

Tracing the factors controlling the climate-induced migration and role of floating farming as an adaptive measure in the Southwest coastal region of Bangladesh

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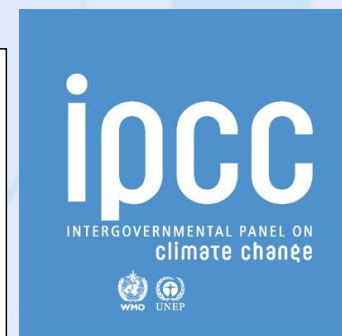
Research interests

- Climate Change Adaptation and Water Resource Management
- Numerical Simulation for Contaminant Fate and Transport
- Global Changes and its impacts on Water Resources



Global report

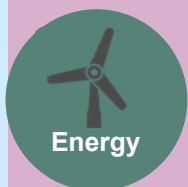
- Lead author (IPBES, GEO), chapter scientist (IPCC)



Asia-Pacific Climate Security Project (APCS) 2023-2026

(Funded by Ministry of Foreign Affairs Japan)

Sub-themes (17 Researchers are involved)



Energy

Impacts of Decarbonization on Energy Security and Geopolitical Relations

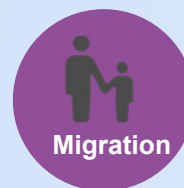
This sub-theme group will provide perspectives on the security risks at various levels that could be caused by efforts toward decarbonization and examine their implications for Japan and the options available to Japan to make recommendations for Japan's foreign policy and for international rules / regional collaboration.



Food

Food Security and Climate Security

This sub-theme group will address three researches to make a framework that integrates food security and climate security; strategies for addressing the impact of climate change on food production through policy responses; analysis of international legal and policy-making processes on food security governance; and case study on rural-urban water reallocation in Pakistan.



Migration

Climate Insecurity and Its Impacts on Human Mobility

This sub-theme group will unpack the current policy gaps and challenges at local, domestic and international levels, and give implications to relevant Japanese/Asia-Pacific policies and interventions through the analysis of international norm-making processes and case studies in Bangladesh and Fiji.

Adaptation



Improving National Climate Adaptation Planning from Human and National Security Perspectives

This sub-theme group will identify the synergies and additionality between climate security, human security, and national security dimensions, specific adaptation planning and activities to achieve it, and how climate, human and national security can be strengthened by bringing related stakeholders together leading to greater security outcomes.



