

Climate Change Impacts on Urban Livelihoods in Bangladesh: Analyzing the Intensity in the City of Rajshahi

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Abstract: Climate change is not an issue to be taken lightly. The pace of current civilization and its unlimited tendency to exploit nature has impacted almost every sphere of the planet. Not a single corner of the earth is safe. Even underdeveloped cities like Rajshahi, incorporating a minimum number of greenhouse emitting units, are exposed to the adversity of climate change. This study highlights how intensifying the result of climate change is and how it is threatening livelihoods. From the perspective of the local residents and the officials of the governing agencies, this study finds that the situation is concerning and livelihood is highly threatened. The study argues that climate change is an issue of concern even in the non-coastal cities in Bangladesh.

Keywords: Climate change; impact; intensity; livelihood; Rajshahi City.

1. INTRODUCTION

The issues of climate change have appeared as international concern within the last thirty years. It is widely agreed that the global mean temperature has increased up to 0.3°C to 0.6°C within the last centuries. The permanent existence of global warming has remained consistently identical with the prediction by the scientists over the world confirming variation in all sorts of climatic variables during the last few decades. The existing consensus in growing greenhouse gases will eventually make the atmosphere hotter [1]. The percentage of warming by the way is very unreliable. In 1990, the Intergovernmental Panel on Climate Change (IPCC, 1990) predicted that with a "Business-as-usual" scenario of greenhouse gas emissions, the world should be 3.3°C warmer by the end of the next century, with a range of uncertainty of 2.2 to 4.9°C [2]. Nevertheless, rates of global temperature variances are more significant than those, which have taken place naturally during the previous 10,000 years. Within the second portion of the current century (2001-2200), the earth's temperature would exceed what has happened over the previous 150,000 years so far. As the least developed nation of the world, Bangladesh may also be the most helpless to climatic change and its impacts. The growing trend of the global temperature perhaps increases the intensity of various climatic or natural hazards, such as, thunderstorms, tropical cyclones, drought, floods, etc. The proximity of variance in climate can't help being considered significantly in circumstances of the upcoming development of Bangladesh [3].

Warrick et al. (1994) confirmed the changes in rainfall and temperature across Bangladesh. In this study, writers have expressed average yearly temperatures from settling the reference year as 1951-80. They showed that, in this course of time, the temperature of Bangladesh is increasing from the last portion of the previous century. They denoted a general advancement in temperature up to 0.5°C, which can easily be compared with the magnitude of the already observed global warming [4]. The detailed analysis of yearly rainfall here in Bangladesh in the course of 1970-1991 presents a little dissimilar lengthy manner in average yearly rainfall amount [5]. Few other types of research have been conducted on rainfall variance and changes in the climate of Bangladesh considering agriculture as the primary mandate. These studies are also capable of giving concepts about the intensity of climate change in Bangladesh [6]. In a study done by Kabir (2015), it claims that the predicted decrease in the production of rice may reach up to 20% and 50% in a few varieties of rice within the years of 2050 to 2070, consecutively. According to Kabir, growth in everyday minimum and maximum temperatures are discovered as the primary cause for degradation in the rice harvest [7]. The average minimum temperature had an increasing trend up to 1976 during the post-monsoon and then descended after 1976, each being highly significant. In the cold season, till 1976 there was a significant decreasing manner but from the year 1977 the temperature seems to be increasing year to year. However, the rate is very small and insignificant.

In the context of Rajshahi, the Barrage Farakka seems to play an important role in being one of the key catalysts of climate change in this region because it has slowed down the flow of the river Padma. Adel (2013) has found the riverine ecosystem of Bangladesh is facing ecocide because of the Barrage [8]. In the words of Adle:

India has been drawing at least 60% of the downstream Bangladesh Ganges basin ecosystem's water without regard to the condition of the ecosystem in Bangladesh. Gain and Giupponi (2014) studied the impact of the Farakka Dam on thresholds of the hydrologic flow regime in the lower Ganges River Basin (Bangladesh) and the reduced flow in the Ganges is responsible for the increase of salinity in the southwest coastal region of Bangladesh and a reduction

of fish and agricultural diversity. They concluded that future studies are required, aiming at a more in-depth understanding of the system to investigate the combined impact of climate change and human-induced perturbation [9].

This research focuses on, however, all the aspects of the climate of Rajshahi and the effects of changes on the livelihood of the city considering the observation and experience of the local respondents and the institutes which play a key role as the actor in tackling the climate change effect.

