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RESEARCH PROPOSAL ON

**UNDERSTANDING FARMERS' PERCEPTIONS AND ADAPTIVE RESPONSES TO
CLIMATE CHANGE-INDUCED SALTWATER INTRUSION: A MIXED-METHODS
STUDY FROM COASTAL SATKHIRA, BANGLADESH**

SCHOLAR'S NAME

SIDRATUL MUNTAHA SHISHIR

SCHOLAR'S AFFILIATION

SHER-E-BANGLA AGRICULTURAL UNIVERSITY

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Introduction: Bangladesh's coastal region is among the most climate-vulnerable areas of the world, where agriculture is increasingly threatened by rising sea levels, tidal surges, and shifting rainfall patterns. A particularly severe manifestation is saltwater intrusion, in which seawater encroaches into freshwater systems and cultivable land, disrupting agricultural cycles and undermining local livelihoods. Satkhira district offers a striking example of this vulnerability: historically shaped by seasonal flooding and tidal fluctuations, the region has experienced intensified salinity in recent decades, leading to soil degradation and declining crop yields. Farmers who once depended on traditional cultivation practices are now compelled to adapt under mounting environmental and socio-economic stress. Within this context, two core concepts frame the present research. Saltwater intrusion refers to the penetration of saline water into areas once reliant on freshwater sources, while coping strategies describe the adaptive choices farmers make to maintain productivity and manage risk. Although salinity and climate impacts have been widely studied across Bangladesh, existing research is often generalized across districts and lacks attention to localized dynamics. In particular, few studies have examined how farmers' perceptions influence their adaptive actions at the village level [1], and even fewer have critically assessed the effectiveness of these coping strategies [2]. Moreover, much of the literature depends heavily on dated data [3] or quantitative surveys alone [4], leaving unexplored the nuanced decision-making processes that shape adaptation [5]. Satkhira represents a distinctive case, characterized by resource-constrained smallholders cultivating rice, vegetables, and shrimp under increasing pressure from salinity. Understanding how farmers perceive the problem and why they choose particular strategies is crucial, as their decisions ultimately determine the resilience of local agriculture. Beyond documenting what farmers do, this study seeks to uncover the social, cultural, and economic factors that drive adaptive behavior. Such knowledge is indispensable for designing interventions that are both effective and culturally appropriate, while also offering transferable lessons to other coastal regions facing similar risks. By employing a mixed-methods case study, this research will contribute new insights into the lived realities of one of the most vulnerable districts in Bangladesh. It will bridge the gap between perception and practice, evaluate the potential effectiveness of adaptation strategies, and generate evidence that can inform policy formulation, resilience planning, and community-based interventions. In doing so, the study emphasizes the human dimension of climate adaptation—how knowledge, perception, and practice interact within real agricultural systems under conditions of environmental stress.

Research Questions:

1. How do farmers in Satkhira perceive the impacts of climate change-driven saltwater intrusion on their agricultural practices and livelihoods?
2. What coping strategies and adaptive responses have farmers adopted to manage saltwater intrusion, and how effective are these strategies in sustaining agricultural productivity and resilience?

Literature Review: The impacts of climate change-induced saltwater intrusion on coastal agriculture in Bangladesh have been examined in several studies, highlighting both challenges and

adaptive responses among farming communities. Fahim and Arefin [1] investigated the livelihood implications of salinity intrusion in southwest Satkhira, revealing that households have been compelled to modify their agricultural and economic practices, yet their study provided limited insight into the specific coping mechanisms employed by farmers. In a related context, Haque et al. [2] explored technology-based adaptations, such as rainwater harvesting and reverse osmosis, demonstrating their effectiveness in alleviating water scarcity, though the socio-economic factors affecting technology adoption were not fully analyzed. Rahman [3] focused on small-holder farmers' adaptation strategies under salinity stress, emphasizing the role of awareness and education in shaping adaptive behavior, but without thoroughly evaluating the practical effectiveness of these strategies in sustaining agricultural resilience. Alam [4] assessed the awareness levels of southern coastal inhabitants regarding salinity intrusion, identifying a general lack of understanding that limits adoption of coping strategies, yet the underlying reasons for this knowledge gap and potential educational interventions remain unexplored. Complementing these findings, Barua [5] examined indigenous knowledge practices employed by farmers to address salinity intrusion, highlighting the value of traditional strategies but failing to assess their integration with modern scientific approaches. Collectively, these studies provide valuable insights into the effects of salinity and the range of adaptive responses, yet notable gaps persist, including insufficient focus on the detailed coping mechanisms, limited analysis of socio-economic influences, lack of evaluation of awareness-raising interventions, and underexplored integration of indigenous and scientific knowledge. Addressing these gaps informs the design of the proposed research, which aims to investigate the specific adaptive strategies employed by farmers in Satkhira, analyze the socio-economic determinants of adaptation, evaluate the effectiveness of awareness and educational initiatives, and assess the potential for harmonizing indigenous knowledge with modern scientific methods, thereby contributing to the development of sustainable, context-specific adaptation strategies for coastal agriculture in Bangladesh.