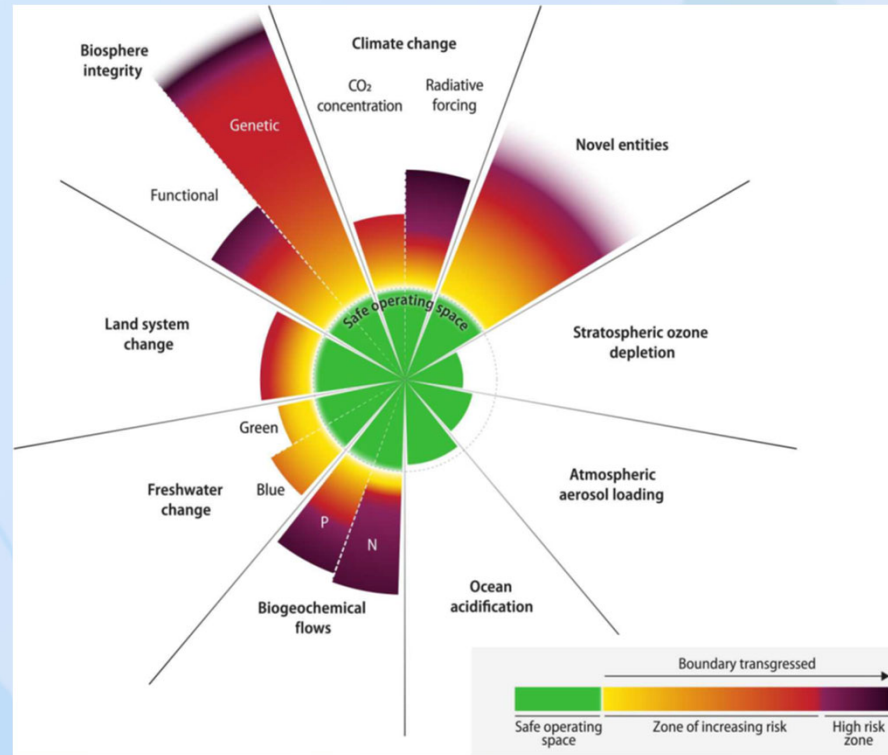
Ocean

Climate Change Driven Changes in Geopolitical Strategy Structures and Maritime Security

This sub-theme group will assess the impact of climate change, including natural disasters, sea level rise, marine ecosystems distribution, involvement of major powers in climate change measures for small island nations and geopolitical conflicts, and changes in sea lanes for defense and ocean governance.

Background

Environmental changes and its impact on water resource and livelihood



- In lieu of triple planetary crisis (climate change, biodiversity loss, and pollution) and land degradation, freshwater plays a limiting factor for human well-being.
- Importance of holistic management of policies and governance for achieving long term sustainability in any region or country never been greater.

Fig. Earth reaches beyond six of nine planetary boundaries (Richardson et al., 2023)

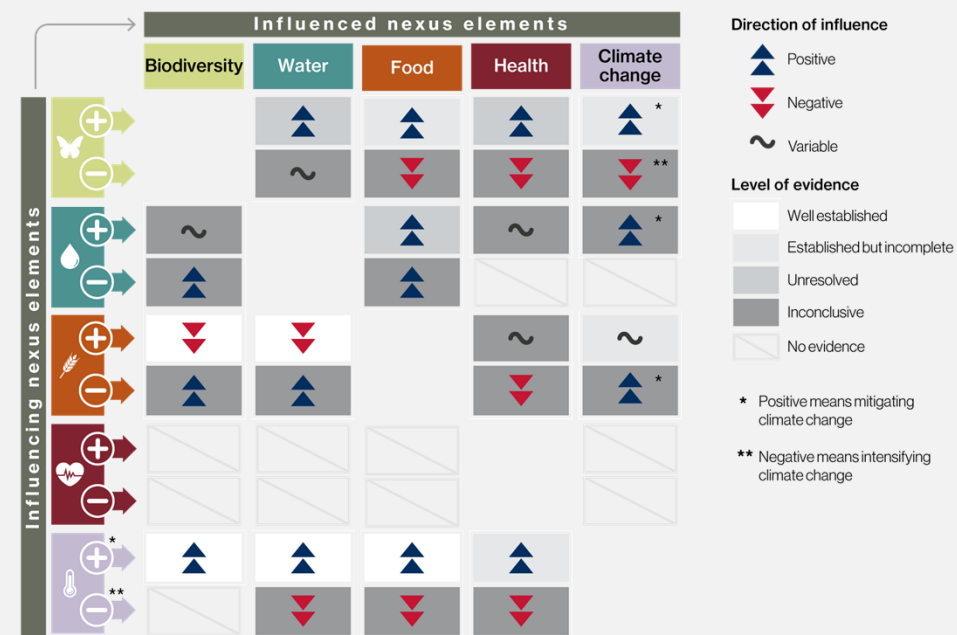
Vulnerability refers to the inability (of a system) to withstand the effects of a hostile environment.

