Analyzing Differentiated Climate Change Impacts on Women in the Wetland Area: A Case Study on Sunamganj District

Md. Kazi. Rokonuzzaman[1&2], Md Abdur Rahim[1&3]*, Raman Kumar Biswas[1], Most. Nusrat Binte Nur[1], Md. Faisal[1], Ayesha Siddiqua[1], and Dhiman Kumer Roy[4]

[1]Dept. of Disaster Resilience and Engineering, Patuakhali Science and Technology University, Dumki, Patuakhali-8602, Bangladesh; [2]Dept. of Earth Science, Graduate School of Science, Tohoku University, Sendai, Miyagi 980-8578, Japan; [3]Institute of Mountain Hazards and Environment (IMHE), Chinese Academy of Sciences (CAS), Chengdu, 610000, China; and [4]Dept. of Geology and Mining, University of Barishal, Kornokathi, Barishal-8200, Bangladesh.

*Correspondence: arahim@pstu.ac.bd (Md Abdur Rahim, Doctoral Student, Key Laboratory of Mountain Hazards and Earth Surface Processes, Institute of Mountain Hazards and Environment (IMHE), UCAS, China; & Associate Professor, Dept. of Disaster Resilience and Engineering Faculty of Environmental Science and Disaster Management, Patuakhali Science and Technology University, Dumki, Patuakhali-8602, Bangladesh).

ABSTRACT

Disadvantageous geo-location, dense population, and poverty make Bangladesh climate-sensitive, particularly in livelihoods. The impacts are detrimental to the economy, environment, and social development of the people of Dowarabazar and Jamalganj Upazila, Sunamganj District. This research aimed to scale the differentiated impacts of climate change on wetland women. To conduct the research, a survey approach following the Community Disaster Resilience Index (CDRI) was applied. The data were collected through questionnaire survey and observation. The sample size was 300 (150 males and 150 females). Simple random samplings were applied. The study included women of middle-aged, young, elderly, disabled, ethnic, religious minorities, widowed, destitute, and all income classes of poor and rich. It is found that the women's community is extremely vulnerable to different climatic impacts affecting women's capital of human, social, economic, physical, and natural. Women's social capital is highly impacted and the impact score is 3.54. Secondly, human capital (score is 3.07). The impact scores of natural and physical are 2.92 and 2.49. The lives and livelihoods of women have been severely curbed by climatic complications, vulnerable sanitation, poor house structure, and illiteracy. Proper management and access to income generation, empowerment, and social services are required for women's adaptation and resiliency.

Keywords: Climate, Impacts, Women, Vulnerable, Resiliency, Adaptation, and Empowerment.

INTRODUCTION:

Bangladesh ranked seventh among the ten countries in the world most vulnerable to climate-induced natural catastrophes, affected from 1999 to 2018 (Global Climate Risk Index, 2020). The GCRI (Global Climate Risk Index) also represents total losses of the 1686.33 million US dollars and the number of events is 191. A tropical cyclone named Amphan affected Bangladesh on 20 May 2020. As of 22 May, the UN estimates that 10 million people in 19 districts were affected, with an official death toll of 17 (OCHA, 2020). Bangladesh has a dominant and the harmful patriarchal societal

structure with norms and practices that place females of any age at higher risks of violence (UN Women, 2020). Men in Bangladesh tend to control income distribution, property, and access to credit, decision-making processes, and sources of food. Even in normal times, women lack social power and their condition is being aggravated by the increased demands on them (IDS, 2008). Poverty and women's vulnerability are structural issues requiring the transformation of practices perpetuating them (UNISDR, 2013). Gender inequalities manifest themselves in differing roles, resources, rights, knowledge, & time to adapt to climate change (Babagura, 2010; Petrie, 2010).

Around two-thirds of the total land of Bangladesh is classified as wetlands (Nanda *et al.,* 2016). Which has been projected around seven to eight million hectares (Rahman *et al.,* 2001). Sunamganj the wetland area of Bangladesh affected by climate change adversely, especially because of its unique geographic location (Rahman *et al.*, 2016). The regions often experience disruptive flash floods (Abedin *et al.,* 2020). Flash floods arise for a short duration with slight or some-times no warnings. Haors' unique hydroecological characteristics are shaped in Sunamganj, Sylhet, Moulvibazar, Kishoreganj, Habiganj, Brahmanbaria, and Netrokona Districts (CEGIS, 2012). In the haor area, the socioeconomic and livelihood conditions are much different from the plain and hilly regions (Hossain *et al.,* 2017). The flooding of wetlands negatively affects the economic condition of farmers who are primarily dependent on farming practices (Rahman, 2014).

Widespread problems the region experiences of food insecurity due to a combination of factors which includes: crop losses due to early or flash floods and erosion; poor access to markets, especially during the flood season; and traders and services isolation (Caldwell, 2011). The wetland region has overall notably low literacy rates among the total population, compared to the national average. Moreover, the region has a high incidence of water-borne diseases and very poor maternal and child nutrition and health indicators (BBS, 2010). Under the prevailing social and economic circumstances, women are lagging far behind their male counterparts. Because of gender-based inequalities, all classes of women are typically at

higher risk than men (UN, 2004; Enarson, 2002). Due to separation, divorce, or widowhood, women have less access to rights & resources (Antonopoulos and Floro, 2005). The lack of utility services in informal settlements disproportionately affects poor women, exacerbating inequities based on legal status, race, and other intersecting social circumstances and increasing their vulnerability to climate shocks (Jagriti, 2015; Khosla, 2010).

