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Impact of Climate Change on Crop Yield in Salinity-Prone Coastal Bangladesh

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Abstract:
Climate change poses a serious threat to agriculture, especially in low-lying, salinity-affected coastal regions of Bangladesh. This study investigates the impact of climate change on crop yields in the *Satkhira* and *Patuakhali* districts, using one-sample t-tests and Pearson correlation analyses. Data were collected from 375 experienced farmers in two severely affected coastal upazilas. The t-tests compared local crop yields to national averages, revealing statistically significant reductions in yields. The correlation analysis explored the relationships between 12 socio-economic and farming-related variables and farmers' perceptions of climate change impacts on crop production. Key findings include significant yield declines in major crops such as rice, tomato, and sesame. Strong correlations were also found between perceived climate impacts and factors such as cropping intensity, climate change awareness, use of climate-smart practices, and adaptive capacity. The study highlights the urgent need for improved agricultural extension services, training in climate-resilient farming methods, and the development of targeted regional policies to support farmers in these vulnerable coastal areas.

Keywords: Climate change, salinity, t-test, Pearson correlation, adaptation

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1. Introduction

Climate change, widely recognized as one of the most unpredictable and urgent threats to our planet, has become a major global challenge endangering ecosystems, human health, agricultural sustainability, and economic stability. Defined as long-term changes in weather patterns and average temperatures mainly caused by human-induced greenhouse gas (GHG) emissions, climate change is already impacting every continent and ocean system (IPCC, 2014). Its effects are evident in the increasing frequency of extreme weather events, rising sea levels, biodiversity loss, glacier retreat, and changes in rainfall patterns. The Intergovernmental Panel on Climate Change (IPCC) projects that global temperatures will increase by 2.5°F to 10°F by the end of this century, with developing countries—especially those in tropical and subtropical regions—being the most affected due to their limited ability to adapt and their reliance on climate-sensitive sectors like agriculture and fisheries (IPCC, 2014; World Bank, 2019).

These changes are already happening. In 2023, the Earth's temperature was 1.48°C above pre-industrial levels, making it one of the warmest years on record and signaling that the critical 1.5°C limit—considered a threshold for manageable climate impacts—may soon be exceeded (UNEP, 2023). The consequences of this warming are wide-ranging. Agriculture, a vital source of food security and livelihoods for many developing nations, is increasingly disrupted by irregular rainfall, droughts, floods, and rising temperatures. These climatic changes reduce crop yields and increase the occurrence of pests and diseases, worsening food insecurity (AON, 2020). The economic costs are substantial as well; in 2020, natural disasters related to extreme weather caused 95% of global disaster losses, totaling US$268 billion (AON, 2020). Additionally, climate change accelerates species extinction, with 20–30% of assessed plant and animal species at increased risk if global temperatures rise 1.5–2.5°C above pre-industrial levels (IPCC, 2014). This rapid biodiversity loss threatens essential ecosystem services such as pollination, water purification, and disease regulation.

Coastal regions are especially vulnerable to sea-level rise and salinity intrusion. Low-lying delta countries like Bangladesh—located just meters above sea level—face existential threats from ocean encroachment, storm surges, and erosion. By 2050, sea levels in Bangladesh are expected to rise by 0.3 meters, displacing nearly 0.9 million people; by 2100, displacement could reach 2.1 million if current trends continue (World Bank, 2022). Bangladesh is widely recognized as one of the most climate-vulnerable countries due to its geographic position, high population density, poverty, and dependence on agriculture. About 70% of its population lives in rural areas, with over 87% of rural households relying on farming for income, making agriculture critical for food security and poverty reduction (World Bank, 2016). However, climate-related challenges such as floods, salinity intrusion, and erratic monsoons are reducing agricultural productivity, destabilizing rural economies, and threatening the country's food supply. The Bangladesh Delta Plan 2100 was developed to address these issues through integrated water management, infrastructure improvements, and climate-smart agriculture. Despite these efforts, progress remains limited, and over 80 million people remained vulnerable to flooding as of 2020 (World Bank, 2022).