Nexus Key messages

A. Past and current nexus interactions

Biodiversity is essential to our very existence, supporting our water and food supplies, our health and the stability of the climate

A INTERACTIONS AMONG NEXUS ELEMENTS



A PROJECTED FUTURE IMPACTS ON THE NEXUS ELEMENTS

Nexus archetype	Nexus element				
	Biodiversity	Water	Food	Health	Climate
1. Nature-oriented nexus	▲▲	▲▲	▲	▲	▲▲
2. Balanced nexus	▲	▲	▲▲	▲▲	▲
3. Conservation first	▲▲	~	▼▼	~	▲
4. Climate first	▼	~	▼▼	▲	▲▲
5. Food first	▼▼	▼	▲	▲	▼▼
6. Nature overexploitation	▼▼	~	▼▼	▼	▼▼

Impacts on each nexus element under each nexus archetype

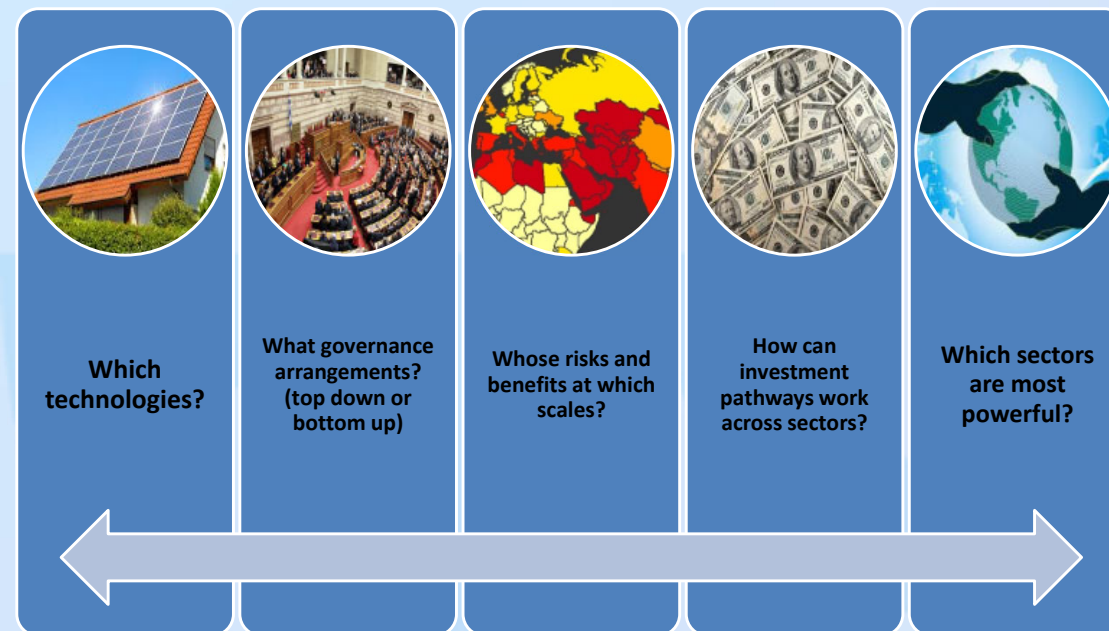
- ▲▲ Highly positive
- ▲ Moderately positive
- ▲ Slightly positive
- ~ Variable
- ▼ Slightly negative
- ▼ Moderately negative
- ▼ Highly negative

B. Future nexus interactions

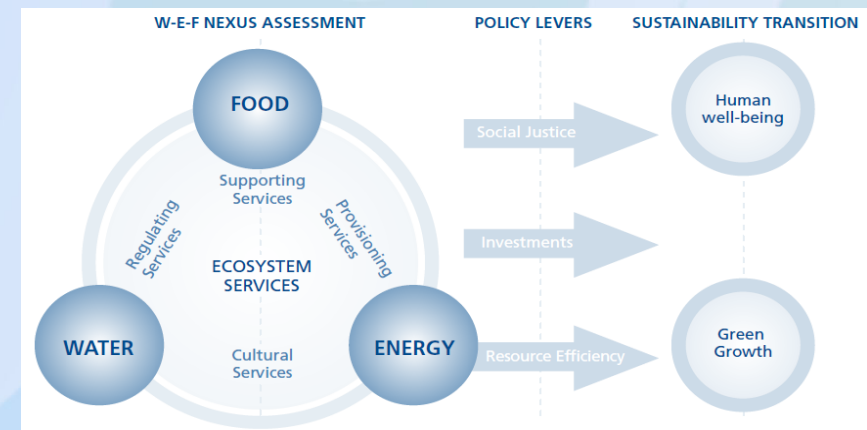
Scenarios focused on synergies among biodiversity, water, food, human health and climate change have more beneficial outcomes for global policy goals (e.g.- SDGs)

