Soil salinity, household wealth and food insecurity: Evidence from the rural Ganges Brahmaputra delta

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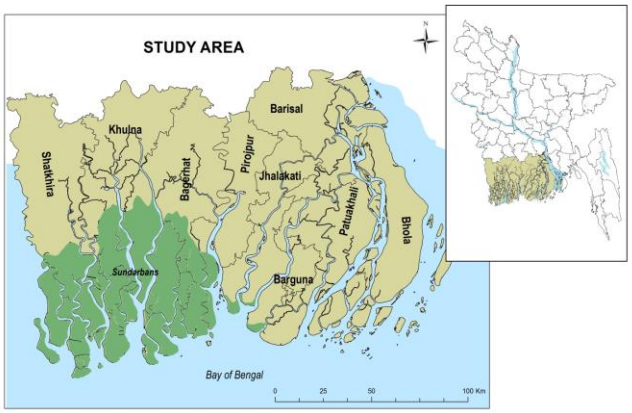
Background (1)

- Recent studies reveal that even though the hunger target of MDG 1 is likely to be within reach (UN, 2013), around 12% of the global population are deprived of food and one in eight people are suffering from chronic hunger (FAO et al., 2013).
- In particular, LDCs will be at risk of failing to meet their global and national developmental goals, despite the declining trends of food insecurity over the past 21 years (Smith et al., 2000, FAO et al., 2013).
- In Bangladesh (LDC), ensuring food security has been amongst the country's greatest challenges and priorities since gaining independence (Faisal and Parveen, 2004, BCAS, 2010).

Background (2)

- At the same time, salinity intrusion has been acknowledged as a major challenge in the south west coastal region of Bangladesh - one of the most vulnerable regions to climate change in the world.
- Salinity rise has already reduced around 2 million metric tons of rice production and is negatively affecting fish diversity (Gain et al., 2008) and local crops and biodiversity (Hossain and Dearing, 2013, Hossain, 2010).
- The rural poor communities are likely to be most affected.

Study area

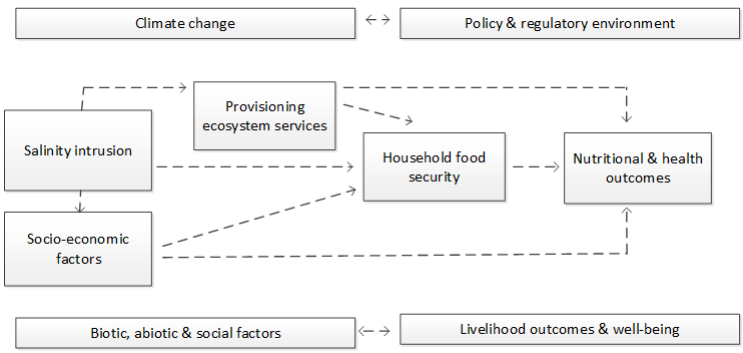


9 districts in the coastal Ganges Brahmaputra delta: Barguna, Barisal, Bhola, Jalokhati, Patuakhali, Pirojpur, Bagerhat, Khulna, and Satkhira.

Research objectives

- Investigate the association between salinity intrusion and HH food security in the coastal GBD.
- Examine the association between households' socio-economic characteristics and food security in the coastal GBD.

Conceptual framework



Note: The framework draws from Millennium Ecosystem Assessment (2005).

Data

- Data originate from the most recent (2010) Bangladesh Household Income and Expenditure Survey (HIES) [household level].

- Supplemented by soil salinity data from Soil Resource Development Institute (Ahsan et al., 2010).

Methods

- Descriptive statistics: cross-tabulations and T-test;
- Logistic regression modelling using STATA 12.

Descriptive statistics

Variable	Per cent (%)	Mean	SD
food insecurity (% of food insecure HHs)			
based on expenditure on food	44.71		
based on calorie availability	33.23		
salinity intrusion			
saline area (%)		0.40	0.28
weighted salinity score (dS/MA)		3.62	11.48
highly saline area (%)	30.2		
number of household members		4.5	1.7
HH socio-economic characteristics			
years of education of HH head		3.57	4.22
age of HH head		47.59	14.52
HH head is female	12.39		
HH head worked during last seven days	79.46		
HH engaged in crop cultivation	51.52		
HH raises livestock	81.72		
HH has been receiving remittances	16.2		
overall n	993 (n)		

Independent groups T-test

Distribution of salinity intrusion by households' food security status.

HH food security	Salinity intrusion	mean	median	SD	T-test statistic
food secure	Saline area (%)	0.38	0.45	0.28	(-2.05)**
food insecure		0.42	0.45	0.28	
food secure	Salinity score (dS/MA)	3.33	2.48	3.51	(-1.89)*
food insecure		3.78	2.91	3.48	

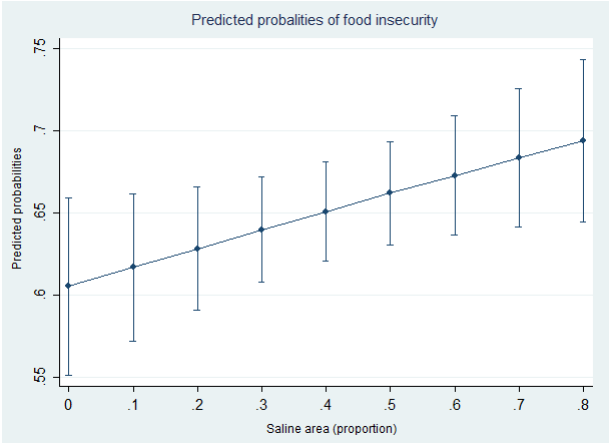
Regression results (1)