Climate change also deepens existing socio-economic inequalities. Vulnerable populations—including women, children, the elderly, and low-income groups—are disproportionately affected due to unequal access to resources, limited mobility, and weak social protections. The combined impacts of climate disasters, health crises like COVID-19, and economic shocks hinder progress toward the United Nations' Sustainable Development Goals (SDGs), particularly those targeting poverty eradication, food security, and climate action (UNEP, 2023).

On the global stage, the 2015 Paris Agreement marked a pivotal moment in climate diplomacy, establishing a legally binding goal to limit global warming to below 2°C, preferably 1.5°C, above pre-industrial levels. Nonetheless, current emission trends indicate these goals are unlikely to be met without significant and immediate reductions in carbon output. According to the UNEP Emissions Gap Report, to stay on a 1.5°C pathway, global emissions must decline by 7.6% annually until 2030—a challenging target given present political and economic barriers (UNEP, 2019). Moreover, much of the methane emissions, a highly potent greenhouse gas, can be reduced with existing technologies, with 40% achievable at no net cost, highlighting a gap between technical feasibility and political will (UNEP, 2023).

Nature-based solutions offer promising opportunities for both mitigation and adaptation. Protecting and restoring ecosystems such as forests, wetlands, and mangroves could deliver about one-third of the emissions reductions needed over the next decade while supporting biodiversity and local livelihoods (UNEP, 2019). The economic benefits of climate action are substantial, with investments in resilience and low-carbon infrastructure potentially generating over 100 million new jobs and $4 trillion in business opportunities annually by 2030 (UNEP, 2023). In Asia, despite being the world's largest emitter due to heavy fossil fuel use, initiatives like China's "sponge cities" and Bangladesh's Delta Plan demonstrate growing recognition of the need for adaptive strategies (Bhowmik, 2004). However, adaptation efforts remain fragmented and underfunded in many regions, particularly in least-developed countries. Achieving climate justice requires equitable access to finance, technology transfer, and capacity building to help vulnerable nations build climate-resilient futures.

Ultimately, climate change is not merely an environmental problem but a systemic threat intersecting with economic development, health, gender equality, and global governance. Addressing it demands transformative action at individual, national, and international levels and across all sectors of society. An inclusive, science-based, and equity-focused approach to climate governance has never been more urgent. To address these issues, the investigator conducted a study titled "Impact of Climate Change on Crop Yield in Salinity-Prone Coastal Bangladesh" with the following objectives: i) To measure the deviation in crop yields caused by climate change using one-sample t-tests. ii) To explore the relationships between selected socio-economic and farming characteristics of farmers and their perceptions of climate change's impact on crop yields using Pearson correlation analysis.

2. Methodology

2.1 Study Area

The study was purposively conducted in two salinity-affected and waterlogged Upazilas (sub-districts) located in the southern part of Bangladesh: *Kolapara* Upazila in *Patuakhali* district and *Shyamnagar* Upazila in *Satkhira* district. These areas were selected because agricultural production and farmers there are significantly impacted by climate change.

2.2 Population and Sampling design

The researcher, with assistance from the respective Upazila Agriculture Officer (UAO), compiled an updated list of farmers from the selected villages. A total of 6,123 farmers were identified, representing the study population. The sample size was then determined using the formula developed by Yamane (1967).

$$n = \frac{N}{1+N(e)^2}$$

Where,

n = Sample Size

N = Population Size

e = Level of tolerable error, here it was 0.05

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Table 1: Distribution of the population size, sample size and reserve list size

District	Upazila	Union	Villages	Population size	Sample size	Reserve list
Satkhira	Shyamnagar	Munsiganj	Uttor Kodomtola	996	61	3
			Dhankhali	702	43	2
		Atulia	North Atulia	653	40	2
			Haolbangi	849	52	3

Patuakhali	Kalapara	Mahipur	Yousufpur	506	31	2
			Kamarpur	653	40	2
		Nilganj	Kumirmara	915	56	3
			Amirabad	849	52	3
Total				**6123**	**375**	**20**

2.3 Data Collection and Analysis

Data were collected using a structured questionnaire and processed using IBM SPSS Statistics 22. One-sample t-tests were applied to test yield deviation from national averages, while Pearson product-moment correlation was used to assess the strength and direction of relationships between farmers' characteristics and perceived climate impact on yield.