Methodology: This study employs a mixed-methods case study design to capture both the breadth of farmers' responses and the depth of their lived experiences regarding saltwater intrusion in coastal Satkhira. The research will focus on smallholder farmers cultivating rice, vegetables, and shrimp, using a multi-stage sampling approach. Two highly affected upazilas (Shyamnagar and Assasuni) will be purposively selected, from which three villages will be randomly chosen; approximately 30 households per village will be surveyed, generating a sample of 180 households. Quantitative data will be collected through structured questionnaires addressing socio-economic profiles, perceptions of salinity, and coping strategies, while qualitative insights will be gathered through six focus group discussions (8–10 participants each) and key informant interviews with agricultural officers, NGO representatives, and local leaders. Survey data (Quantitative) will be analyzed using descriptive statistics and inferential methods such as chi-square tests and logistic regression to explore relationships between socio-economic factors, perceptions, and adaptation choices, whereas FGDs and interview transcripts will be subjected to thematic analysis with NVivo to identify recurring patterns and underlying drivers of decision-making. Findings will be triangulated to ensure robustness and to integrate quantitative and qualitative evidence. Quality control will include pilot-testing of survey instruments, enumerator training, and cross-verification of qualitative transcripts. Ethical standards will be upheld by obtaining informed consent, assuring anonymity, and allowing voluntary participation, with formal approval sought from the relevant

institutional review board. Seasonal variations and potential response biases are anticipated as limitations, which will be mitigated by collecting data during peak salinity periods and assuring respondents of confidentiality. This approach provides a rigorous yet feasible strategy to examine how farmers perceive and adapt to saltwater intrusion, aligning perceptions, practices, and broader adaptation discourse.

Practicalities:

- **Project Plan & Timeline**

The project will span **6 months**, divided into four key phases to ensure systematic execution:

Phase	Activities	Duration	Milestones
1: Preparation	Literature review, questionnaire design, and ethical approval	Month 1	Literature review completed, tools finalized, ethics approval obtained
2: Surveys	Household surveys in selected villages	Months 2–3	180 surveys completed, data collected
3: FGDs & KIIs	Conduct focus group discussions and key informant interviews	Months 2–3	FGDs/KIIs completed, transcripts ready
4: Data Analysis	Enter and clean survey data, descriptive/inferential stats	Month 4	Dataset prepared, preliminary quantitative analysis done
5: Qualitative Integration	Thematic analysis, triangulated with survey results	Month 5	Key themes identified, integrated findings report prepared
6: Reporting & Dissemination	Draft report, stakeholder validation, final submission	Month 6	Draft report completed, workshop held, final report submitted

- **Resource Plan & Budget Overview**

Resource	Purpose	Estimated Cost (USD)
Local Travel	Field visits for surveys, FGDs, and KIIs	\$80
Printing & Stationery	Questionnaires, consent forms, notebooks	\$30
Participant Refreshments	FGDs and community meetings	\$40
Data Management & Software	NVivo or Excel add-ons for qualitative coding	\$50
Communication & Contingency	Mobile credit, unforeseen minor expenses	\$50

Local Assistance / Enumerators	Help with surveys and local coordination	\$50
Total	—	\$300

- **Risk Management Plan**

Potential Risk	Mitigation Strategy
Limited access to remote farmers	Schedule flexible visits, engage local leaders.
Low response rate	Multiple engagement methods: surveys + interviews
Equipment failure	Backup devices and cloud-based data storage
Weather or flood disruptions	Plan alternative field dates and routes.

- **Ethical Compliance**

- ❖ Informed consent from all participants
- ❖ Confidentiality and anonymization of data
- ❖ Right to withdraw at any time emphasized
- ❖ Adherence to institutional and international research standards

- **Custom Components**

- ❖ Surveys and interviews in Bengai for accessibility
- ❖ Integration of indigenous knowledge with scientific adaptation strategies
- ❖ Stakeholder engagement to ensure findings are actionable and policy-relevant
- ❖ Focused on practical solutions for climate-resilient agriculture

- **Limitations**

- ❖ Seasonal flooding or adverse weather may limit access to some areas.
- ❖ Participants may provide socially desirable responses.
- ❖ Findings may be context-specific and not fully generalizable.

Conclusion: This proposal presents a comprehensive, context-sensitive study aimed at understanding farmers' perceptions and coping strategies in response to climate change-driven saltwater intrusion in Satkhira, Bangladesh. By integrating both quantitative and qualitative approaches, the research addresses critical knowledge gaps in adaptive behaviors, socio-economic influences, and the role of indigenous knowledge. The methodology is robust, ethically sound, and designed for practical feasibility within a limited budget, ensuring reliable and actionable insights. Ultimately, the study will generate evidence-based recommendations to enhance climate-resilient

agriculture, support sustainable livelihoods, and inform policy interventions, demonstrating clear relevance and impact for both local communities and broader climate adaptation initiatives.

References:

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- [2] C. E. Haque, M. K. Shehab, and I. M. Faisal, "Meeting climate change challenges in coastal Bangladesh: A study of technology-based adaptations in water use in Satkhira District," *PLOS Climate*, vol. 4, no. 4, p. e0000460, 2025.
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