

Table S1. Selection of the *beels* and villages in Hari-Teka-Bhadra catchment of the GBM delta for the study

Name of the selected beels	Name of the River	No. of villages	Name of the selected villages	Sub-districts	Districts
Bhaina	Hari-Teka	12	Sholgatia, Agarhati, Dahuri and Sarutia	Keshabpur	Jashore
East Khukshia	Hari-Teka	11	Arua, Maynapur and Kalicharanpur	Keshabpur	Jashore
West Khukshia	Hari-Teka	10	Kalicharanpur	Manirampur	Jashore
Kopalia	Hari-Teka	6	-	Keshabpur	
				Manirampur,	Jashore
Kedaria	Hari-Teka	17	-	Abhoynagar	
				Manirampur,	Jashore
				Abhoynagar	
Bruli	Bhadra	10	Dashkahunia	Keshabpur	Jashore
Panjia & Had Baruna	Bhadra	10	-	Keshabpur	Jashore
Madhugram	Hari-Teka	9	East Baruna	Dumuria	Khulna
Tawalia	Hari-Teka	10	Madhugram	Dumuria	Khulna
Pakhimara	Hari-Teka	4	South Rudaghara	Dumuria	Khulna
	Kobadak	12	-	Tala	Satkhira

Field Survey, 2016-2018

The sample size (n) was statistically determined based on the following equation provided by Kothari (2004) [39] and Masud et al. [1]:

$$n = \frac{z^2 pqN}{e^2(N-1) + z^2 pq} \quad \text{Eq (S1)}$$

Here, z = the value of standard variate at a given confidence level (for 95% confidence level, z is 1.96)

p = sample proportion (for 10% household, p is 0.1)

$q = 1 - p$ (q is 0.9)

N = population size of the village

e = acceptance error (within 5% true value, e is 0.05)

Table S2. Sample size determination for the household survey of the Hari-Teka-Bhadra catchment

Name of the <i>Beel</i>	Name of the village	No. of the Household s	Land required of Households (in %)	Target population (N)	Sample size (n)
West Khukshia (NTB)	Kalicharanpur	350	50	175	9
Bhaina (TB)	Agarhati	420	80	336	17
Bruli (NTB)	Dashkahunia	450	80	360	19
Tawalia (NTB)	South Rudaghara	700	80	560	29
Madhugram (NTB)	Madhugram	700	60	420	22
Baruna (NTB)	East Baruna	400	70	280	15
East Khukshia (TB)	Arua	480	80	384	20

Masud et al. [7]

Note: 'NTB' for non-TRM *beel* and 'TB' for TRM *beel*

Table S3. Performance scale of the SITRM framework

Score for an indicator	Score for the Sustainability Index (or % score of an indicator)	Performance for Satisfaction	Needs to Action
0-1	0-20	Very Bad	Need Very High Action
1.01-2	21-40	Bad	Need High Action
2.01-2.5	41-50	Not Satisfactory	Need Medium Action

2.51-3	51-60	Satisfactory	Need Low Action
3.01-4	61-80	Good	Need Very Low Action
4.01-5	81-100	Very Good	Need No Action