2.4 Variables and their measurement techniques

Twelve independent variables were considered: age, education, dependency ratio, farming experience, net cropped area, cropping intensity, contact with extension media, awareness of climate change, use of climate-smart agriculture (CSA), adaptive capacity, crop production income, and commercialization.

2.4.1 Impact of climate change on crop yield

The impact of climate change on crop yield was the dependent variable of the study. A total of nine crops were considered: three types of rice (Aus, Aman, and Boro), two vegetables (brinjal and tomato), one pulse (mung bean), two oilseeds (sesame and soybean), and one spice (onion). The yield of each selected crop for each farmer was measured in tons per hectare.

The national average yield for each crop was obtained from secondary sources, specifically the Statistical Pocketbook of Bangladesh (BBS, 2020). The impact of climate change on the yield of each crop for each farmer was calculated using the following formula:

$$\mathrm{I} = \frac{\mathrm{Yn}-\mathrm{Yo}}{\mathrm{Yn}} \times 100$$

Where,

I = Impact of climate change on crop yield, i.e. percent deviation from nation yield of a farmer of a crop

Yn = National yield of the crop (Ton/Ha)

Yo = Observed yield of the crop of the farmer (Ton/Ha)

Then impact of climate change of a farmer on crop yield was determined by using the following formula:

$$\text{Average Impact} = \frac{\text{Total impact of climate change on crop yield of a farmer}}{\text{No. of crops cultivated by the farmer}} \times 100$$

2.4.2 Age

The farmers' ages were measured in actual years from their birth to the time of the interview, based on the respondents' verbal answers. Each year of age was assigned a score of one (1).

2.4.3 Education

Education was measured by assigning scores based on the number of years of successful schooling completed by a farmer. One point was given for each level of education passed. For example, a farmer who passed the final examination of class five or an equivalent level was assigned a score of five (5). Farmers who were illiterate received a score of zero (0). Those who could not read or write but were able to sign their name were given a score of 0.5. If a farmer had not attended formal school but had received non-formal education, their educational status was assessed as equivalent to that of a formal school student.

2.4.4 Dependency ratio

The dependency ratio is the ratio of dependents to the working-age population. Dependents are defined as individuals younger than 15 or older than 64, while the working-age population includes those aged between 15 and 64. In this study, the dependency ratio was calculated using the formula proposed by Hayes (2024):

$$\text{Dependency ration} = \frac{No.of\ family\ member(s)\ aged\ \leq 14 + No.of\ family\ member(s)\ aged\ \geq 65}{No.of\ family\ member\ aged\ 15 - 64}$$

2.4.5 Farming experience

Farming experience is a valuable skill that contributes to the accumulation of human capital among workers. It influences economic behavior and plays a role in shaping entrepreneurial decisions based on individual characteristics. In this study, one (1) point was assigned for each year of farming experience.

2.4.6 Net cropped area

Net cropped area of a farmer is referred to as the area of land on which his/her family carried out the farming operation. Net cropped area of a farmer was determined by using the following formula as used by Ali (2008).

Net cropped area = single cropped area + double cropped area + triple cropped area

Initially net cropped area was measured in decimal, then it was converted into hectare.

