that report family members chronically ill                                 |
| Situational vulnerability | Housing location             | Distance from the main river  |
|                           | Distance to Water Source     |   |
|                           | Electricity Access           |   |
|                           | Financial services access    | HHs who have access to financial services to any financial institution                |
|                           | access to transportation     | HHs depends solely on agriculture-based income  |
| Structural vulnerability  | support from neighbours      | HHs member who have received support from neighbour.                                  |
|                           | Infrastructure               | people who have affected by poor infrastructure e.g. embankment, house                |
|                           | Land Tenure                  | household who has lack tenure security can it harder for any compensation or support. |
|                           | Satisfaction with healthcare | Lack of access to early warning system and safety measure increase vulnerability      |

**Results**

**Exposure of Urban poor to natural and man-made hazards**

Table 2 highlights the hazards faced by the respondents, including floods, cyclones, excessive rain, extreme heat and cold, waterlogging, flash floods, and water shortages during the dry season. The percentages of individuals affected by floods are as follows: Balur Math (29.3%), Burir Danga (22.0%), Chorkana (24.0%), and Ratarati Colony (24.7%). Cyclone impacts are reported at Balur Math (30.6%), Burir Danga (23.1%), Chorkana (24.6%), and Ratarati Colony (21.6%).

Interviews with the community leaders and elders reveal that floods were not a significant issue in the past, while the intensity of cyclones has increased. Excessive rain currently affects 29.8% of residents in Balur Math, 23.2% in Burir Danga, 23.8% in Chorkana, and 23.2% in Ratarati Colony. Extreme heat impacts 29.7% of Balur Math, 23.2% of Burir Danga, 23.2% of Chorkana, and 23.9% of Ratarati Colony. Extreme cold affects 28.1% of Balur Math, 24.4% of Burir Danga, 23.1% of Chorkana, and 24.4% of Ratarati Colony.

**Table 2:** Exposure to hazards by the respondents

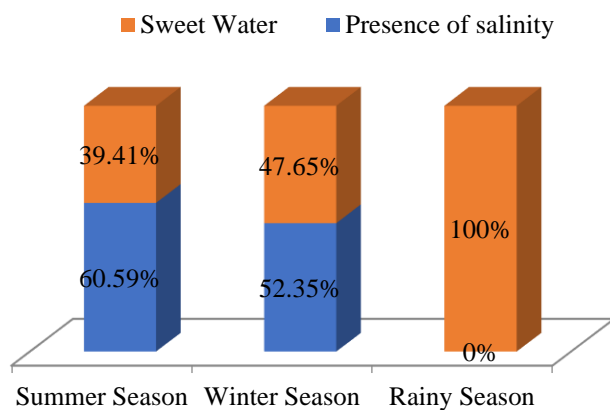
| Problems of the people       | Location of the house        |                              |                              |                              |
|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
|                              | Balur Math, Ward 05          | Burir Danga, Ward 04         | Chorkana, Ward No 09         | Ratarati Colony, Ward No 06  |
|                              | Percentage (%) of respondent | Percentage (%) of respondent | Percentage (%) of respondent | Percentage (%) of respondent |
| Flood                        | 29.3                         | 22.0                         | 24.0                         | 24.7                         |
| Cyclone                      | 30.6                         | 23.1                         | 24.6                         | 21.6                         |
| Excessive Rain               | 29.8                         | 23.2                         | 23.8                         | 23.2                         |
| Excessive Heat               | 29.7                         | 23.2                         | 23.2                         | 23.9                         |
| Excessive Cold               | 28.1                         | 24.4                         | 23.1                         | 24.4                         |
| Water Logging                | 26.1                         | 24.6                         | 26.8                         | 22.5                         |
| Flash Flood                  | 38.0                         | 0                            | 31.4                         | 30.6                         |
| Water Shortage in Dry Season | 29.6                         | 23.3                         | 23.3                         | 23.9                         |

Waterlogging affects 26.1% of residents in Balur Math, 24.6% in Burir Danga, 26.8% in Chorkana, and 22.5% in Ratarati Colony. Flash floods impact 38.0% of Balur Math, 0.0% of Burir Danga, 31.4% of Chorkana, and 30.6% of Ratarati Colony. These issues were previously insignificant, indicating an increase in both frequency and intensity of these problems.