2. METHODOLOGY

This study has been conducted in Rajshahi City Corporation which is a growing city of about 800,000 people in the northwest part of Bangladesh. It is one of the cleanest, peaceful and hygienic cities of the country. The study is qualitative in nature but many numeric figures were adopted from relevant literature. Required data have been collected from both primary and secondary sources. The primary sources of data were study field, study respondents and regular climate change relevant activities of the Rajshahi City Corporations, etc. On the other hand, various research reports and articles, official statistics, relevant books, daily newspapers, government policies and strategies, etc. were used as the secondary sources of data. The sample size of the respondents was 160. The respondents were divided into two categories, such as, stakeholders/local residents (150) and officials of responsible governing institutions (10). Local residents were chosen randomly whereas officials of governing agencies were chosen purposively. Data have been collected through questionnaire surveys and face to face interviews. Two different questionnaires (for each the local residents and officials) were used to complete questionnaire survey including both open and close ended questions.

3. RESULTS AND DISCUSSION

Respondents were asked about the effect of climate change in the city of Rajshahi. Only 1.33% of the total respondents consider this city is safe from rising temperature and only 0.66% consider this as a least threatening agenda where 94.66% see temperature is rising alarmingly day by day and it has become unbearable for them particularly in the hot season. They believe if the rising trends remain the same, the livelihood of this place will be under huge threat and it may demolish the habitat of this region in the near future (Table 1). About the colder seasons, 9.33% agreed on the statement that Rajshahi is a city which is safe from cold waves and 4.66% said that it is somewhat threatened but not a thing to be concerned about. 22.66% respondents believe that cold waves are threatening the habitats and a huge portion of the total respondents (63.33%) admitted that in the winter they have to suffer a lot because of the cold weather. However, nobody refused to share their opinion.

Storm is always one of the major concerns of the effects of climate change across the globe. Here, Rajshahi is no exception to that. 14% respondents ensured the safety of this city from the attack of the storm and 10.66% sees this as a tiny concern whereas 67.33% claimed that this city is extremely affected by the storm. Not only that, 8% respondent also thinks this town is threatened by the storm and it is a fact to be concerned about. Assuring about the city being affected by the storm multiple times a year, they also told the story of their suffering. Some of them lose their shade every year and spend a handsome amount of money to rebuild their houses. Mostly the families living in the tin shade houses in the slums near the bank of river Padma are the primary sufferers. The storm has been reported severely in the study of Salehin and Haque (2019). They have pointed this as a burning issue for this city. They also mentioned the sufferers have to spend a considerable amount of money every year which is more than a few thousand. It might not sound much but people who are living on the river bank and living in a tin shade house may find it difficult [10].

Table 1: Intensity of climate change in Rajshahi City

Responses of the local residents										
Climate aspects	Safe		Least threatened		No opinion		Threatened		Severe	
	Freq.	Rate	Freq.	Rate	Freq.	Rate	Freq.	Rate	Freq.	Rate
Temperature	2	1.33%	1	0.66%	0	0%	5	3.33%	142	94.66%
Cold wave	14	9.33%	7	4.66%	0	0%	34	22.66%	95	63.33%
Strom	21	14%	16	10.66%	0	0%	12	8%	101	67.33%
Flood	64	42.66%	3	2%	0	0%	0	0%	83	55.33%
Thunder	11	7.33%	12	8%	0	0%	2	1.33%	125	83.33%
Heavy Rainfall	21	14%	5	3.33%	0	0%	32	21.33%	92	61.33%
Drought	3	2%	9	6%	0	0%	52	34.66%	86	57.33%

[Source: Field Survey, 2020]

Table 1 shows that, in case of flood, 42.66% of the total respondents believe that they are safe from the flood and only 2% think that this is the least threatening agenda in Rajshahi where more than half (55.33%) of the respondents consider themselves as the

victim of the flood as well. They also confirmed that every year they have to tackle the flood when the river Padma overflows through their houses and sometimes they have to seek shelter elsewhere. However, the entire city is protected by the dam built along the side of the mighty Padma. Yet flood is an issue for half of the total people. Salehin (2016), in his study also claimed that this city is affected by the flood on a regular basis but it has a peculiar nature. The south-western portion of the riverbank is particularly safe where the middle region of the bank is severely affected. However, this is the case of the river bank. By the way, Rajshahi city is severely affected by water maroon. Every considerable rainfall makes the entire city flooded for a few hours and the suffering of the city dwellers knows no bounds during that time [11]. Because of the changing pattern in the climate, the rainy season is late and unpredictable. So it has undoubtedly appeared as a matter of concern for the people of Rajshahi city. However, unplanned urbanization, a faulty drainage system, and ignorance of the city habitats are the variables for this crisis but the still changing climate has no doubt added a new dimension to this problem.