2.4.7 Cropping intensity

Cropping intensity is defined as the number of crops grown on the same field within a single agricultural year. It is calculated using the following formula and expressed as a percentage.

$$\text{CI} = \frac{TCA}{NCA} \times 100$$

Where,

CI = Cropping Intensity

TCA = Total Cropped Area

= Single cropped area × 1 + Double cropped area × 2 + Triple cropped area × 3

NCA = Net Cropped Area

= Single cropped area + Double cropped area + Triple cropped area

2.4.8 Extension media contact

Extension media contact includes three types of interactions: individual contact, group contact, and mass contact. Individual contact involves face-to-face, one-on-one communication between farmers and extension agents. Group contact occurs when farmers are reached as part of a group, typically formed around a shared interest. This method also involves face-to-face interaction, allowing for the exchange of ideas, discussion of problems, technical recommendations, and planning future actions. Mass contact involves extension workers reaching out to large audiences to disseminate new information and promote the adoption of innovations. This approach is particularly effective for quickly raising awareness about new agricultural technologies. After thorough consultation with relevant experts and advisory committee members, 15 extension media were selected for the study. Respondent farmers were asked to describe the frequency of their contact with each medium using five response options: 'regular,' 'often,' 'occasional,' 'rare,' and 'never,' which were assigned scores of 4, 3, 2, 1, and 0, respectively. Logical frequencies were assigned for each response. Finally, a farmer's extension media contact score was calculated by summing the scores across all media. Therefore, the total possible extension media contact score ranged from 0 to 60, where 0 indicated no contact and 60 indicated the highest level of contact.

2.4.9 Awareness on climate change

Awareness of climate change among farmers refers to their understanding and knowledge of climate change issues. Changes in the climate of any region can significantly alter the microclimate of specific crops or agricultural fields, which directly affects crop yield, productivity, crop quality, vegetation, soil erosion, groundwater levels, and other related factors. To measure a farmer's awareness of climate change, respondents were asked to respond to 10 statements addressing various climate change issues. Responses were scored with weights of 2, 1, and 0 points corresponding to "strongly agree," "agree," and "do not know," respectively, for each item. Consequently, the total possible score for all items combined was 20. Thus, a farmer's climate change awareness score could range from 0 to 20, where 0 indicates no awareness and 20 indicates the highest level of awareness regarding climate change.

2.4.10 Use of climate smart agricultural practices

Climate-Smart Agriculture (CSA) is an integrated approach that employs a range of clean, low greenhouse gas emission technologies to manage landscapes including cropland, livestock, forests, and fisheries. Its goal is to facilitate both adaptation and mitigation in order to build resilience against the impacts of climate change globally, over the short, medium, and long term. Although CSA builds upon existing agricultural knowledge, technologies, sustainability principles, and synergistic practices, it is crucial to understand whether farmers adopt positive, nature-based solutions to cope with adverse conditions and minimize damage to agricultural and economic crop production. To measure the extent of CSA adoption, farmers were asked to respond to nine questions related to different CSA practices. Responses were scored with values of 3, 2, 1, and 0 corresponding to "regular," "occasional," "seldom," and "never" use of each practice, respectively. Therefore, a farmer's CSA practice use score could range from 0 to 27, where 0 indicates no use of CSA practices and 27 represents the highest level of use.

2.4.11 Adaptive capacity against climate change impacts

Adaptive capacity refers to a farmer's ability to adjust to climate change, including climate variability and extremes, in order to minimize potential damage, seize opportunities, or cope with consequences. Effective use of adaptation strategies reduces vulnerabilities and limitations, thereby enhancing crop yield and productivity. A farmer's adaptive capacity to climate change impacts was measured by asking respondents to rate their capacity across six items related to adaptive capacity. Scores were assigned weights of 3, 2, 1, and 0 corresponding to "high capacity," "moderate capacity," "low capacity," and "no capacity," respectively. Consequently, a farmer's adaptive capacity score could range from 0 to 18, where 0 indicates no adaptive capacity and 18 represents the highest adaptive capacity to climate change impacts.

2.4.12 Crop production income

The term **crop production income** refers to the annual gross income earned by a farmer and their family members from the crops they produce. This income is expressed in Bangladeshi Taka (BDT). To measure this variable, the total earnings of an individual farmer in BDT were converted into a score, with one (1) point assigned for every one thousand BDT earned.