To cope with seasonal and episodic weather & natural disasters women have fewer resources. Consequently, traditional roles are reinforced, and women's ability to diversify their livelihoods is diminished (Masika, 2002; Denton and Parikh, 2003). Increasing the number of women in leadership positions would elevate the quality of their contribution to the economy and help Bangladesh achieve middle-income status (Marcus Noland, 2016). There are several researches in the haor (wetland) areas of Bangladesh but very few researches are based on the differentiated impacts analysis. The study area of Sunamganj District is unexplored in terms of identifying the differential impacts of climate change on women.

Site selection for the research
Sunamganj District is located in the north-central region of Bangladesh below in (**Fig. 1**). The area is 3,669.58 sq. km, located between 24°34' and 25°12' north latitudes & between 90°56' & 91°49' east longitudes. Sunamganj District constitutes the bowl-shaped depression basin of the country, locally called haor. There are 95 haors located in this area. Sunamganj District comprises of 11 Upazilas (BBS, 2011). 15 villages of 6 unions under Dowarabazar and Jamalganj Upazilas of Sumanganj District were selected for the designed research. The area of Dowarabazar Upazila is 324.19 sq. km. There are 294 villages, and 9 unions in Dowarabazar Upazila (BBS, 2011). The area of Jamalganj Upazila is 338.74 sq. km. and comprises 5 unions and 165 villages (BBS, 2011). The household survey location map is shown in below **Fig. 2**.

Research approach and method
Community Disaster Resilience Index (CDRI) was used to measure differentiated climate change impact on women and to enhance social equity in the study area.
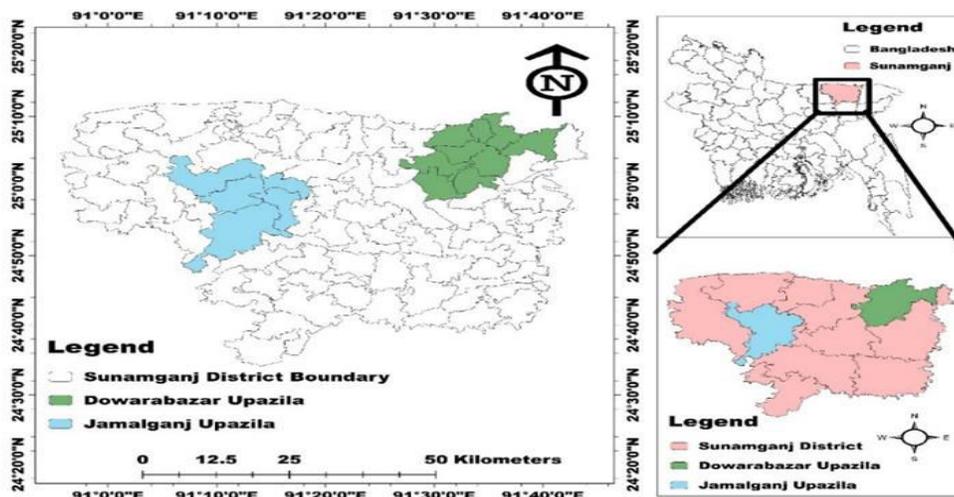
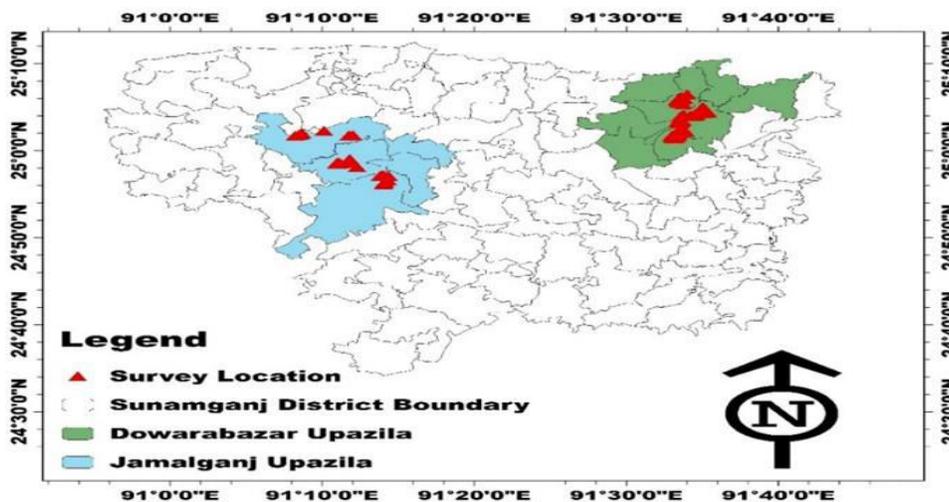**Fig. 1:** Study area map of Sunamganj District.

Fig. 2: Household location map in the study area.

The surveys were conducted at individual house-holds of all types of women and men middle-aged, young girls, elderlies, disabled, ethnic, religious minorities, widowed, destitute women, and all income classes of the pro-poor, poor, middle class, or even rich. The Community Disaster Resilience Index (CDRI) method is considered for quantitative and qualitative analysis that consists of five dimensions or capitals. These are directly or indirectly affected by differentiated climate change vulnerabilities in women. The five dimensions are: human, physical, social, economic, and natural. Each of these parameters is highlighted in **Table 1**.