About thunder, there are no crucial findings; however, above 80% of the respondents considered this as a threat which is severe, however nobody managed to provide any substantial findings (Table 2). On the other hand, heavy rainfall seems to be an issue. Here, only 14% respondents considered the rainfall is as usual and nothing to worry about where only a few (more than 3%) consider this as too tiny to be concerned about but more than half of the respondents reported this as a severe fact and one of the burning concerns for this region and more than 34% think this as a threatening factor since heavy rainfall is increasing day by day. It might be brief but very unpredictable according to the additional information provided by the respondents. This uncertain surprise rainfall is causing water maroon and the roads and neighborhoods are sinking under a few feet of water leaving the town dwellers with untold sufferings.

Table 2: Intensity of climate change in Rajshahi City

Climate aspects	Responses of the local governing institutions			
	Safe	Least Threatened	Threatened	Severe
<i>Temperature</i>				
<i>Cold wave</i>				
<i>Strom</i>				
<i>Flood</i>				
<i>Thunder</i>				
<i>Heavy Rainfall</i>				
<i>Drought</i>				

[Source: Field Survey, 2020]

Drought has always been the companion of the northern region of Bangladesh. Rajshahi belongs to this region. However, the city is out of harvesting and farming. Therefore, perhaps drought will get fewer priorities. Still, more than half of the respondents think drought is affecting the city of Rajshahi every year.

Now the same issues should be considered from the perspective of the institutions which are entrusted with the responsibilities to tackle the changing climate and reach the targets of SDG 13 within 2010 ensuring climate governance. The consideration of the governing bodies is slightly different. Where the response of the local residents relied on the severe level, the agencies address all the aspects like, temperature, storm, and thunder in the threatened level which is a notch down in the scale. But homogeneity was found in terms of heavy rainfall. Flood and drought received lesser priorities. Variation in the natural component by the effect of climate change has been described above. However, climate change is making the daily livelihood of the people intense and threatening all spheres of their lives. From the infants to the old ones no one is safe from the grasp of changing climate. The true picture of people’s livelihood affected by the effect of climate change has been reflected in the study of Mallick and Hossain (2018) [12].

A UN report (2018) suggested that hunger is increasing across the globe with an unruly climate: more than 821 million people around the world were found undernourished in 2017. In Bangladesh, the government and NGOs and the communities are giving endless efforts to control extreme poverty. Progress has been shown in poverty reduction in the country in the recent few years, however, impacts of climate change are still aggravating poverty in a few regions. However, it is observed that,

...many in the Rajshahi and Rangpur divisions are being threatened by extreme poverty as a result of climatic events, like flooding and river erosion in the north-western region of Bangladesh. A recent survey of Bangladesh Bureau of Statistics (BBS) has identified Kurigram as the most poverty-stricken district in the country, with the highest poverty ratio lingering as an outcome of the negative effects of climatic events [13].

The German NETZ and Bangladesh Centre for Advanced Studies (BCAS) in their document on the climate change trends in the region and the associated impacts of climate change on livelihoods and food security of the poor and indigenous communities, has documented long term trends and impacts of climate change.

They have also found that the north-western region is suffering from both climate variability (temperature rise, change in precipitation, and changes in seasonal patterns) as well as climatic extremes including frequent flood and riverbank erosion, heat stress and drought, erratic rainfall, thunderstorm, cold wave, and fog. The study conducted a long-term trend analysis of climate data and has suggested that the average rise of temperature in the north-western region would be 1.3°C and 2.6°C for the years 2030 and 2070, respectively. Winter precipitation is projected to decrease at a higher rate in 2030, while in 2075 there would not be any appreciable rainfall in winter [14].

On the other hand, monsoon precipitation would increase at a rate of 12 percent and 27 percent for the two projection years, respectively. Therefore, severe drought will occur in summer along with more devastating floods in monsoon in the region. Recent back to back floods in quick succession have made the climate shock visible. By the way, increasing floods and river erosion in northern sectors are affecting food security, agriculture and livelihood of the millions living in the region [15].