2.4.13 Commercialization

The commercialization score of a farmer was calculated based on the proportion of the value of crops sold relative to the total value of crops produced. Following the method used by Ali (2008), the commercialization score was computed using the following formula:

$$\text{Commercialization} = \frac{\text{Value of sold crops}}{\text{Total value of raised crops}} \times 100$$

The relevant market price was used to determine the commercialization score of each individual. The commercialization score ranges from 0 to 100, where 0 indicates no commercialization and 100 represents the highest level of commercialization.

2.5 Data Processing

The collected raw data were thoroughly reviewed to identify and correct any errors or omissions. Completed interview schedules were carefully examined to ensure that all necessary data were fully recorded and systematically organized to facilitate coding and tabulation. Minor errors detected during this process were promptly corrected. A detailed coding scheme was developed, and for qualitative data, appropriate scoring methods with assigned weights were applied to convert the data into quantitative form. These data were then tabulated in accordance with the study's objectives. After coding, both the raw data and respondents were categorized into various groups to support the analysis of independent and dependent variables. The categorization process was based on the data's distribution characteristics, insights from an extensive literature review, and further elaboration as needed. For statistical analysis, IBM SPSS Statistics version 22 was used. Descriptive statistics—including frequency and percentage distributions, range, rank order, mean, standard deviation, and coefficient of variation—were employed to describe both independent and dependent variables. The results were presented in tables for clarity. Additionally, Pearson's Product-Moment Correlation was initially applied to examine the relationships between selected farmer characteristics and the impact of climate change on crop yield.

3. Results and Discussion

3.1 Impact of climate change on crop yield

The perceived impact of climate change on crop yield among climate-affected farmers ranged from 2.50 to 29.32, with a mean of 16.05 and a standard deviation of 4.42. Based on these impact scores, farmers were categorized into three groups: low impact, medium impact, and high impact, as shown in Table 2.

Table 2: Distribution of the farmers according to their perceived impact of climate change on crop yield

Category	Farmers	
	Observed Frequency	Observed Percentage
Low Impact (<Mean-SD, or <11.62)	36	9.6
Medium Impact (Mean±SD, or 11.62-20.48)	276	73.6
High Impact (>Mean+SD, or >20.48)	63	16.8
Total	**375**	**100**

The data presented in Table 2 indicate that the majority of farmers (73.6%) perceived a medium impact of climate change on crop yield. In contrast, 9.6% of farmers reported a low impact, while 16.8% experienced a high impact. Overall, it was observed that an overwhelming majority (90.4%) of farmers perceived a medium to high impact of climate change on crop yield.

3.1.2 Crop yield deviation due to climate change

Crop yields were significantly reduced in croplands affected by climate change and salinity. The yield deviation for each crop was calculated using the following method:

$$Yd = \frac{b-a}{b} \times 100$$

Where,

Y_d = Yield deviation of the crop

b = National average yield of that crop

a = Average yield of that climate-affected farmers

The observed deviation of crop yield in the selected area from the national yield has been mentioned in table 3.

Table 3: Deviation of selected nine (9) crops due to climate change

Selected crops	Average crop yield in the climate-affected area (Ton/Ha) **(a)**	National Average yield (Ton/Ha) **(b)**	% Average Yield Deviation $Yd = \frac{b-a}{b} \times 100$	Value of T (Sig. level)
Aus Rice	1.96	2.58	24.03	347.58
Aman Rice	2.22	2.61	15.32	475.37
Boro Rice	3	4.19	28.4	148.38
Brinjal	9.81	11.94	17.84	121.11
Tomato	12.59	14.93	15.65	79.7
Mungbean	0.84	0.9	6.44	108.6
Sesame	0.79	0.94	15.58	84.538
Soybean	1.43	1.62	11.72	162.53
Onion	10.46	12.24	14.53	209.07

Source of national average yield: BBS Statistical Pocketbook 2023

Aus Rice

The observed average yield of Aus rice was 1.96 tons per hectare, compared to the national average yield of 2.58 tons per hectare. This represents a yield reduction of 24.03% due to the impact of climate change. The significant t-value indicates that the observed yield of Aus rice in the salinity-affected regions of *Satkhira* and *Patuakhali* was significantly lower than the expected national yield.