Nexus approach and its challenges

- Looking in to the complex nature of this water resource management, it needs a clear vision on the following:



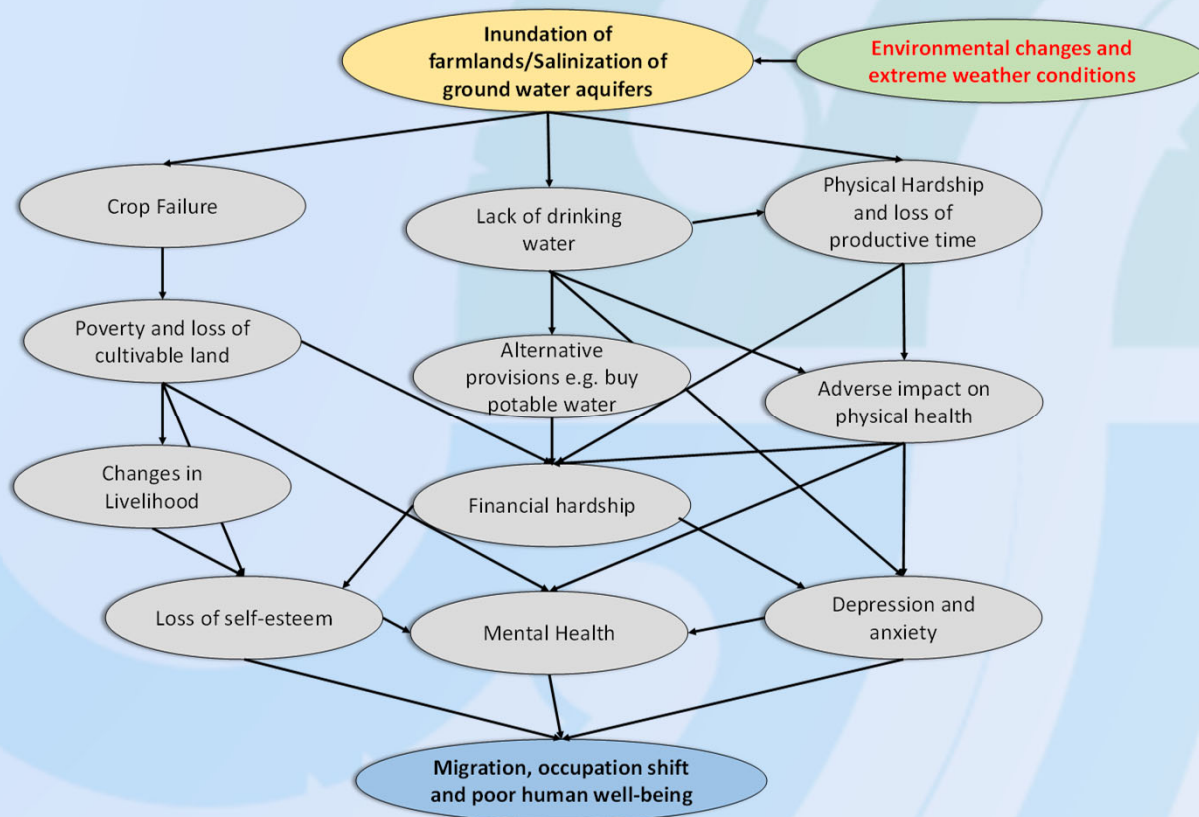
An Ecosystem Services Emphasis



Supporting a wide range of ecosystem services for long-term socio-economic and environmental benefits