Authors' compilation

Table S4. The components and indicators of SITRM

Component	Indicator	Explanation	Threshold		
			Max	Min	
Tidal River	Tidal flow	Average annual flow of surface water (m ³ /sec) at Ranai in 2002	High tide	600 ^a	< 550 ^b
			Low tide	250 ^a	< 200 ^b
	Drainage Capacity	Capacity of the Hari-Teka River at Ranai- downstream river to drain out excess water from the catchment	Depth (m)	12 ^a	< 10 ^b
			Width (m)	75 ^a	< 70 ^b
	Riverbank erosion	Protection of the people's assets from riverbank erosion (%)		100 ^a	0 ^b
Sediment Management	Sedimentation	Average annual sedimentation rate on river bed regarding cross-sectional area (%)		>5 ^b	0 ^a
	Waterlogging	Area freed from waterlogging (including permanent water body) in the catchment (%)	Monsoon (August)	55 ^a	<50 ^b
			Post-monsoon (December)	70 ^a	<35 ^b
	Land reclamation	Land development by even sediment distribution in the TRM beel (%)		100 ^a	0 ^b
Environment	Crop production	Average annual production (ton/ha/yr)	Paddy (Boro)	3.5 ^a	<3 ^b
			Vegetables	4.5 ^a	<3.5 ^b
			Shrimp+Prawn	0.5 ^a	<0.4 ^b
	Vegetation with settlement	Area is covered with vegetation (%)	Monsoon (August)	15 ^a	<12 ^b
			Post-monsoon (December)	30 ^a	<25 ^b
	Sea level rise	Average land elevation targets 0.4 to 0.5 m of the TRM beel by considering annual sea level rise (8 mm/yr) for 50 years plan in the catchment for 10-12 beels (a 4 years TRM project)		0.5 ^a	<0.4 ^b
	Employment	Availability of agricultural related job (days/month) in the catchment (%)		25 ^a	<20 ^b
	Salinity	Salinity of Hari-Teka River during high-tide (ppt)		>2 ^b	<1 ^a
	Terrestrial biodiversity	Increase in Number of species (%)	Livestock	10 ^a	0 ^b
			Birds	5 ^a	0 ^b
4-legged animals			10 ^a	0 ^b	
		Trees	Fruit	10 ^a	0 ^b
			Timber	15 ^a	0 ^b
Migration	No. of migrated (day laborer) people (%)	Temporary	> 30 ^b	10 ^a	
		Permanent	> 1 ^b	0 ^a	
Human Health	Health Impact	Diarrhea disease (cases/1000 pop)		100 ^b	0 ^a
Institution (Community participation)	Awareness and coordination	Awareness (of community people and Beel Committee) and Coordination (among CBOs, GOs & NGOs) (%)	Awareness	100 ^a	0 ^b
			Coordination	100 ^a	0 ^b
	Compensation	No. of land owners get crop compensation from Government (%)	Marginal farmer (< 100 decimal land)	100 ^a	0 ^b
		Other farmers (> 100 decimal land)	100 ^a	0 ^b	
	LUC	Accessibility of crop production (%)	Paddy (Boro)	80 ^a	<70 ^b
			Vegetables	50 ^a	<40 ^b

	Alternative livelihoods	To support landless (beel dependable) and poor (if applicable including resettled) people with alternative livelihoods	100 ^a	0 ^b
Institution (Governance)	Rotation of TRM in the beels of the catchme	Networking among beels with adjacent rivers for TRM operation in the catchment (%)	1 ^a	0 ^b
	Water Governance	Trends and strategy of water governance (at locally/nationally/regionally) - connecting a. main canals of the beels to the tidal rivers b. one catchment to another catchment c. upstream to downstream rivers d. identifying/learning the gaps/problems from past/present TRM project and (by policy improve/change) solve it in the present/next TRM project	1 ^a	0 ^b

Note: 'a' for preferable threshold value and 'b' for not preferable threshold value

Source: Opinion survey, 2016 and adapted from Masud et al. [1]

Table S5. The estimation of average land elevation of tidal basins in Hari-Teka-Bhadra catchment due to sediment deposition by TRM

Name of the TRM <i>beel</i>	Area of TRM in the <i>Beel</i> (A _L) in ha	Total quantity of sediment deposition in the tidal basin (SD _B) in ton (m ³)	Average land elevation of the tidal basin (G _e) in m
<i>Beel Bhaina</i>	572	65,00000	1.14
<i>Beel Kedaria</i>	600	5,00000	0.083
<i>Beel East Khukshia</i>	840	93,00000	1.1

Note: (1 ha = 10,000 m²)

Data Source: Masud et al. [8] and Personal communications with Hashem Ali Fakir, Consultant, Uttaran, Tala, Satkhira and Mahir Uddin Biswash, President, Water Management Federation (WMF), Bangladesh.

Table S6. LUC (in ha) of the Hari-Teka-Bhadra catchment area based on *Beel East Khukshia*-TRM Masud et al. [1]

Name of the <i>Beel</i>	Boro paddy		Prawn, Shrimp & White fish		Prawn & White fish		White fish		Winter Vegetables		Summer Vegetables	
	With-TRM	Without-TRM	With-TRM	Without-TRM	With-TRM	Without-TRM	With-TRM	Without-TRM	With-TRM	Without-TRM	With-TRM	Without-TRM
Kopalia	100	60	85	75	15	25	0	0	50	30	0	0
Bruli	100	80	0	0	50	30	50	70	60	20	40	10
Bhaina	100	100	100	100	0	0	0	0	100	70	80	50
Kedaria	100	10	30	0	70	5	0	95	80	10	0	0
Baruna	100	70	0	0	100	100	0	0	100	50	100	0
Madhugram	50	5	25	25	70	70	5	5	100	25	100	0
Tawalia	100	75	50	30	50	70	0	0	50	10	50	0
West												
Khukshia	22	13	10	2	50	50	40	48	5	2	0	0
Panjia+Had	100	95	0	35	100	50	0	15	15	10	100	55
East												
Khukshia	0	100	0	100	0	0	0	0	0	80	0	40

Masud et al. [1]