Aman Rice

The observed average yield of Aman rice was 2.21 tons per hectare, while the national average yield is 2.61 tons per hectare. This indicates a yield reduction of 15.32% attributed to the impact of climate change. The significant t-value confirms that the observed yield of Aman rice in the salinity-affected regions of *Satkhira* and *Patuakhali* was significantly lower than the expected national yield.

Boro Rice

The observed average yield of Boro rice was 3.00 tons per hectare, compared to the national average yield of 4.19 tons per hectare. This reflects a yield reduction of 28.40% due to the impact of climate change. The significant t-value indicates that the observed yield of Boro rice in the salinity-affected regions of *Satkhira* and *Patuakhali* was significantly lower than the expected national yield.

Brinjal

The observed average yield of brinjal was 9.81 tons per hectare, while the national average yield is 11.94 tons per hectare. This represents a yield reduction of 17.84% due to the impact of climate change. The significant t-value indicates that the observed yield of brinjal in the salinity-affected regions of *Satkhira* and *Patuakhali* was significantly lower than the expected national yield.

Tomato

The observed average yield of tomato was 12.59 tons per hectare, compared to the national average yield of 14.93 tons per hectare. This indicates a yield reduction of 15.65% due to the impact of climate change. The significant t-value confirms that the observed yield of tomato in the salinity-affected regions of *Satkhira* and *Patuakhali* was significantly lower than the expected national yield.

Mung bean

The observed average yield of mung bean was 0.84 ton/ha. The national average yield of mung bean is 0.9 ton/ha. The yield of mung bean was deviated by 6.44% due to the impact of climate change. The significant value of "t" indicated that the yield of the observed Mung bean was significantly reduced from the expected yield in the salinity-intruded regions of *Satkhira* and *Patuakhali*.

Soybean

The observed average yield of soybean was 1.42 tons per hectare, while the national average yield is 1.62 tons per hectare. This reflects a yield reduction of 11.72% due to the impact of climate change. The significant t-value indicates that the observed yield of soybean in the salinity-affected regions of *Satkhira* and *Patuakhali* was significantly lower than the expected national yield.

Sesame

The observed average yield of sesame was 0.79 tons per hectare, compared to the national average yield of 0.94 tons per hectare. This represents a yield reduction of 15.58% due to the impact of climate change. The significant t-value confirms that the observed yield of sesame in the salinity-affected regions of *Satkhira* and *Patuakhali* was significantly lower than the expected national yield.

Onion

The observed average yield of onion was 10.46 tons per hectare, compared to the national average yield of 12.24 tons per hectare. This indicates a yield reduction of 14.53% due to the impact of climate change. The significant t-value confirms that the observed yield of onion in the salinity-affected regions of *Satkhira* and *Patuakhali* was significantly lower than the expected national yield.

The results of the t-test confirm that crop yields in the study area are significantly lower than the national averages, reinforcing concerns about the impact of climate change on agriculture. Correlation analysis further indicates that socio-economic resilience—through knowledge, practical adaptation, and innovation—can help mitigate the perceived impact of climate change.

3.1.3 Correlation Analysis

Table 4: Pearson's Product Moment Correlation Coefficient Showing Relationship Between Focus and Explanatory Variables

Focus Variable:	Explanatory Variables	Tabulated Value (df = 165)	Value of Coefficient Correlation	Significance
Impact of Climate Change on Crop Yield	Age (X1)	0.151 (0.05) 0.198 (0.01)	-0.034	NS
	Education (X2)		0.047	NS
	Dependency Ratio (X3)		0.013	NS
	Farming Experience (X4)		-0.003	NS
	Net Cropped Area (X5)		0.074	NS
	Cropping Intensity (X6)		0.530	**
	Extension Media Contact (X7)		0.067	NS
	Awareness on Climate Change Issues (X8)		-0.222	**
	Use of Climate Smart Agricultural Practices (X9)		-0.135	**
	Adaptive Capacity Against CC Impacts (X10)		-0.130	*
	Crop Production Income (X11)		0.045	NS
	Commercialization (X12)		-0.120	*