Table 1: Components and sub-components of the CDRI framework that have been adopted and contextualized in the study.

Form of Capital (Components)	Indicators
Human Capital	Education
	Health
	Skills
	Agency
Social Capital	Trust
	Networking
	Norms

Economic Capital	Income
	Savings
	Investment
Physical Capital	Housing
	Business
	Facilities
Natural Capital	Access to forest resource
	Access to water resource
	Ecosystem

CDRI calculation

The Community Disaster Resilience Index (CDRI) method encompasses of five dimensions which are equally divided into five parameters. Considering the weighting scheme with five variables their ranked is W1, W2, …. W5 based on their importance. In this ranking "0" indicates no importance, lower importance "1" and most importance "5" in shaping the highest score of a particular parameter and impact dimension. Because this simple structured questionnaire with uniform numbers for each variable and parameter ranging between 1 and 5, it allows a transparent adoption of the formula (Eq. 1) named weighted mean to calculate the CDRI scores for each variable, parameter, & dimension in a uniform and synchronized approach (Joerin and Shaw, 2011). The following equation is proposed for integrating the five major domains of capital to generate the Community Disaster Resilience Index (CDRI) from the research perspectives.

$$CDR_i = \frac{\sum(w_1 SC_i + w_2 EC_i + w_3 HC_i + w_4 PC_i + w_5 NC_i)}{n}$$ ………. (Eq. 1) (Mayunga, 2007)

Here,
CDR_i = Overall community disaster resilience index, SC_i = Social capital index, EC_i = Economic capital index, HC_i = Human capital index, PC_i = Physical capital index, NC_i = Natural capital index, w = weight, n = Number of capital domain, i = Domain numb.

Data collection

Both quantitative and qualitative data were collected through primary and secondary methods for this study.

Primary data collection

The accuracy of information depends greatly on the survey methods used. An inspection survey is conducted to understand the area's environment, social capital, and people's capacity development perception.

Household questionnaire survey

To gather the quantitative data, individual face-to-face interviews were conducted. A semi-structured questionnaire is used to collect data from the household survey. Required information for research is collected from the area through this questionnaire survey. A total of 300 household surveys were directed to fulfill the research purposes. The survey involved 150 male and 150 female interviews.

Focus group discussion (FGD)

Focus group discussions were conducted with both males and females to find out female real conditions. It helps to gather a wide range of information in a short time. The participants of the FGD were 8 to 10 women engaging in different occupations and different ages. Based on the objectives of the research, 10 Focus group discussions (FGD) of both females (5 No.) and males (5 No.) were conducted in both Upazilas.

Key informant interviews (KII)

KII interviews with 10 key informants were performed for this research. The survey engaged the respective Upazila's government, and NGO offices, the Chairman of the union parishad, union Parishad Members of each union, teachers, and other experienced society in the respective area for the interview.

Secondary data collection

To the establish a foundation for the study, various secondary sources of data have been utilized, including study books, journals, articles, newspapers, abstracts, internet documents, government office records, NGO office reports, union and the Upazila Parishad office records, and published reports.

Data analysis

For the estimation of indicators by the respondents' multiple and single perceptions considered as high, medium, low, very low, and no values are made for each criterion. These categories are weighted according to the responses simply by assigning most severe or out of control = 5, very high = 4, high = 3, medium = 2, and low = 1 point and weighing the totals by multiplying with the respondent's value and then dividing it by value of sampling shown in annex-1. Thus, a total value for the particular differentiated impacts is derived. All data have been analyzed using ArcGIS 10.7 (Study area and household survey map), SPSS, & Microsoft Excel (different analytical charts).

RESULTS AND DISCUSSION:

Socio economic status

During the questionnaire interview, almost half of the respondents opined they were poor, and the value is about 51.21% (**Fig. 3**). Poor have fewer opportunities for income generation during any disastrous events. A poor household especially a women-headed household severely affected due to lack of earnings because of social & cultural barriers of conservatism, early marriage, lack of awareness, less technical support from outside assistance, etc. A large group of people (about 38.75%) is in middle-income categories and middle-income families face the most unexposed problems due to floods, flash floods, and other natural stresses.

The intermediate-level population can't receive any kind of help from others because of social crises. Even they don't share any crisis with others. However rich

people in the study area are less affected by climate anxieties. Only 10.03% shared they were affected but most of the cases can survive with their own resources.
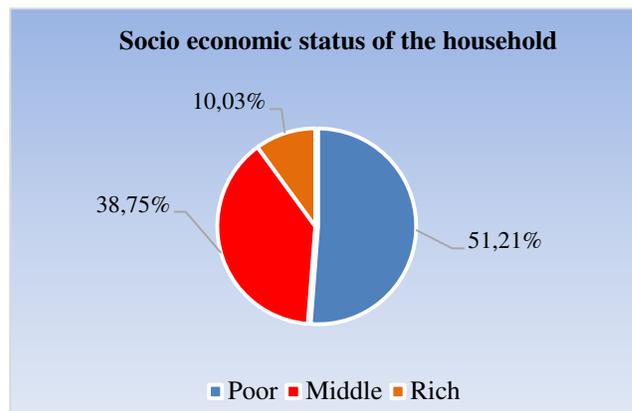

Fig. 3: Respondent's socioeconomic status of the household.