Water shortages during the dry season affect 29.6% of Balur Math, 23.3% of Burir Danga, 23.3% of Chorkana, and 23.9% of Ratarati Colony. Statistical hypothesis testing has confirmed these observations, showing that urban populations now face more severe and frequent climate-related challenges than in the past.

**Service and infrastructure-related vulnerabilities**  
**Water**

In Mongla Port Municipality, as in other parts of Bangladesh, accessing fresh groundwater is a significant challenge. There are no deep tubewells available for drinking purposes. Consequently, the municipality directly supplies water to all residents through a 500,000-liter water treatment plant installed by the Department of Public Health Engineering (DPHE). This treated water is designated exclusively for drinking. The municipality employs a household-wise supply system, and for the impoverished, they have set up community water supply systems. Despite these efforts, not all areas within the municipality are covered, leaving some residents reliant on alternative water sources. According to the data, 52.94% of people obtain their drinking water from community supply systems, 32.94% collect water from ponds, and 14.12% purchase water in gallons. Thus, the majority depend on the municipality’s water supply.



**Figure 2:** Drinking water quality at the study area

The quality of drinking water varies throughout the year in Mongla. Water quality is categorized into two types: sweet and saline. The year is divided into three seasons—summer, winter, and rainy—based on these water quality variations. Respondents indicate that water quality shifts with the seasons. During the summer, 39.41% of people have access to sweet water, while 60.59% encounter saline water. In the winter, 47.65% have sweet water, whereas 52.35% face salinity issues. However, during the rainy season, 100% of the population has access to sweet water. This data indicates that salinity in drinking water is most problematic during the summer, whereas the rainy season provides universally sweet water.

**Drainage**

In the slums of Mongla, proper drainage systems are scarce. Only 9.41% of residents have access to a proper drainage system, leaving 90.59% without any means to manage waterlogging. This lack of drainage infrastructure significantly increases their vulnerability to waterlogging during rains and floods, exacerbating their living conditions.

**Health Issues**

Residents of Mongla frequently suffer from diseases such as diarrhea, cholera, malaria, and dengue. According to respondents, these health issues stem from drinking contaminated water, living in unhygienic environments, waterlogging, and the presence of salinity in their drinking water. A substantial 67.06% of respondents attribute their health problems to all these factors, while 32.94% believe they are affected by all except the salinity in drinking water, indicating they may rely on pond water that is free from salinity.

**Access to Healthcare**

For medical treatment, residents generally visit either government hospitals or nearby dispensaries, depending on the severity of their illness, the distance to healthcare facilities, their financial situation, and their awareness of the health issues. Financial constraints lead many, particularly the hardcore poor, to delay or forgo treatment. Often, the poor show a lack of concern for their health due to financial limitations. Data shows that 53.53% of residents seek treatment at government hospitals, often taking loans to cover expenses. About 34.12% prefer

nearby dispensaries due to financial issues and the distance of more than 200 meters to the nearest government hospital. Additionally, 12.35% do not seek any medical treatment, relying instead on herbal remedies, especially during emergencies.