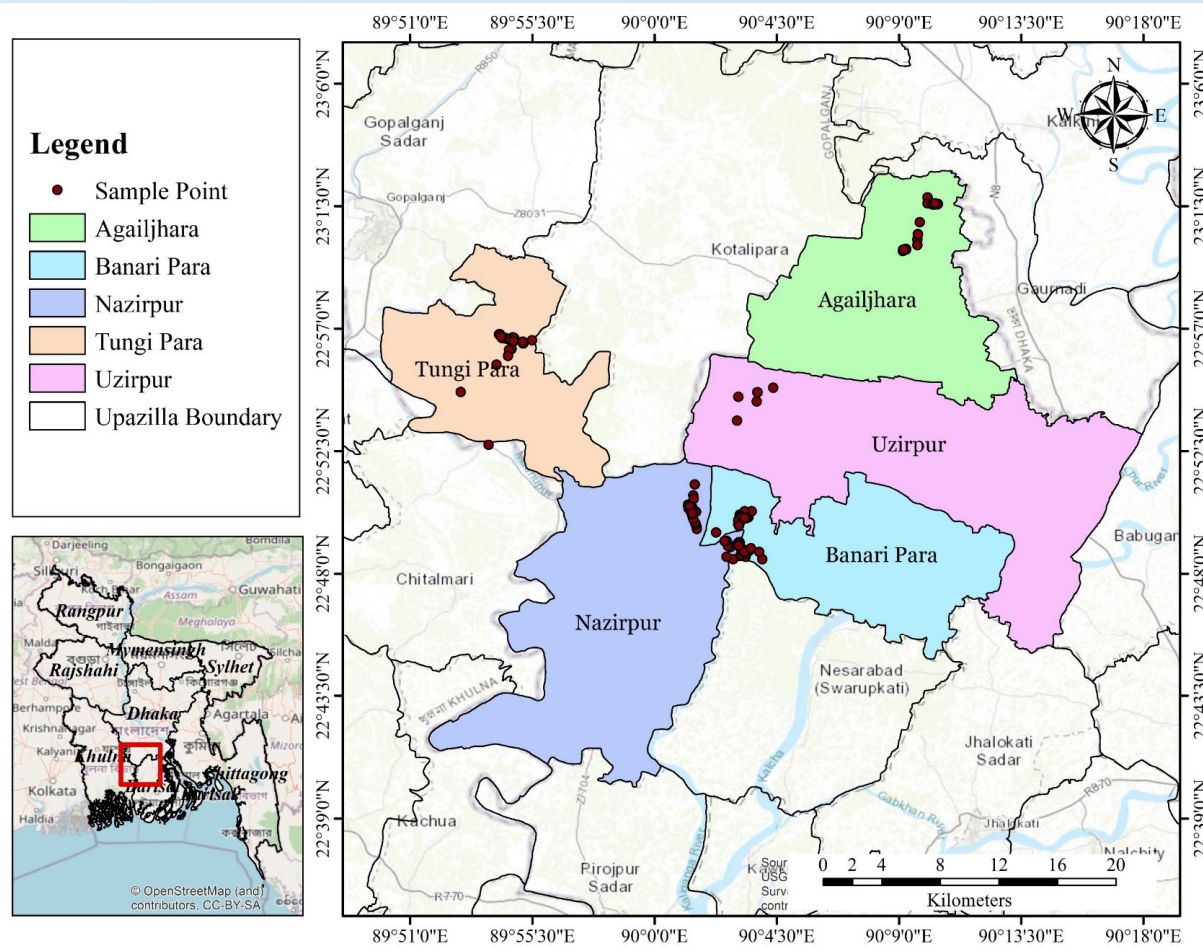
Background for the coastal region in Bangladesh