Income generation

Fig. 4 indicates the climate change impact on economic sectors is very high in the study area. The monthly income is very low which is represented in **Fig. 4**. It is evaluated that income from 3000 to 10,000 taka per month is poor, from 10,000 to 30,000 are middle class, and more than 30,000 Bangladeshi takas are considered rich. About 62.56% of respondents have no contribution to income generation. Especially during calamities, there are no opportunities for the women to income generation and they are completely dependent on others. Besides, a large group earning money per month from less than 3000 to a maximum of 15,000 taka is not enough to support the family.
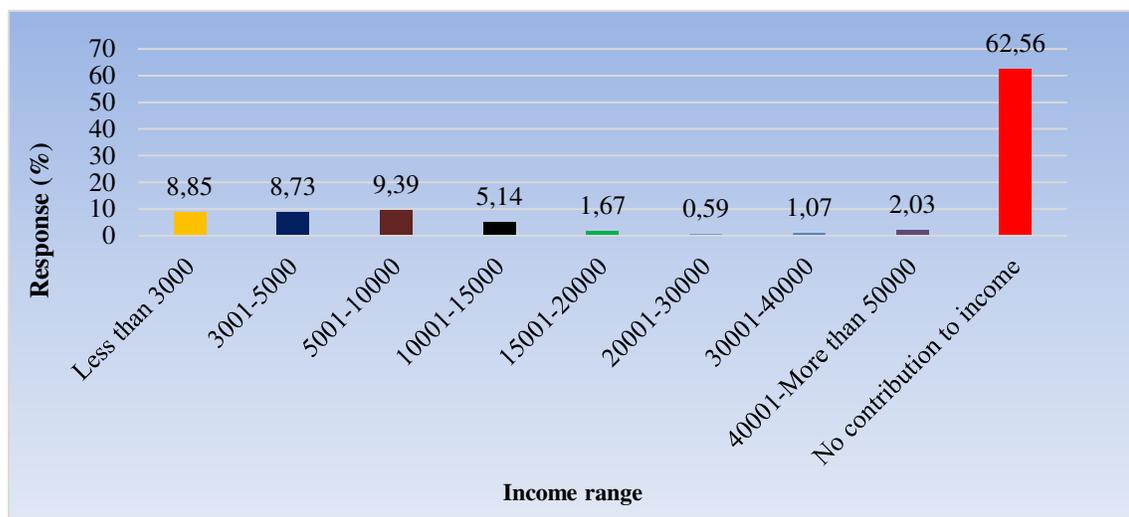

Fig. 4: Income generation per month.

Only a few people are in the middle and rich class and earn money from more than 10,000 to 50,000 taka per month. Although in most cases, poor and middle-class people fight with climate vulnerabilities rich people somewhat can cope with their resources.
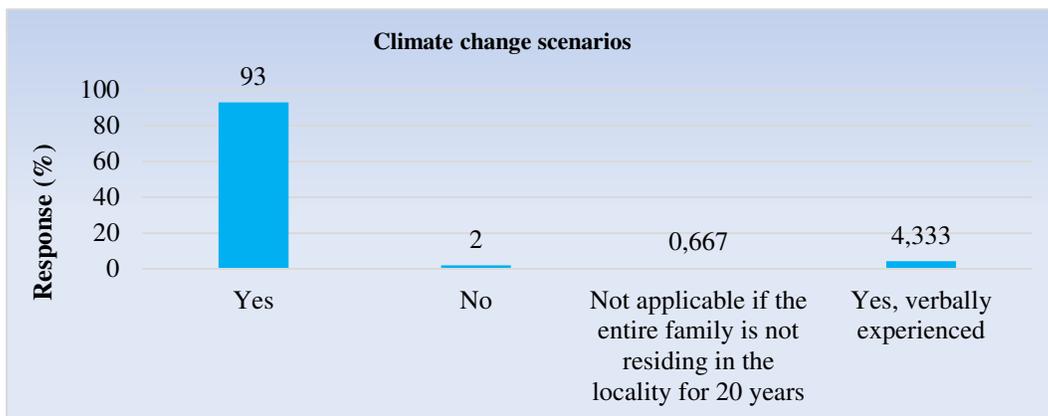

Fig. 5: Last 20 years climate change scenarios at Sunamganj.

Climate change at Sunamganj in the last 20 years
In the wetland areas, the climate drastically changes & about 93% of respondents agreed with this statement below **Fig. 5**. The Haor area's geographical location is an important reason for climate change impacts. Every year different natural events of thunderstorms, flash floods, & floods hurt food production, fish farming, income generation, health, education, etc. Only 2% of respondents disagreed & they think climate change isn't an abnormal issue. It's the rule of nature. 0.667% didn't know and they didn't notice the change. However, 4.33% of respondents verbally experienced & agreed that climate change is noticeable and the impact on women is very high compared to men.