**Issue of Access and control, exclusion**

It has been argued that the higher urbanisation rate is behind the changes in the urban environment (Swyngedouw & Kaika, 2014). Empirical studies have explored how the city got divided based on resource consumption and recipient of wastages (Adnan et al., 2018; Bakker et al., 2008; Kaika, 2003; Swyngedouw & Kaika, 2014). The urban service governance system is fragmented in cities of Bangladesh, where the middle- and high-income groups are the majority as the formal service recipients. In contrast, slum residents have been given a different governance system where international/local NGOs and political leaders become influential actors. The governance mechanisms in the slums have tried to achieve two key objectives: influence development policies and strategies (advocacy for water intervention in the slum, for example) and practice the process of democratic participation where decisions should not be made only by the experts and powerholders. The latter also calls for alternatives and often comes with rival projects, and the services are ensured through societal development (Castro, 2007). However, the community organization and its way of operation are detached from the mainstream city governance system and are said to be the source of community segregation. Slums have been the focus of research and interventions aligned with the United Nations’ goal to improve the lives of the millions of slum dwellers. Interventions in slums focused on engaging slum residents in the decision-making processes. It has been understood that political consciousness will enable them to negotiate. However, discussion with the local leaders and slum residents suggests they have become more politically aware, more organized and can participate in the decision-making process. However, in terms of the availability of services and amenities, slum residents have been pushed towards the informal network rather than connecting them with the service providers. Services-whether it is land, water or health, comes with two issues. One is access and another is control. Urban migrants residing in the government land received access somehow but do not have control. Similarly, access to water sources may be attained but control over that resources in crucial. Households who do not have tubewell in their community have restricted access (nighttime, early morning) and poses no control. Women who are the primary water collector faces long waiting time.

**Income vulnerabilities**

Income vulnerabilities remain the major challenge for the urban poor in small cities. The issues include limited work opportunities, difficulty in communicating to find work, lack of work opportunities, and health problems. According to the respondents, 26.47% face limited work opportunities, 34.71% have communication problems in finding work, and 38.82% experience all these problems. During floods, their surroundings become waterlogged, and water often enters their homes, making it difficult to

go out. Additionally, during these times, they are more susceptible to waterborne and airborne diseases due to waterlogging. Most people in this area work as daily labourers, and their income depends on their daily work, which significantly decreases during floods.

To cope with their low income, people engage in various activities. They borrow money, eat less, and work harder or longer hours when they can. According to the respondents, 21.18% borrowed money within the last six months, 15.88% ate less, 3.53% worked harder or more, and 54.71% did all these activities. As the result shows only a small percentage (3.53%) work harder or more during floods because they have limited work opportunities, but they try to earn more to manage the uncertain situation.

### **Innate, Situational and Structural Vulnerability: Small town experiences**

Virokannas et al (2020) identified innate vulnerability as where a person is at risk due to the natural characteristics one does not have any control over it. For example, gender, disability or medical condition. Situational vulnerability is associated with a specific situation a household or a group of people is going through (Gilodi et al, 2022). For example, living in a disaster-prone area, victims of a disaster. Structural vulnerability can occur in society due to social, political and ecological phenomena (Brown et al 2017). It deals with the norms, legal issues and policy sphere in a society that can trigger inequality or exploitation.

All four study areas present varied degrees of innate, situational and structural vulnerabilities. About two-thirds of the respondents do not have a regular job. Chronic illness due to salinity and low water quality also reduces their ability to find work. One community leader asserts 'Jobs are scarce and many people are competing for one job' (Personal Communication, 2023). As Table 1 illustrates, a significant number of households are exposed to different natural and man-made hazards. This in turn increases the innate vulnerability. One community group member revealed

*'Our men often go outside of the city for work-sometimes for a longer time. We are helpless if a disaster happens during that period' (Personal Communication, 2023).*

Urban poor in Mongla Municipality mostly live in the four locations(study areas of this paper) that are predominantly run by the informal economy. In the absence of formal services, the landlords in the informal settlements also become their service providers. Entry to these areas is also controlled by the landlords and thus requires the residents to be compliant with them. Community group efforts diminish with the end of the project. One community representative replied

*'We had a committee to look after the tubewells. We used to save regularly for maintenance. Tubewells are saline and I did not see any activity since 2021' (Personal Communication, 2023).*