Food insecurity	model 1	model 2	model 3	model 4	model 5
variable	OR (CI)	OR (CI)	OR (CI)	OR (CI)	OR (CI)
Salinity intrusion (area)	1.63 (1.02; 2.60)**	1.61 (0.97; 2.69)*	1.12 (0.65; 1.92)		
Salinity intrusion (weighted score)				1.04 (1.00; 1.08)*	0.99 (0.95; 1.04)
HH socio-economic characteristics					
Wealth quintile					
Poor			0.69 (0.43; 1.13)		0.66 (0.40; 1.09)
Medium			0.79 (0.48; 1.30)		0.80 (0.48; 1.32)
Rich			0.42 (0.26; 0.68)***		0.39 (0.24; 0.64)***
Richest			0.35 (0.21; 0.57)***		0.32 (0.19; 0.53)***
Baseline: poorest			1.00		1.00
Religion					
Hinduism		0.73 (0.50; 1.06)	0.74 (0.50; 1.09)		0.78 (0.53; 1.15)
Buddhism		0.64 (0.10; 4.09)	0.66 (0.10; 4.28)		0.72 (0.11; 4.65)
Baseline: Islam		1.00	1.00		1.00
Number of HH members		1.07 (0.98; 1.17)	1.10 (1.01; 1.20)**		1.09 (0.99; 1.19)*

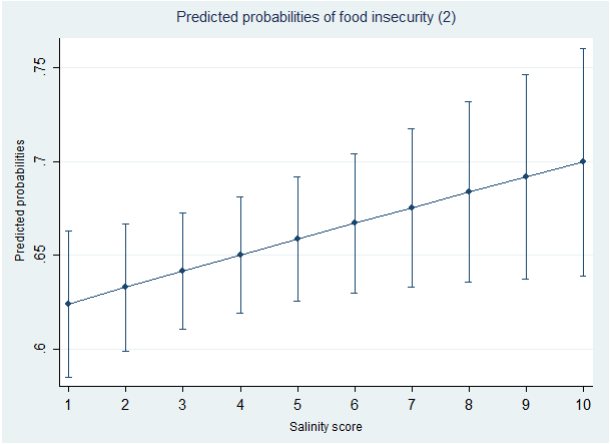
Regression results (1 -ctd)

Food insecurity	model 1	model 2	model 3	model 4	model 5
Characteristics of HH head					
HH head is female		0.65 (0.38; 1.13)	0.65 (0.37; 1.16)		0.67 (0.38; 1.20)
Baseline: HH head is male		1.00	1.00		1.00
Years of education of HH head		0.90 (0.87; 0.93)***	0.93 (0.90; 0.96)***		0.93 (0.89; 0.96)***
HH head worked during last seven days		0.76 (0.48; 1.20)	0.76 (0.47; 1.21)		
Baseline: didn't work		1.00	1.00		
Age of HH head		1.00 (0.99; 1.01)	1.00 (0.99; 1.01)		1.00 (0.98; 1.01)
HH agricultural activities					
HH engaged in crop cultivation		0.78 (0.58; 1.06)	0.80 (0.59; 1.10)		0.82 (0.60; 1.13)
Baseline: HH not engaged in crop cultivation		1.00	1.00		1.00
HH raises livestock		0.65 (0.44; 0.97)**	0.69 (0.46; 1.03)*		0.72 (0.48; 1.09)
Baseline: HH does not raise livestock		1.00	1.00		1.00
Remittances					
HH has been receiving remittances		0.59 (0.39; 0.88)***	0.61 (0.41; 0.92)**		0.59 (0.39; 0.90)***
Baseline: HH has not been receiving remittances		1.00	1.00		1.00
Constant	1.53 (1.22; 1.92)***	3.78 (1.74; 8.18)***	5.09 (2.21; 11.73)***	1.59 (1.32; 1.94)***	5.72 (2.46; 13.32)***
Log likelihood	-627,52	-585,43	-569,03	-604,36	-545,82
number of observations	973	969	964	933	924

Predicted probabilities (1)



Predicted probabilities (2)



Regression results (2)

Additional regression results for high vs. lower salinity areas.

Variable	High salinity	Lower or no salinity
Food insecurity	OR (CI)	OR (CI)
Poor	0.59 (0.26; 1.33)	0.82 (0.45; 1.52)
Medium	0.49 (0.23; 1.07)*	1.11 (0.59; 2.09)
Rich	0.14 (0.06; 0.31)***	0.71 (0.21; 1.31)
Richest	0.36 (0.14; 0.92)**	0.39 (0.21; 0.72)***
Baseline: poorest	1.00	1.00
Number of HH members	1.02 (0.87; 1.20)	1.19 (1.07; 1.32)***
Years of education of HH head	0.95 (0.89; 1.02)	0.93 (0.90; 0.97)***
HH engaged in crop cultivation	1.39 (0.80; 2.42)	0.57 (0.40; 0.80)***
Baseline: HH not engaged in crop cultivation	1.00	1.00
HH has been receiving remittances	0.40 (0.17; 0.98)**	0.53 (0.35; 0.80)***
Baseline: HH has not been receiving remittances	1.00	1.00
Constant	4.58 (1.95; 10.76)***	2.32 (1.24; 4.36)***
Log likelihood	-165,37	-408,65
number of observations	300	685

Conclusions

- The results of unadjusted models show that salinity intrusion has a significant effect on household food insecurity.
- However, this impact becomes statistically insignificant when a household's wealth is taken into account.
- Education, household size and whether or not a household has been receiving remittances, are all significant predictors of food insecurity in the study area.

Policy implications

- While soil salinity remains an important influencing factor of household food insecurity, investments in strategies to reduce income inequality and pro-poor initiatives should be prioritized in the GBD.

- Income generation and income diversification initiatives should be given priority and socially equitable monetary risk-sharing mechanisms established.

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