The participants in the Rajshahi region think that drought and heat stress are the most harmful effects of climate change followed by falling groundwater levels and cold waves. The participants in Dinajpur also identified drought, heat stress and declining groundwater levels as major climate disasters, along with the cold wave and flood; while the participants in Rangpur, Kurigram, and Gaibandha have identified flood and erosion as the most devastating natural disasters, which have been intensified by climate change in the recent years.

Temperature rise, drought, frequent floods, and riverbank erosion are affecting the resources, infrastructures, and livelihoods of the people every year. Subsistence agriculture, sharecropping, home garden, and vegetable growing were identified as the most affected and vulnerable sectors, which are critically important for nutrition and income of the poor, indigenous communities, and women. Crop cultivation, vegetable, and home gardening have been highly affected by drought in Rajshahi and Dinajpur [16].

Frequent floods and river erosion have a more significant impact on key livelihood sectors including agriculture, livestock, poultry, food security, water, sanitation, and health in the Rangpur region, compared to Rajshahi and Dinajpur. Flood also affects the livelihoods of the poor and the regional infrastructures including roads and communication systems, which again limit the livelihood activities of the poor, women, and marginalized people.

The farmers have informed that climate hazards are causing huge loss and damage to agriculture. The farmers in Rajshahi and Dinajpur cannot plant crops in time due to drought conditions and low soil moisture in the dry season and have to wait for rain for months. In the villages studied under the survey, the growth and yield of wheat, maize, vegetable, and fruits have been affected by drought and low rainfall. Pest attacks has been reported as common in the region. Flood damaged standing crops including paddy and vegetables in the Charland and flood plains of Rangpur and Dinajpur [17].

Now Table 3 describes the multidimensional effects of climate change in the city of Rajshahi. According to the local respondents, food security is threatened and it is noticed by 24%. Health security is at risk which is believed by 56.66% where food security has gained lesser priority in the institute's point of view. On the other hand, in the governance context health security has gained the optimum concern. About work security, however, more than half of the respondents have claimed that their profession has no solid security but the governing bodies have separate things to say. They have pointed this as a mild phenomenon altogether. Perhaps, the local people are mixing this up with the regular unemployment rate.

As for the economic context, the answer is so poor. Economic insecurity is tremendous, celebrated by 65.33% of the total respondents where this is also found severe by the high officials of many agencies who are supposed to tackle the challenges of climate change. Social insecurity is reported by a few (15.33%) and also found mild by the governing agencies but disaster management is a huge question mark according to data of the local people. 95.33% of the local people are not satisfied with the disaster management system at all and this weakness is also confessed by the agencies as well. Each of them has to say that climate change and the new natural phenomenon are adding a new dimension of challenges on a regular basis. The Ministry of Disaster Management and Relief confirmed that they are breaking sweats to prevent the havoc after any disaster and managing relief to all. From lack of funds to lack of personnel, every sort of challenge is there. The compatibility of the current actors in this regard is under question now.

By the way, although more than 88% of respondents consider climate change as a threat upon the local government, the institutions think it differently. They still consider this as a fact yet to be concerned about. Agriculture, bio-diversity and the cattle farming has also gained a little priority but not worthy mentionable here. Climate change is posing a threat to communication, this statement is accepted by almost 77% of the respondents and this is also pointed out as an affected area because of climate change by the governing agencies. Like transport, infrastructural development is also marked as an affected zone both by the local respondents and by the officials of the governing agencies who are the key actors of SDG 13 (Climate action).