### **Institutional responses**

In Mongla municipality, various NGOs collaborate with the local government to support impoverished communities, particularly during floods or high temperatures. While numerous NGOs operate in the area, four major ones play a crucial role in assisting these communities: World Vision, Bangladesh Association for Sustainable Development (BASD), CSS, and Shurjer Hashi. Each NGO contributes uniquely, and the municipality itself also actively aids the poor. World Vision focuses on child education and social infrastructure development through its Area Development Program (ADP), emphasizing disaster management and education for the children of poor families. They provide free education, school uniforms, books, health services, and coaching fees to 3,574 children, prioritizing families who cannot afford to send their children to school, are highly vulnerable to climate change, and earn less than BDT 4,000 monthly. Additionally, they offer adult education and life skills training, teaching community members about disaster management, health, and social responsibilities. World Vision also installs sanitary toilets in schools where their selected children study, ensuring access to sanitary facilities during disasters. This initiative, funded by the USA, has been operational since 2001.

BASD, on the other hand, focuses on economic and social capacity building for marginalized communities through self-help groups. Starting their journey in Mongla in 2009, BASD launched a project titled Capacity Enhancement and Resource Integration for Poverty Reduction Phase-II, supported by Australia and the Bangladesh government. They encourage community members to form cooperatives, deposit weekly savings, and use these funds as backups during crises or for small loans. BASD trains these cooperatives in various skills, including making sanitary toilet rings, rainwater collection, disaster preparedness, and basic health care. They also provide health and educational facilities, distributing educational materials and free medicines during disasters. They aim to empower community members to become self-sufficient and capable of handling their challenges. CSS, which began its operations in Mongla in 2007, focuses on health awareness, particularly related to HIV and sexually transmitted infections (STIs). Targeting impoverished individuals who often resort to prostitution due to financial hardships, CSS provides education, medical support, and preventive goods like condoms. They have six field workers who identify and support these individuals, offering free medical services and discounted medicines. Funded by organizations in the Netherlands and America, CSS aims to reduce the spread of HIV and STIs by 2020.

Shurjer Hashi provides primary health care and family planning services through a clinic and 29 satellite clinics across Mongla Port Municipality. They offer health services, family planning education, vaccinations, and vitamin campaigns, serving 4,126 registered members. Field workers visit homes to provide primary knowledge and support. The clinic is supported by USAID and DFID. The Mongla Port Municipality Authority also plays a significant role in supporting poor communities despite the absence of tenure security. Most slums are located on port authority-owned land, limiting permanent infrastructure

development by NGOs. However, the municipality provides basic services like drinking water and public toilets. In 2012, they installed a water treatment plant with an overhead tank, supplying water to households in wards 5 and 6. They also plan to install a second treatment plant in 2015. Additionally, the municipality has installed water taps in certain wards and constructed roads in some slum areas. To address waterlogging, the municipality plans to dredge local lakes and build a sluice gate by June 2015. While there is no budget for housing settlements, the municipality aims to rehabilitate the poor in planned settlements over time.

To further enhance support for the poor communities in Mongla, several additional measures could be implemented. Firstly, providing tenure security for residents in slums could encourage more NGOs to invest in permanent infrastructure, improving living conditions and stability. Establishing a dedicated budget for settlement development would allow the municipality to build durable housing and community facilities, ensuring long-term support for vulnerable populations. Additionally, expanding health and education services to cover more areas and individuals, particularly during disasters, would significantly benefit the community. Increased collaboration between NGOs and the municipality could lead to more comprehensive and coordinated efforts, maximizing the impact of various initiatives. Finally, continuous training and capacity-building programs focusing on disaster preparedness, health, and economic self-sufficiency would empower residents to better cope with challenges and improve their quality of life.