- Bangladesh is one of the most vulnerable area for different hazards
- Over the last four decades, Bangladesh has encountered 84 flood events with an estimated aggregated damage of US\$ 13.24 billion (EM-DAT, 2023).
- Long-term waterlogging prevents farmers from continuing traditional land-based agricultural practices, leading to challenges such as poverty, hunger, and unemployment for farmers in coastal areas



Ground reality Based on the pilot study using Focus Group Discussions and Key Informant interviews

Study area and objectives



With this background, this study has three objectives : This study specifically addresses two research questions:

- How do environmental migrants' habitat preferences impact their post-migration well-being?
- To assess the impact of adopting floating farming on farm profit, considering the behavior of both adopters and non-adopters of floating farming

Methodology

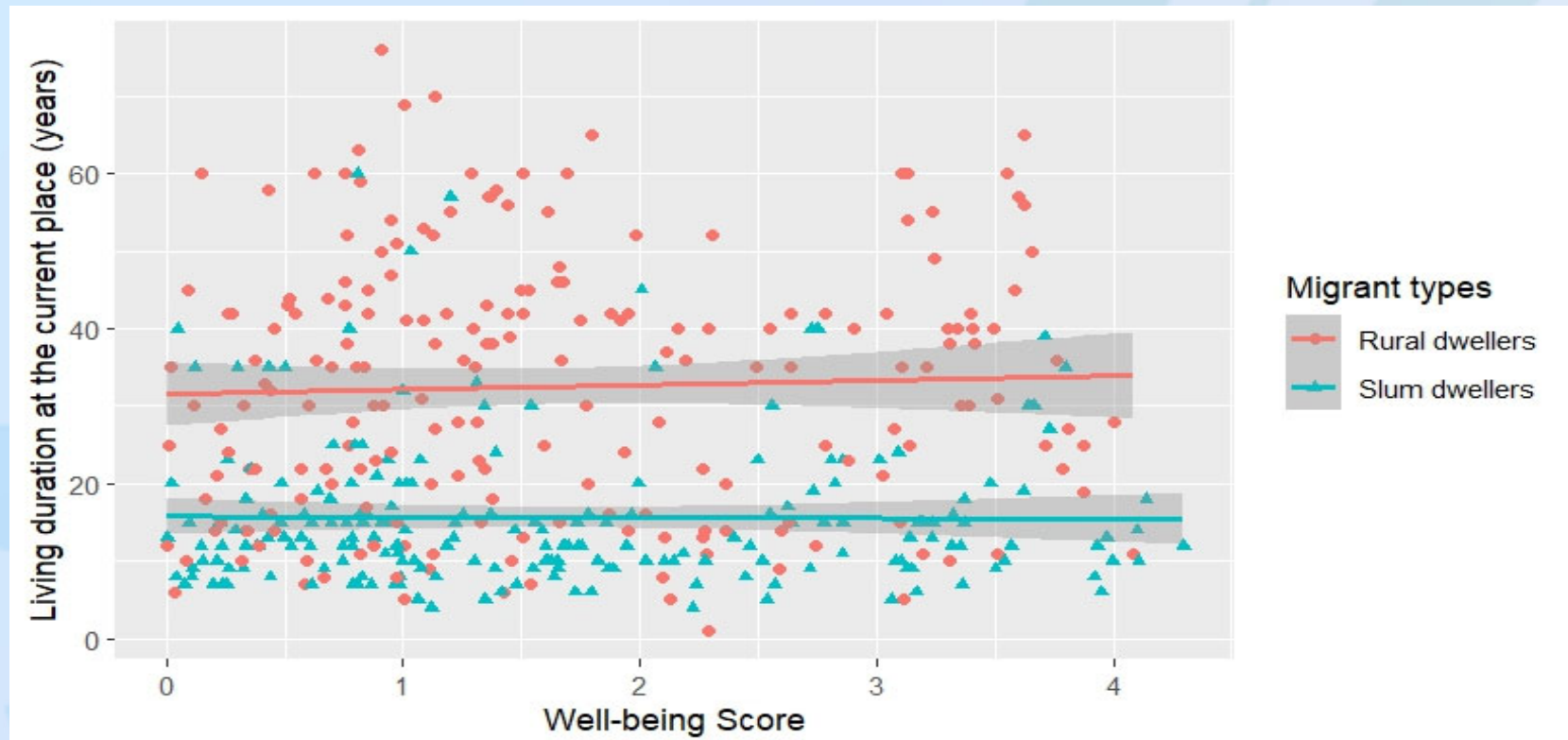
Criteria for study area selection

1. Presence of persistent waterlogging even during the dry season
2. Inhabitants' dependence on available natural resources for their livelihood, directly or indirectly
3. High susceptibility of the area to natural hazards, such as tropical cyclones, floods, and salinity intrusion.

Methodology for household survey

- Systematic random sampling was used to select 341 households from the 16 villages.
- The questionnaire, consisting of 48 closed-ended questions, was prepared in several phases, including a draft questionnaire prepared based on inputs provided by participants from a pilot survey.
- The head of each household of at least 20 years old (or other adult members in case head of the household is absent) was considered the respondent during data collection.
- Regression models (OLS and logistic) and Endogenous switching regression model (ESR) were employed for the data analysis

(i) Key findings for climate migrants and their well-beings



- In rural areas respondents appeared to enjoy better social capital than slum areas
- Despite lower degrees of access to different services (e.g., sanitation, education etc.), respondents in rural areas exhibited higher level of well-being score