Note: *NS = Not Significant; *= Significant at p < 0.05; ** = Significant at p < 0.01; Degrees of freedom (df) = 165, hence tabulated r values are approximately 0.151 at 0.05 and 0.198 at 0.01 level*

The correlation analysis reveals a number of significant relationships among the selected variables. Farming experience (X4) was strongly and positively correlated with age (X1) at the 1% significance level (r = 0.787**), indicating that older farmers tend to have more farming experience—a commonly observed pattern in agrarian communities (Ahmed et al., 2020). In contrast, education (X2) showed significant negative correlations with both age (X1) and farming experience (X4), suggesting that younger farmers are generally more educated. This reflects a generational shift in access to formal education, particularly in rural areas of developing countries (Rahman & Akter, 2021).

The dependent variable—impact of climate change on crop yield (Y)—showed a strong positive correlation with cropping intensity (X6) (r = 0.530**, $p < 0.01$), indicating that farms with higher cropping intensity may demonstrate greater resilience or perceive less negative impact from climate change. This may be due to their increased exposure to and adoption of adaptive farming practices (Hossain et al., 2022).

Conversely, awareness of climate change issues (X8), use of climate-smart agricultural (CSA) practices (X9), adaptive capacity (X10), and commercialization (X12) all had significant negative correlations with the perceived impact of climate change on crop yield. This suggests that farmers who are more informed about climate change and actively adopt CSA practices tend to experience or perceive less adverse impact, supporting the idea that awareness and adaptation strategies can help reduce climate vulnerability (IPCC, 2022; Bryan et al., 2013).

Notably, awareness of climate change issues (X8) was highly correlated with the use of CSA practices (X9) (r = 0.576**) and moderately correlated with adaptive capacity (X10) (r = 0.183**). This highlights the role of awareness in encouraging the adoption of sustainable and adaptive farming methods. Awareness and knowledge are widely acknowledged as key drivers of behavioral change in agricultural adaptation (Ndungu et al., 2020).

Additionally, net cropped area (X5) showed a positive correlation with crop production income (X11) (r = 0.484**), reinforcing the economic benefit of cultivating larger land areas—an observation well-documented in agricultural economics literature (Ali & Erenstein, 2017).

In summary, the findings emphasize the critical importance of enhancing farmers' awareness and understanding of climate change, promoting climate-smart agricultural practices, and strengthening adaptive capacity. These measures are essential for mitigating the negative impacts of climate change and ensuring sustainable agricultural productivity in vulnerable rural communities.

4. Conclusions

This study was guided by two primary objectives, both of which were thoroughly addressed through field-level data collection from 375 farmers across two climate-vulnerable coastal districts—Satkhira and Patuakhali. Findings from one-sample t-tests clearly demonstrated that the yields of all nine selected crops were significantly lower in the study areas compared to national averages. Crops such as Boro rice, Aus rice, sesame, and vegetables like brinjal and tomato showed notable yield reductions, with deviations ranging from 6.44% to 28.4%. These results confirm growing concerns that salinity intrusion, irregular rainfall, and other climate-induced stresses are critically undermining agricultural productivity in coastal Bangladesh.

Further analysis using Pearson correlation revealed that various socio-economic and behavioral factors significantly influence how farmers perceive and experience the impacts of climate change. Notably, cropping intensity exhibited a strong positive correlation with perceived climate impact, suggesting a possible link between more intensive farming practices and increased vulnerability to climate stressors. Conversely, variables such as awareness of climate change, adoption of climate-smart agricultural (CSA) practices, adaptive capacity, and commercialization were all negatively correlated with perceived climate impacts. This indicates that farmers who are better informed and more proactive in adopting resilient practices tend to perceive less adverse impact on their crop yields.