#### **Way Forward: New thought on land tenure, resource flows and participatory approaches**

Improving the livelihoods of urban poor populations requires a multifaceted approach. While sketching future activities, authorities should consider the three types of vulnerabilities that demand simultaneous initiatives. Firstly, ensuring secure land tenure is foundational as many scholars argue. Urban poor communities reside in informal settlements or on government-owned land, where tenure insecurity impedes their access to basic services and hinders development. Addressing this issue involves policies that secure land rights for these communities, ensuring they can invest in and benefit from physical infrastructure developments such as roads, drainage systems, schools, and sanitation facilities. Tenure security vis-à-vis services provision requires not only the access to it but also some form of control over the resources. These infrastructure investments are crucial not only for improving living conditions but also for mitigating health risks associated with inadequate infrastructure and environmental hazards. At the same time, structural and legal adjustment in the formal service delivery system is also crucial considering the current population growth of the cities. Cities in the Global South are going to see a significant population in the informal settlements-spilling over the boundaries of slums. There are encouraging examples of the formalization of informal in Latin America and Indonesia (Suhartini, 2016). Ignoring the growth of informal settlements by formal service-

providing organizations only exacerbates the vulnerabilities of the urban poor.

Secondly, enhancing the role of non-governmental organizations (NGOs) is essential. The literature emphasizes the effectiveness of NGOs in complementing governmental efforts by providing targeted, community-driven initiatives. However, efforts are required to break the informal networks or the patron-client relationship within the urban poor settlements. Many community groups were found ineffective after the NGOs opted out. Segregated flow of the resources needs to be minimized, and formal sector resource flows are inevitable to successfully run the community organizations.

Thirdly, fostering community-based initiatives and participatory decision-making processes is crucial. Empowering residents, particularly women, through training programs and leadership opportunities enhances their capacity to address local challenges effectively. All these strategies are in practice. For example, almost all the community groups formed in Mongla City are either headed by women or have majority participation. Nevertheless, one female group leader asserts that men make the decisions about water supply services or any construction-related activities. She maintains 'We do not have the technical knowledge to deal with these activities, we have little understanding about the technical discussion made in the city-scale meetings'. As a result, there is hardly any evidence in Bangladesh that these community groups have a spill-over effect in the city-level policy formulations.

In summary, integrating secure land tenure, robust NGO involvement, and community-driven initiatives can significantly improve the livelihoods of urban poor populations. This holistic approach not only addresses immediate infrastructure needs but also builds long-term resilience and sustainability within these communities. Specific recommendations for the policymakers, and the government are to adopt legal framework for climate migrants, support and offer safe livelihoods, expand social protection schemes, support SMEs and strengthening local governance capacity. Data driven decision making rather than short term project-based activities should be monitored and if get proven, incorporating within the government's regular budget allocation is crucial for long term sustainability.

#### **Conclusion**

Urban poor communities, particularly those in climate change-affected zones, face escalating challenges due to the intensifying impacts of climate change. These communities have long relied on traditional adaptation methods, but the severity of climate-related problems has increased markedly in recent decades. Adaptation strategies vary widely depending on local conditions and individual financial resources, influencing their ability to cope effectively. A critical issue exacerbating their plight is the lack of secure land tenure, particularly evident in slum areas and among impoverished groups in Bangladesh. Public-owned lands generally offer some security, whereas privately owned-lands often lack tenure stability, impeding efforts for substantial physical and infrastructure development. Despite sporadic support from private and public initiatives, which tend to focus more on

capacity-building than holistic development, urban poor communities continue to rely predominantly on their own resilience and traditional adaptation techniques to navigate these multifaceted challenges. Informality is no longer a stand-alone issue in the current urban settings and demands a more comprehensive understanding and careful interventions.

#### Funding Statement

The authors did not receive any specific grant or financial support from public or commercial, funding agencies for this research.