(ii) Statistical summary of farmers being sampled

Variables	Unit of measurement	Full Sample (341) Mean	Adopters of floating farming (268) Mean	Non-adopters of floating farming (73) Mean	Difference
<u>Climatic shocks</u>					
Waterlogged days	Number of waterlogged days	100.72	107.29	76.62	30.671***
Waterlogged farm	Waterlogged days ≥ 90 =1; otherwise=0	0.64	0.66	0.55	0.12*
Hazard effect	Cyclone, storm, surge or salinity-induced mild to high damage in farming activities =1; otherwise=0	0.66	0.69	0.53	0.156**
Erratic rainfall perceived	Mild to highly erratic rainfall=1; otherwise=0	0.84	0.84	0.82	0.021
<u>Farmers' knowledge and training</u>					
Previous knowledge of floating farming	Yes=1; otherwise=0	0.67	0.78	0.27	0.506***
Training on any agro-farming	Yes=1; otherwise=0	0.39	0.362	0.472	-0.11*
Training on non-floating farming	Trained on non-floating farming =1; otherwise=0	0.25	0.2	0.44	-0.237***
Training on floating farming	Trained on floating farming =1; otherwise=0	0.22	0.28	0.03	0.249***
<u>Farming support</u>					
Technical support	Technical support received from any GO, NGOs or other organizations= 1; otherwise=0	0.2	0.25	0.03	0.219***
Input subsidy support	Input support received from any GO, NGOs or other organizations= 1; otherwise=0	0.4	0.388	0.431	-0.042
Cash subsidy support	Cash support received from any GO, NGOs or other organizations= 1; otherwise=0	0.38	0.36	0.47	-0.104
Extension support	Extension support received from any GO, NGOs or other organizations= 1; otherwise=0	0.53	0.52	0.58	-0.057
Disaster relief support	Yes=1; otherwise=0	0.16	0.183	0.097	0.086*
Microcredit support	Yes=1; otherwise=0	0.72	0.716	0.736	-0.02
<u>Farmers' and farms' features</u>					
Age	Years	47	47.59	44.85	2.737*
Education	$\geq$ Primary Education (05 Years) =1; otherwise=0	0.62	0.62	0.62	0.003
Religion	Muslim=1; otherwise=0	0.57	0.65	0.26	0.389***
Household size	Numbers	5.57	5.64	5.3	0.34
Risk preference	Prefer to take risk=1; otherwise=0	0.33	0.32	0.37	-0.045
Membership to cooperatives	Yes = 1; otherwise=0	0.28	0.29	0.22	0.072
Cultivation season	Numbers/year	1.89	1.86	2.01	-0.155
Distance from canal	Meters	172.52	167.78	189.95	-22.165
Profit	USD/decimal	51.2	51.95	48.6	3.357
*** p<0.01, ** p<0.05, * p<0.1					