Together, these findings highlight the complex interplay between environmental stressors and socio-economic conditions. While the biophysical impacts of climate change are clearly detrimental, their severity can be mitigated through effective adaptation strategies, increased awareness, and the adoption of improved agricultural practices. To protect and sustain agriculture in coastal regions, it is essential to expand extension services, promote climate-resilient farming methods, and integrate adaptive capacity indicators into regional and national policy frameworks. Only through such comprehensive efforts can a secure and sustainable agricultural future be ensured in the face of an increasingly unpredictable climate.

5. References

1. Ahmed, S., Hossain, M. A., & Rahman, M. M. 2020. Farmers' adaptation strategies to climate change impacts on agriculture in Bangladesh. *Environmental Development*, *33*, 100504. https://doi.org/10.1016/j.envdev.2019.100504.
2. Ali, A., & Erenstein, O. 2017. Assessing farmer use of climate change adaptation practices and impacts on food security and poverty in Pakistan. *Climate Risk Management*, *16*, 183–194. https://doi.org/10.1016/j.crm.2016.12.001.
3. Ali, M.S. 2008. Adoption of selected ecological Agricultural practices by the farmers. An unpublished PhD dissertation of the Department of Agricultural Extension Education, Bangladesh Agriculture University Mymensingh.
4. AON.2020. *Weather, Climate & Catastrophe Insight: 2020 Annual Report*. Retrieved from https://www.aon.com.
5. BBS.2020. *Bangladesh Bureau of Statistics: Agricultural Yearbook 2020*. Dhaka: BBS.
6. BBS.2023. *Bangladesh Bureau of Statistics: Agricultural Yearbook 2023*. Dhaka: BBS.
7. Bryan, E., Ringler, C., Okoba, B., Roncoli, C., Silvestri, S., & Herrero, M. 2013. Adapting agriculture to climate change in Kenya: Household strategies and determinants. *Journal of Environmental Management*, *114*, 26–35. Retrieved from https://doi.org/10.1016/j.jenvman.2012.10.036
8. Hayes, A. 2024. What is the dependency ratio and how can you calculate it? Retrieved from https://www.investopedia.com/terms/d/dependencyratio.asp.
9. Hossain, M. I., Paul, B. K., & Sultana, R. 2022. Climate change, agriculture, and adaptation in Bangladesh: A review. *Climate*, *10*(3), 40. Retrieved from https://doi.org/10.3390/cli10030040
10. IPCC. 2014. *Climate Change 2014: Synthesis Report.* Geneva: Intergovernmental Panel on Climate Change.
11. 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. Cambridge University Press. Retrieved from https://doi.org/10.1017/9781009325844.
12. Ndungu, C. W., Bebe, B. O., Ondiek, J. O., & Mutavi, S. 2020. Determinants of farmers' climate change adaptation strategies in Kenya. *Climate*, *8*(4), 81. Retrieved from https://doi.org/10.3390/cli8040081.
13. Rahman, M. A., & Akter, M. 2021. Education and climate change perception: A study on smallholder farmers in Bangladesh. *International Journal of Climate Change Strategies and Management*, *13*(3), 325–340. Retrieved from https://doi.org/10.1108/IJCCSM-08-2020-0075.
14. UNEP. 2019. *Nature for Climate Action: The Role of Nature-Based Solutions in Addressing the Climate Crisis*. Nairobi: United Nations Environment Programme.
15. UNEP. 2023. *Emissions Gap Report 2023: Broken Record—Temperatures Hit New Highs, Yet World Fails to Cut Emissions*. Nairobi: United Nations Environment Programme.
16. World Bank. 2022. *Bangladesh: Enhancing Coastal Resilience in a Changing Climate*. Washington, DC: World Bank.
17. World Bank. 2019. *Bangladesh: Enhancing Opportunities for Clean and Resilient Growth*. Washington, DC: World Bank.
18. World Bank. 2016. *Bangladesh: Climate Change and Agriculture Country Profile*. Washington, DC: The World Bank.
19. Yamane, Y. 1967. Mathematical Formulae for Sample Size Determination.

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