Changes in pattern for the last 20 years
From the analysis (**Fig. 6**), 93% agreed that climate change has been happening for over 20 years. In the
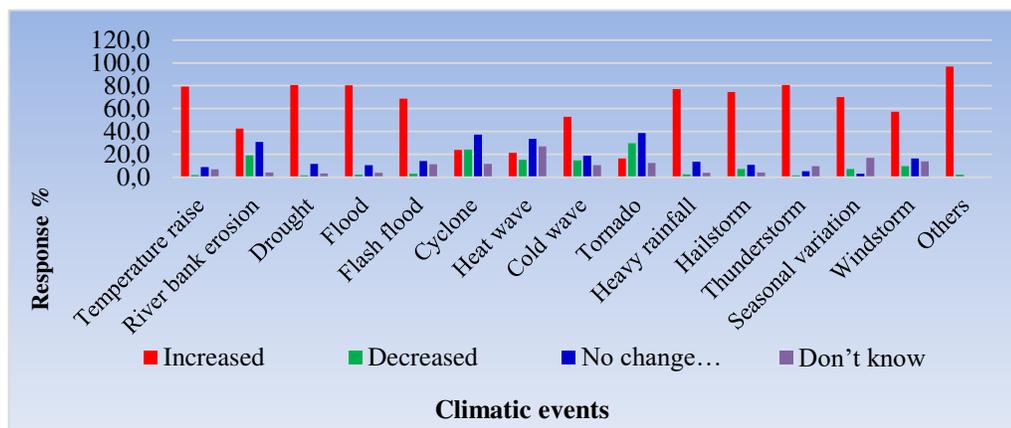
last 20 years temperature fluctuation, the river bank erosion, drought, flood, flash flood, cold wave, heavy rainfall, hailstorm, thunderstorm, seasonal variation, and windstorms have increased noticeably in the study area. Raising temperatures, drought in the summer season, seasonal floods, flash floods, heavy rainfall, hailstorms, thunderstorms, and seasonal variation relatively more increased than others. Increasing phenolmena of climate cause large stresses on the human being. Women are particularly immensely affected by the aforementioned catastrophes. At present, thunderstorms, floods, and flash floods in the study area have created an alarming situation for livelihood. Recent statistics indicate that Sunamganj wetland area is more vulnerable to thunderstorms.

Fig. 6: Climatic events at Sunamganj in the past 20 years.

Dimensional analysis

Human capital

Human capital (**Fig. 7a**) is subdivided into four indicators education, health, skill, and agency. All the indicators are affected by climate change in the haor region. Among these, the most affected is women's agency and the score is 3.48. Women have barriers to deciding on a disaster and it is found high rate from other human indicators. Political power, patriarchal norms, gender roles, lack of knowledge, and religious conservatism create barriers to making the decision. Women's livelihood alternative skills are impacted by the climate stresses and the calculated value is 3.41. Due to a lack of the awareness, money, and other resources, absence from the empowering environment is the root cause of achieving skills. Thirdly, girls' education was hampered due to the changes with a value of 3.12. Because they face difficulty in attending school and inability to pay for education. The above graph specifies that there is a lower impact on women's health than the other indicators and the value is 2.29. Waterborne diseases, emotional stresses, menstrual problems, and skin diseases are common health issues for women.

Impacts on women's social capital

Social capital (**Fig. 7b**) is hampered due to climate change. Trust, networking systems, and social norms are all of the indicators greatly impacted due to climate stresses. The networking system of women is highly affected and the impact score is 4.09. Women face various problems in joining basic service programs. The family didn't permit women to engage in institutions to build a network. Sometimes women are not interested although they have enough time. In most cases, networking programs are arranged by male people, so women's decisions are not given much priority, & subjected to physical & mental harassment when attending such sessions. Besides, society has a lack of trust in women during the disaster risk reduction processes. Social trust is the second impacted area according to the calculation and the score is 3.81. Masculinity, lack of awareness, less attention to women's needs, physical states of women, etc. are the sources of the lack of social trust. During the distribution of relief and resources, women faced more difficulties than men when disasters struck. Also,

the social norms and values of women are affected by disaster and the score is about 2.74. Climatic effects are responsible for to rise in domestic violence, sexual assault, and social insecurity.

Impacts on women's economic capital

Climate change hurts women's income, savings, and investments. From (**Fig. 7c**), the most impacted area is savings and the impact score is 3.11. Religious conservatism, lack of the savings knowledge, less access to income generation, disapproval from family, and lack of savings institutions developed women's savings-related problems. Secondly, it reduced women's income generation and the value is 2.86. The impact on livelihood & income generation due to climate change causes migration and challenges to the migrated people. The challenges change the nature of women's income characteristics. Women also faced different kinds of barriers in the job sectors. Patriarchal norms, conservatism, & illiteracy make women more vulnerable to taking and repaying loans. Women are discouraged from participating in economic activities due to the fear of falling into a cycle of debt. Women's investment is hindered by poor income sources and social barriers, resulting in a score of 1.99 for economic impact.

Climate change impacts on women physical capital

Community physical resources (houses, businesses, and facilities) are significantly hampered due to hazards (**Fig. 7d**). In the study area, housing structures affected by climate change resulted in a score of 2.13 and that is the lowest score from other physical structures. Community kaccha houses are frequently impacted by disasters. The house gets inundated, washed away, and sometimes can be tilted. Due to this reason, women can't actively join other services to build their capacity. The community business capacity impacted score is 2.55. People actively linked with different primary and secondary businesses. Climate change directly or indirectly hampered their business. Most of the respondents directly or indirectly connected with agri-business. Lack of agricultural inputs and agricultural storage hampered agricultural-related business. Besides, Women face challenges in accessing agricultural and non-agricultural assets for business. Lack of skill, lack of the capital to afford the assets, conservatism, and lack of technical support are the

principal barriers to women doing business. Lack of facilities women can't continue their daily activities. Most of the impact is on the facilities of women (score is 2.8). WASH facilities were seriously affected due to the disaster. Toilets were inundated and washed away in times of frequent events. Sometimes toilet materials