Key findings

- 2/3rd of the farms in the study locations remained waterlogged for over three months a year (on average 100 days/year).
- Hazard effects, i.e., cyclones, storms, surges, and salinity invoking considerable damage to farming activities, played vital roles in encouraging them to adopt floating farming.
- About 66% of the farmers who suffered hazard effects adopted the floating farming strategy (69%), which is 16% significantly higher than non-adopters.
- Only 22% received training on floating farming and farmers who had training on floating farming appeared to adopt the floating farming strategy more, while those who received traditional farming training tended to opt for non-floating farming.
- For the adopter farms, the average profit was US\$ 52/decimal, which was around US\$ 3/decimal higher than the profit made by the non-adopter farms

Effect of support on floating farming adopters' profit

Adaptation	Sub-samples	Decision stage		Treatment effect (TE)	Control mean	% change due to the treatment
		Adoption	Non-adoption			
Erratic rainfall affected farmers	Cooperative membership	31.04	12.47	18.57***	32.48	57.16
	Technical support	36.51	16.95	19.55***	32.11	60.88
	Credit support	30.39	12.86	17.53***	33.40	52.49
	Training support	36.28	26.70	9.58***	31.74	30.19
	Input support	35.73	154.45	-118.72***	35.06	-338.65
	Certified seed support	37.39	35.83	1.56	25.53	6.10
Waterlogged farmers	Cooperative membership	29.35	12.45	16.90***	33.99	49.72
	Technical support	27.72	25.11	2.60	33.36	7.81
	Credit support	33.66	23.92	9.74***	32.69	29.80
	Training support	36.43	8.16	28.28***	33.38	84.70
	Input support	38.42	5.69	32.73***	31.58	103.64
	Certified seed support	40.17	45.50	-5.33**	25.94	-20.56
Hazard affected farmers	Cooperative membership	26.91	16.60	10.31***	35.34	29.17
	Technical support	32.17	15.40	16.78***	15.40	108.94
	Credit support	32.87	22.09	10.77***	31.24	34.49
	Training support	33.57	96.62	-63.05***	33.69	-187.15
	Input support	33.77	16.94	16.82***	32.80	51.30
	Certified seed support	37.25	23.08	14.16***	28.63	49.48

*** p<0.01, ** p<0.05

- Overall, results showed that provisioning the said farming supports had a significant positive impact on farm profits compared to non-adopters across the different climatic challenges. Hence, these results provide valuable insights to policymakers for designing and implementing effective support programs that enhance profits from floating farming in the wake of climate-related challenges.

Summary

- This study significantly contributes to the existing body of research by introducing a unique perspective of floating farming in the wetland areas of Bangladesh and incorporating counterfactual analysis.
- It fills a crucial gap by investigating the determinants of adoption and quantifying the impact of floating farming on farm profit, providing knowledge on the economic implications of this adoption strategy.
- Training and previous knowledge on floating farming, farming support, location, age, education, religion, and cultivation season were determinants of adopting floating farming across farm households. Furthermore, considering the said climatic shocks, various farming supports (e.g., cooperative membership, technical, credit, training, input, and certified seed support) appeared to affect profits positively and significantly for the floating farming adopters in most cases.
- Finally, the counterfactual results, applied through ESR model to compare between adopters and non-adopters, suggest that farmers who adopted floating farming could make 60% more profit compared to non-adopter farmers.

Thank you so much