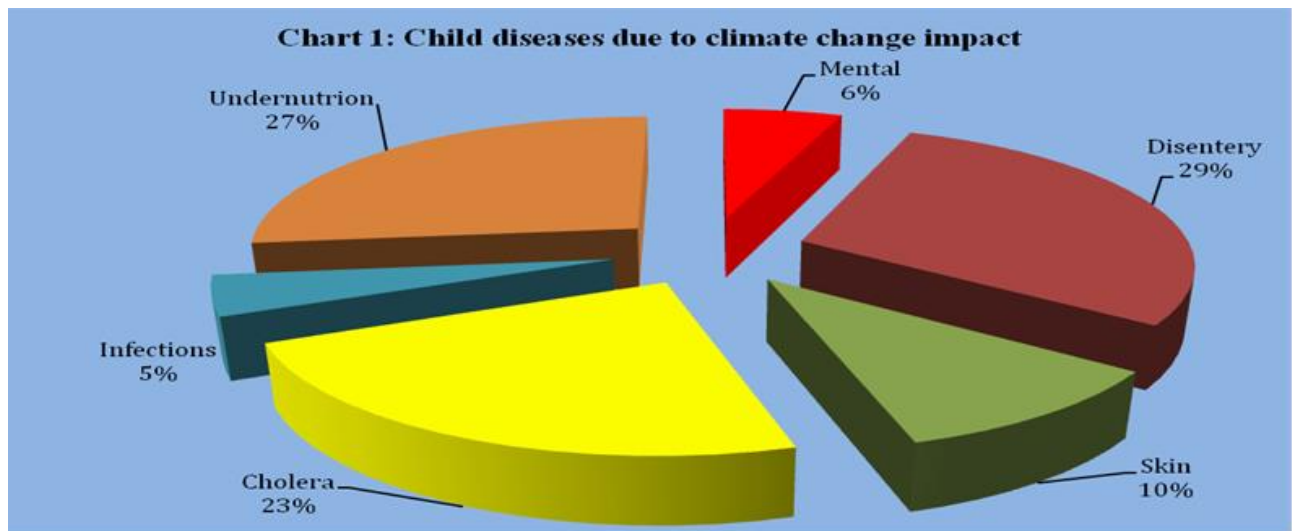
Table 3: Intensity of climate change on the livelihood in Rajshahi City

Aspects of livelihood	Local Residents		Local governing agencies							Comments
	Frequency	Rate (%)	R C C	M o E	M o S F D	C D F S	M o D M R	N G O s	O t h e r s	
Food Security	36	24%	=	~	=	~	~	n/a	n/a	Affected
Health Security	85	56.66%	~	~	~	~	~	n/a	n/a	Severe
Work Security	85	56.66%	~	~	=	=	=	n/a	n/a	Mild
Economic Security	98	65.33%	~	~	~	~	~	n/a	n/a	Severe
Social security	23	15.33%	=	~	=	=	=	n/a	n/a	Mild
Disaster Management	143	95.33%	~	=	~	~	~	n/a	n/a	Severe
Local Government	133	88.66%	~	=	=	~	=	n/a	n/a	Affected
Agriculture	15	10%	=	~	~	~	=	n/a	n/a	Affected
Bio-diversity	37	24.66%	=	~	~	~	=	n/a	n/a	Affected
Transport	116	77.33%	~	~	~	~	=	n/a	n/a	Severe
Cattle Farming	51	34%	=	~	=	~	=	n/a	n/a	Mild
Infrastructural Development	67	44.66%	~	=	~	~	~	n/a	n/a	Severe
Women and Children	5	3.33%	=	=	=	=	=	n/a	n/a	Safe

(N.B.: in the table, ~ means varied; = means not changed)

[Source: Field Survey, 2020]

Both children and women, climate change is always threatening these vulnerable groups. Basically, the children are suffering from climate change-related diseases [18]. The Chart 1 below shows that multiple diseases are caused due to climate change. Not only that, but diseases are also showing the different patterns from time to time i.e. in summer or in winter. However, very little has yet realized that since the data tells a completely opposite story.



[Source: Nazir and Tonoy, 2019]

Based on the above discussion, one thing is certain that the city of Rajshahi is not safe from the grasp of the changing climate. However, Rajshahi is far away from the sea and there are hardly any heavy industries or high concentration of carbon and greenhouse gas, yet it is one of the sufferers of climate change showing various symptoms which indicates that the intensity of climate change in Rajshahi is naked and clear.

4. CONCLUSIONS AND RECOMMENDATIONS

Climate change has surely left the lives of the habitats exposed to the impacts. Scientists are insisting to take precautionary measures and suggesting the entire community of the planet to take certain measures to adapt to these changes. They are also assuming certain ways to mitigate the already occurred damages. The constant denial of the developing world is making the situation worse. The atmospheric hazard caused by the developed and highly industrial countries is tearing apart innocent places like Rajshahi. The authorities must pay heed to this hazard and react to it properly within no time. Here certain steps can be handy.

- The institutions have to take the climate change agenda seriously.
- Local people have to be more cooperative with their regional authorities in order to work hand in hand to tackle climate change.
- The government has to give proper concern about the effect of climate change on the northern part of the country as well.
- The local development bodies of Rajshahi city have to be conscious about the entire city. So, every development work should be distributed throughout the entire city so that it can reach its ultimate efficiency.
- The local authorities have to monitor the climate vulnerable areas more closely than ever.
- The institutions must show more interest in conducting research and should be flexible for any research work that requires their help.

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