#### References

- Adnan, M. N., Safeer, R., & Rashid, A. (2018). Consumption based approach of carbon footprint analysis in urban slum and non-slum areas of Rawalpindi. *Habitat International*, 73, 16–24. <https://doi.org/https://doi.org/10.1016/j.habitatint.2017.12.012>
- Arsad, F.S.; Hod, R.; Ahmad, N.; Ismail, R.; Mohamed, N.; Baharom, M.; Osman, Y.; Radi, M.F.M.; Tangang, F. The Impact of Heatwaves on Mortality and Morbidity and the Associated Vulnerability Factors: A Systematic Review. *Int. J. Environ. Res. Public Health* 2022, 19, 16356. <https://doi.org/10.3390/ijerph192316356>
- Auerbach, L. W., Goodbred Jr, S. L., Mondal, D. R., Wilson, C. A., Ahmed, K. R., Roy, K., ... & Ackerly, B. A. (2015). Flood risk of natural and embanked landscapes on the Ganges-Brahmaputra tidal delta plain. *Nature Climate Change*, 5(2), 153-157.
- Ahmed, A. U., Alam, M., & Rahman, A. A. (1999). Adaptation to climate change in Bangladesh: future outlook. Vulnerability and adaptation to climate change for Bangladesh, 125-143.
- Al Mamun, M. A., & Pavel, M.A.A. (2014). Climate Change Adaptation Strategies through Indigenous Knowledge System: Aspect on Agro-Crop Production in the Flood Prone Areas of Bangladesh. *Asian Journal of Agriculture and Rural Development*, 4(1), 42-58.
- Al Mamun, M. A., & Uddin, K.F. (2021). Impacts of the Pandemic on the Informal Economy. In: Titumir, R.A.M., Georgeou, N., & Chowdhury, A. (eds.). Covid-19 and Bangladesh: Response, Rights and Resilience. University Press Limited, Dhaka, 1-151.
- Bakker, K., Kooy, M., Shofiani, N. E., & Martijn, E.-J. (2008). Governance failure Rethinking the institutional dimensions of urban water supply to poor households. *World Development*, 36(10), 1891–1915. <https://doi.org/10.1016/j.worlddev.2007.09.015>
- Banks, N. (2008). A tale of two wards: political participation and the urban poor in Dhaka city. *Environment and Urbanisation*, 20(2), 361-376.
- Bodansky, D. (2001). The history of the global climate change regime. *International relations and global climate change*, 23(23), 505.
- BRAC. (2021). Climate Change. Retrieved from <https://www.brac.net/climate-change>.
- Brown, K., Ecclestone, K., & Emmel, N. (2017). The many faces of vulnerability. *Social Policy and Society*, 16(3), 497–510. <https://doi.org/10.1017/S1474746416000610>
- Castro, J. E. (2007). Water governance in the twentieth-first century. *Ambient. Soc.*
- Chowdhury, M. A., Hasan, M. K., & Islam, S. L. U. (2022). Climate change adaptation in Bangladesh: Current practices, challenges and the way forward. *The Journal of Climate Change and Health*, 6, 100108
- Climate Change Cell 2006, “Climate Variability and Change in Bangladesh: Impact, Vulnerability and Risk”, Climate Change Cell, Department of Environment Component 4b, Comprehensive Disaster Management Program, Bangladesh.
- Dharmarathne, G., Waduge, A.O. Bogahawaththa, M., Rathnayake, U and Meddage, D.P.P. (2024). Adapting cities to the surge: A comprehensive review of climate-induced urban flooding, Results in Engineering, <https://doi.org/10.1016/j.rineng.2024.102123>.
- Dodman, D. (2009). Blaming cities for climate change? An analysis of urban greenhouse gas emissions inventories. *Environment and Urbanization*, 21(1), 185-201.
- Fleming, J 1998, “Historical Perspectives on Climate Change”, Oxford University Press, Inc.
- De Zeeuw, J., & Reeman, A. (2024b). Vulnerable people in the context of social impact assessment and management. In Edward Elgar Publishing eBooks (pp. 258–273). <https://doi.org/10.4337/9781802208870.00027>
- Gough, K. V., Yankson, P., Wilby, R., Amankwaa, E., Abarike, M., Codjoe, S., ... & Nabilse, C. (2019). Vulnerability to extreme weather events in cities: implications for infrastructure and livelihoods.
- Gilodi, A., Albert, I., and Nienaber, B. (2022). Vulnerability in the Context of Migration: a Critical Overview and a New Conceptual Model. *Human Arenas*. <https://doi.org/10.1007/s42087-022-00288-5>