are disrupted during the flood. Women face difficulties collecting water from far distances and most of the time they use polluted water. Bathing, cooking, and cleaning houses and clothes are extremely hampered due to climatic events.
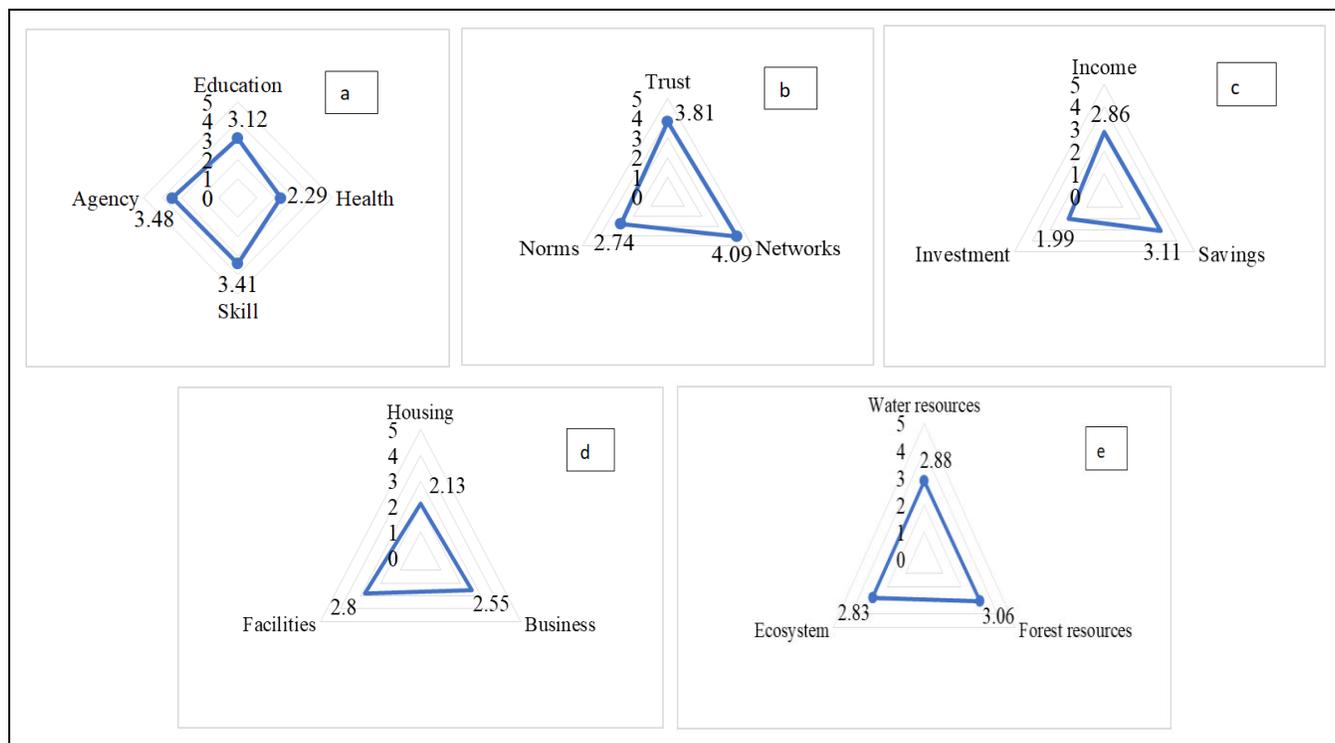

Fig. 7: (a) Climate change impacts on women's human capital; (b) impacts on social capital; (c) on economic capital; (d) on physical capital and (e) impacts on women's natural capital.

Climate change impacts on women natural capital
The natural resources in the wetland zones have been severely impacted by climate change. **Fig. 7e** represents women harshly affected by managing forest resources (Impact score is 3.06). Lack of firewood source and storage capacity and gender roles make them more vulnerable. Generally, women collect water for both domestic use and drinking purposes and water resources are the next impacted natural capital, and the impact score is 2.88. Due to the climatic impacts, water sources are the inundated and sometimes washed away. Women feel physical and mental difficulties in collecting water from long-distance muddy roads and queue service to serve their families. Women also faced pregnancy-related complications, diarrhea, cholera, and other waterborne diseases. Local people use different purifying methods to drink water as filtration, chlorination, and heating method. Using ecosystem

services related to women in the area largely impacted by climatic events. The calculated impact score of ecosystems is 2.83. The distribution of the natural resources is largely influenced by political biases. In the haor areas, improper monitoring of the government body affects to access natural resources for women. Fisher-women are not freely accessed in the whole-haor areas for easy livelihood and their income is reduced due to the unfair behavior of the local leaders. Besides, the lack of management and monitoring of natural resources impacted the women's natural capital highly.