#### Acknowledgement

The authors are grateful to the participants of this study for their unconditional support and voluntary response. The authors also acknowledge the efforts of anonymous reviewers for their critical and structured comments.

#### Competing Interest

The authors declare that they have no competing interests.

#### Credit Author Statement

Ashek Mahmud: Investigation, Data Analysis, Writing – the first draft; Md. Salauddin: Concepts and Methodology Literature Review, Analysis and discussion.

- Government of Bangladesh. (2019). Bangladesh Climate Change Strategy and Action Plan (BCCSAP). Retrieved from <http://www.icccad.net/wp-content/uploads/2019/11/Bangladesh-Climate-Change-Strategy-and-Action-Plan-2019.pdf>.
- Harlan, S. L., & Ruddell, D. M. (2011). Climate change and health in cities: Impacts of heat and air pollution and potential co-benefits from mitigation and adaptation. *Current Opinion in Environmental Sustainability*, 3(3), 126-134.
- Huq, S., Rahman, A., Konate, M., Sokona, Y., & Reid, H. (2015). Mainstreaming adaptation to climate change in least developed countries (LDCs). *Routledge*.
- IPCC. (2014). Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.
- IPCC. (2022). Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.
- Jabeen, H., Johnson, C., & Allen, A. (2010). Built-in resilience: Learning from grassroots coping strategies for climate variability. *Environment and Urbanization*, 22(2), 415-431.
- Jha, A. K., Bloch, R., & Lamond, J. (2012). Cities and flooding: A guide to integrated urban flood risk management for the 21st century. The World Bank.
- Kalam, A., Alam, M. J., Basharat, L., Sarker, G. F., Al Mamun, M. A., & Ahsan, A. H. M. (2024). The right to education and attitudes toward Hijras in Bangladesh: assessing educational support to achieve sustainable communities. *Quality Education for All*, 1(1), 187-203.
- Kaika, M. (2003). Constructing scarcity and sensationalising water politics: 170 Days that shook Athens. *Antipode*, 35(5), 919-954. <https://doi.org/10.1111/j.1467-8330.2003.00365.x>
- Pavel, M.A., Chowdhury, M.A. & Al Mamun, M. A. (2014). Economic evaluation of floating gardening as a means of adapting to climate change in Bangladesh. *International Journal of Environmental Studies*, 71(3), 261-269.
- Rabbani, G. (2010). Climate Change Vulnerabilities for Urban Areas in Bangladesh. *International Journal of Climate Change Strategies and Management*, 2(1), 21-34. doi:10.1108/17568691011021225
- Rahman, M. F., Islam, M. N., & Islam, M. A. (2014). Climate change adaptation practices in coastal Bangladesh. *Natural Hazards*, 70(2), 659-686.
- Revi, A., Satterthwaite, D. E., Aragón-Durand, F., Corfee-Morlot, J., Kiunsi, R. B. R., Pelling, M., ... & Sverdlík, A. (2014). Urban areas. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.
- Reynolds, R, Wiedmer, D & McGuigan, C 2002, "Poverty and Climate Change: Assessing Impacts in Developing Countries and the Initiatives of the International Community", London School of Economics Consultancy Project for the Overseas Development Institute.
- Roy, M., Hulme, D., Jahan, F., & Moinuddin, G. (2011). Which way to the future? Local perspectives on the impact and sustainability of a development project in Bangladesh. *Environment and Urbanization*, 25(2), 467-483.