Overall climate change impacts on women
To fulfill the research objectives the CDRI method is used to analyze quantitative impact values through the household data calculation. CDRI method is divided into five capitals human, social, economic, physical,

and natural (**Fig. 8**). Women face social discrimination and the condition is being aggravated by the increased differentiated climate change impacts on them. Social capital indicates that women in the study area are mostly affected due to social barriers and the impacted score is 3.54 which is the highest impact score in this research. From the analyses, climate change impacts the social sector within the weight between 3 to 4 and is categorized as more than high but less than a very high impact. Social trust in women, networks, and norms are greatly affected by climate change. Women are characteristically at higher risk than men in receiving education, health care, and nutrition intake. Study reveals women's human capital is affected as the second highest score is 3.07. Education, health, skill, & agency or decision-making are severely interrupted due to climate stresses. Although women can access it sometimes but cannot control natural resources and other property rights (Ribeiro *et al.,* 2010; Shahjalal M., 2021). The third impacted area in this study on

women is natural capital & the score is 2.92 considered as medium type impacts. The natural capital includes water resources, forest resources, and the ecosystem services, & women are hindered moderately due to climate change. Wetland flood reduces the farmer's economic condition, mainly dependent on agriculture & other secondary occupations. Economic capital has the fourth highest score of 2.62 and causes medium-level climate change impacts on women's livelihood than males. Economic wealth is related to income, saving, and investment and women are not usually familiar in most cases. Climate-induced flash flood in wetland areas affects settlement, agricultural production, road, & other communications every year (Islam *et al.,* 2010). The moderate and fifth-rank impact is the physical capital of women and the impact score is 2.49. In the research area, women frequently face housing problems, agricultural and non-agricultural business barriers, and also change to be disrupted in water, sanitation, and hygiene services.
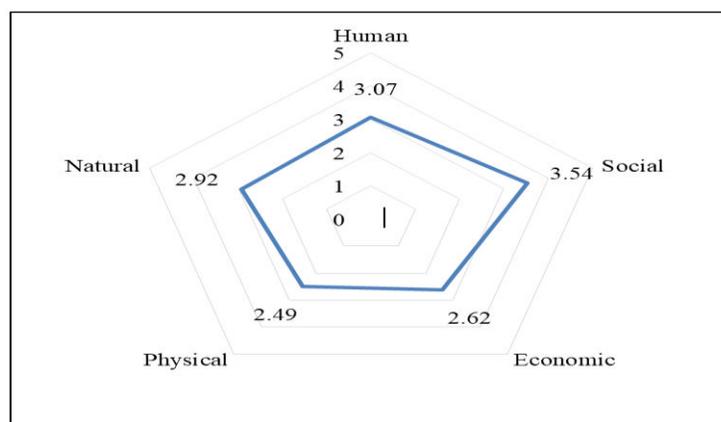

Fig. 8: Dimensional analysis according to the CDRI model.

CONCLUSION:

Women in hoar areas (wetlands) in Bangladesh are highly susceptible to the influences of climate change. Usually, people living in haor areas are more vulnerable to floods, flash floods, riverbank erosion, heavy rainfall, temperature variation, and thunder-storms. Women face social discrimination and the condition is being aggravated by the increased differentiated climate change impacts on them. The frequent ire-gular natural events have severe impacts, especially on the women's income, livelihood, education, health, infrastructure, assets, and skills. Besides, different climates caused health complications, the vulnerable sanitation, poor house structure, illiteracy of women, the water

crisis in the dry season, and water source management in the rainy season, directly and indirectly, affected women's lives & livelihood. The analyzed Community Disaster Resilience Index (CDRI) shows the climatic impact score of social capital (3.54), human capital (3.07), natural capital (2.92), economic capital (2.62), and physical capital (2.49). People exist in poverty and to migrate other places due to the loss of income and property. More than 85% are involved directly or indirectly in agricultural work. Paying female roles in agricultural work is very difficult. Respondents of the study area have minor access to savings from their daily earnings. Sometimes they managed the economic losses that arose from damage and inundation of the

cultivated lands by taking a loan from microcredit organizations, other banks, and societies while women have fewer opportunities for such recovery. The availability of the financial resources largely constrained recovery from disasters. Migrating to other places often poses an additional problem for the improvised people, especially in securing livelihood options due to their lack of technical and communication skills. They need motivation, counseling, training, & all institutional provisions from the government and the NGOs for their sustainable livelihood. Investing in basic social services and infrastructure, particularly in health care, water, sanitation, childcare, and the labor-saving technologies reduces women's workloads and builds resilience without further limiting their time and self-determination. Intersecting inequalities of the women increases women's profits, resources, opportunities, and adaptive dimensions to reduce the differentiated climate change vulnerabilities.

ACKNOWLEDGEMENT:

CONFLICTS OF INTEREST:

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

REFERENCES:

1) Abedin J, Khatun H., (2020): Impacts of Flash Flood on Livelihood and Adaptation Strategies of the Haor Inhabitants: A Study in Tanguar Haor of Sunamganj, Bangladesh. *The Dhaka University J. of Earth and Environmental Sciences,* **8**, 2019.
https://www.banglajol.info/index.php/DUJEES/article/view/50757/36069

2) Antonopoulos R, and MS Floro, (2005). Asset ownership along gender lines: Evidence from Thailand. Gender, Equality, and the Economy Working Paper No. 418.
https://www.levyinstitute.org/pubs/wp418.pdf

3) Babagura A., (2010). Gender & Climate Change: South Africa Case Study. Southern Africa: Heinrich Boll Stiftung.
https://www.boell.de/sites/default/files/assets/boell.de/images/download_de/ecology/south_africa.pdf

4) Bangladesh Bureau of Statistics, (2010). Household Income and Economy Survey 2010.

5) BBS 2011: District Statistics, (2011). Bangladesh Bureau of Statistics and Informatics Division, Ministry of Planning Government, the People's Republic of Bangladesh.