- Roy, M., Hulme, D., Jahan, F., & Moinuddin, G. (2013). Which way to the future? Local perspectives on the impact and sustainability of a development project in Bangladesh. *Environment and Urbanization*, 25(2), 467-483.
- Roy, M. K., et al. (2011). Climate Change Vulnerabilities for Urban Areas in Bangladesh. *Journal of Climate and Development*, 3(2), 87-102. doi:10.1017/S1756552900010439
- Salauddin, M., Sarker, M.G.F., & Al Mamun, M. A. (2022). The Local Heritage 'Dhokols': Build Back Better Water Access in Reducing Gender-Based Vulnerabilities in Bangladesh. In: Roy, S. (eds.). *Gender and the Politics of Disaster Recovery: Dealing with the Aftermath*. *Routledge*, 1-256: 140-160.
- Salauddin, M. & Ashikuzzaman, M. (2011) Nature & Extent of population displacement due to climate change: a study on Bogi village of Sarankhola upazila under Bagerhat district, Khulna, *International Journal of Climate Change Strategies and Management*, Vol. 22 No. 5, pp. 620-631, Emerald Group Publishing Limited 1477-7835.
- Salauddin, M., Zohir, S., and Sarker, A. K., 2024. Governance and water landscape in Khulna city: past, present and future direction. *Khulna University Studies*. 21(1). DOI: <https://doi.org/10.53808/KUS.2024.21.01.1188-se>
- Satterthwaite, D. (2011). How urban societies can adapt to resource shortage and climate change. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 369(1942), 1762-1783.
- Shamsuddoha, M., & Chowdhury, R. K. (2007). Climate change impact and disaster vulnerabilities in the coastal areas of Bangladesh. COAST Trust, Dhaka, 40-48.
- Swapan, M. S. H. (2016). Who participates and who doesn't? Adapting community participation model for developing countries. *Cities*, 53, 70-77.
- Swyngedouw, E., & Kaika, M. (2014). Urban Political Ecology. Great Promises, Deadlock... and New Beginnings? - (L'ecologia política urbana. Grans promeses, aturades... i nous inicis?). *Documents d'Anàlisi Geogràfica*, 60(3), 459-481. <https://doi.org/10.5565/rev/dag.155>
- Suhartini, N. (2016). Governing Informality: Urban Basic Services in Informal Settlements in Jayapura, Papua, Indonesia. The 9th IFOU International Conference. <https://doi.org/10.13140/RG.2.2.14127.84649>
- The World Bank. (2010). World Development Report 2010: Development and Climate Change.

- The World Bank. (2021). Climate Change Action Plan 2021-2025: Supporting Green, Resilient, and Inclusive Development.
- UN-Habitat. (2011). Urbanization and Climate Change: Bridging the Divide. Retrieved from <https://unhabitat.org>
- United Nations Framework Convention on Climate Change (UNFCCC) 2007, “Climate Change: Impact, Vulnerabilities and Adaptation in Developing Country”, Climate Change Secretariat (UNFCCC).
- UN-Habitat 2011, “The Impacts of Climate Change upon Urban Areas”.
- Government of Bangladesh. (2019). Bangladesh Climate Change Strategy and Action Plan (BCCSAP). Retrieved from <http://www.icccad.net/wp-content/uploads/2019/11/Bangladesh-Climate-Change-Strategy-and-Action-Plan-2019.pdf>.
- Virokannas, E., Liuski, S., & Kuronen, M. (2020). The contested concept of vulnerability—A literature review. *European Journal of Social Work*, 23(2), 327–339. <https://doi.org/10.1080/13691457.2018.1508001>
- World Health Organization (WHO). (2025). Heat and Health. Available at: <https://www.who.int/news-room/factsheets/detail/climate-change-heat-and-health>. Accessed on 14 February, 2025