6) Caldwell R, and Raves loot B., (2011). SHOUH ARDO Baseline survey report, Dhaka, CARE Bangladesh: 203 pp.
https://www.carebangladesh.org/upload/files/Publication_9236662.pdf

7) Centre for Environmental Geographic Information Services, CEGIS, (2012).
https://www.researchgate.net/profile/NazneenAktar/publication/281964431

8) Denton F, and Parikh J., (2003). Gender: A Forgotten Element. *Tiempo*, **47**, 27-28.
https://www.iied.org/sites/default/files/pdfs/migrate/G00054.pdf

9) Enarson E., (2002). Environmental Management and Mitigation of Natural Disasters: A Gender Perspective. Panel II, Commission on the Status of Women, 46th Session, March. UN, New York, 2002.
https://www.un.org/womenwatch/daw/csw/csw46/panel-Enarson.pdf

10) Global Climate Risk Index CRI, (2020).

11) Hossain MS, Nayeem AA, and Mazumder AK., (2017). Impact of Flash Flood on Agriculture Land in Tanguar Haor Basin. *Inter J. of Research in Environmental Science*, **3**(4), 42-45.
https://www.arcjournals.org/pdfs/ijres/v3-i4/7.pdf

12) Institute of Development Studies (IDS), (2008). Gender & Climate Change: mapping the linkages, a scoping study on knowledge and gaps.
http://www.adequations.org/IMG/pdf/GenderAndClimateChange.pdf

13) Islam AS, Bala SK., and Haque MA., (2010). Flood inundation map of Bangladesh using MO-DIS time series images. *J. Flood Risk Manage*, **3**(3), 210-222. https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1753-318X.2010.01074.x

14) Jagriti K, Aggarwal S, and Punhani G., (2015). Vulnerability of Poor Urban Women to Climate-Linked Water Insecurities at the Household Level: A Case Study of Slums in Delhi. https://journals.sagepub.com/doi/10.1177/0971521514556943

15) Joerin J, and Shaw R., (2011). Mapping climate and disaster resilience in cities. In Community, *Environment and Disaster Risk Management*, **6**. https://www.researchgate.net/publication/235288412

16) Khosla P and Masaud A., (2010). Cities, Climate Change and Gender: A Brief Overview in Dankelman, I. (ed) Gender and Climate Change: An Introduction. *London, UK: Earthscan*.

17) Marcus Noland, Tyler Moran, and Barbara Kotschwar, (2016). Evidence from a Global Survey, Working Paper 16-3 Peterson Institute for International Economics. https://www.piie.com/sites/default/files/documents/wp16-3.pdf

18) Masika R., (2002). Gender, Development and Climate Change, *Oxfam publication, Oxfam G.B., Oxford*, p.104.

19) Mayunga J., (2007). Understanding and applying the concept of community disaster resilience: A capital-based approach. Summer Academy for *Social Vulnerability & Resilience Building*. 1-16. https://www.researchgate.net/publication/28489485

20) Nanda N, Khan AS, and Dwived K., (2016). Hydro-politics in GBM basin: the case of Bangladesh-India water relations. *The Energy and Resource Institute, New Delhi, India*.

21) OCHA Asia Pacific Humanitarian Update. Cyclone Amphan: Flash Update #2, 22 May (2020).

https://reports.unocha.org/en/country/asia-pacific/card/2COhccXPQc/

22) Petrie B, (2010). Gender and Climate Change: Regional Summary. Southern Africa: Heinrich Boll Stiftung.

23) Rahman AA, Alam M, and Kabir SA, (2001). State of the Environment: Bangladesh 2001, United Nations Environmental Programme. https://doe.portal.gov.bd/sites/default/files/files/doe.portal.gov.bd/publications/

24) Rahaman MM, Sajib KI, and Alam I, (2016). Impacts of climate change on the livelihoods of the people in Tanguar Haor, Bangladesh. *J. of Water Res. Eng. and Management*, **3**(1), 1-9. https://iwra.org/member/congress/resource/1200_Rahaman_PS75001_Sidlaw_Tues_v2.pdf

25) Rahman SU., (2014). Impacts of Flood on the Lives and Livelihoods of People in Bangladesh: A Case Study of a Village in Manikganj District. MS thesis, *BRAC University, Dhaka, Bangladesh*. http://dspace.bracu.ac.bd/bitstream/handle/10361/3802/13168004.pdf?sequence=1

26) Ribeiro N, and Chaúque A, (2010). Gender and Climate change: Mozambique Case Study. *Heinrich Böll Foundation Southern Africa*, 42 p. https://www.boell.de/sites/default/files/assets/bo

27) Shahjalal M. (2021). Global climate change and suffering of woman; a case of Bangladesh, *Asian J. Soc. Sci. Leg. Stud*., **3**(4), 158-164. https://doi.org/10.34104/ajssls.021.01580164

28) UN, (2004). Women 2000 and Beyond - Making Risky Environments Safer. New York: Division for the Advancement of Women, Department of Economic and Social Affairs, United Nations.

29) UN Women, (2020). Rapid Gender Analysis of the Impacts of COVID-19. Gender in Humanitarian Action (GIHA) working group, May 2020.

30) UNISDR, (2013). Background Paper on Issues of Vulnerability and Gender, p. 6. http://www.preventionweb.net/files/34051_backgroundpaperonissuesofvulnerabil.pdf