Table S7. Accessibility of different crops (in percentage) at several beels of the Hari-Teka-Bhadra catchment area [20]

LUC	2006 (without-TRM)		2011 (with-TRM)		2016 (without-TRM)	
	August	December	August	December	August	December
Water body (ha)	23196	16838	20731	12595	24737	22617
Water body (%)	52	38	47	28	56	51

Agricultural land (ha)	14927	15774	16541	17166	16298	13202
Agricultural land (%)	34	36	37	39	37	30
Vegetation & Settlement (ha)	6114	11625	6965	14476	3202	8418
Vegetation & Settlement (%)	14	26	16	33	7	19

Field Survey, 2017

Table S8. The crop production (ton/ha) between with-TRM and without-TRM scenario of the Hari-Teka-Bhadra catchment area

Name of Crops	Crop yield or production (ton/ha)	
	With-TRM	Without-TRM
Rice (<i>Boro</i>)	3.54	2.34
Vegetables	4.6	1.45
Prawn	0.37	0.3
Shrimp	0.083	0.08
White fish	1.96	1.76

Masud et al. [1]

Table S9. Changes in terrestrial biodiversity of the Hari-Teka-Bhadra catchment

Terrestrial biodiversity	TRM Scenarios	Name and Number of the species			Changes	
		Hen	Duck	Goose	Total	Percentage
Bird animals	Without-TRM (2002-6)	830	483	60	1373	
	With-TRM (2007-13)	1059	565	73	1697	+ 23.6
	Without-TRM (2014-18)	909	642	39	1590	- 6.3
4-legged animals				Goat		
	Without-TRM (2002-6)	161		318	479	
	With-TRM (2007-13)	203		287	490	+ 2.30
	Without-TRM (2014-18)	156		260	416	- 15.10
Fruit trees		Mango	Jackfruit	Coconut		
	Without-TRM (2002-6)	829	293	892	2014	
	With-TRM (2007-13)	978	347	1031	2356	+ 17
	Without-TRM (2014-18)	873	214	924	2011	- 14.6
Timber trees		Neem	Mahogany	Shegun		
	Without-TRM (2002-6)	166	1207	697	2070	
	With-TRM (2007-13)	217	1479	895	2591	+ 25.2
	Without-TRM (2014-18)	181	1592	775	2548	- 1.7

Field Survey, 2018

Table S10. Changes in agricultural related employment of day laborers (in days) out of 30 days in different *beels* of the Hari-Teka-Bhadra catchment

TRM Scenarios						West	East
	Madhugram	Bhaina	Baruna	Tawalia	Bruli	Khukshia	Khukshia
Without-TRM (2002-6)	14	22	12	10	10	16	22
With-TRM (2007-13)	23	26	22	21	21	25	24
Without-TRM (2014-18)	18	22	13	13	13	16	28

Field Survey, 2018

Table S11. Migration of day laborers (in %) due to jobless of the Hari-Teka-Bhadra catchment

Migration	Without-TRM (2002-6)	With-TRM (2007-13)	Without-TRM (2014-18)
Temporary	50	13	42
Permanent	0.8	0.5	0.6

Field Survey, 2018

Table S12. Cases of diarrhea of people in the Hari-Teka-Bhadra catchment

No. of people	No. of cases of diarrhea disease in different TRM periods		
	Without-TRM (2002-6)	With-TRM (2007-13)	Without-TRM (2014-18)
580	58	17	20
1000	100	29	34

Field survey, 2018

Table S13. Expert opinions on indicators following 5-point Likert scale

Indicators	Name of the activities	Scores out of 5
Riverbank erosion	Making awareness among people who live in the bank side by GOs	2.4
	Making awareness among people who live in the bank side by CBOs	3.6
	Installing concrete bloked on the riverbank to protect erosion	2.2
	Resettling people if necessary, by the government authority/NGOs	1.4
Awareness and Coordination	Community people's awareness regarding TRM project	3.6
	Active role of CBOs and local NGOs regarding TRM project	4.2
	Coordination between GOs and CBOs for village protection dam	3.2
	Coordination between GOs and CBOs for TRM project's time fixation	1.8
	Coordination between GOs and CBOs for compensation	2.2
	Dissemination of the long-term plan (50 years) for rotational TRM in different <i>beels</i> of the catchment by the authority (BWDB)	1.6
Rotation of TRM <i>beel</i>	Community people were aware regading the plan for rotational TRM	2.4
	<i>Beel Committees</i> have good understand for the next TRM project	2
	CBOs and NGOs have good understand for the next TRM project	2.4
	The authority has taken initiatives to prepare next TRM <i>beel</i> before closing current <i>Beel East Khukshia</i> -TRM	3.6
Water governance	Removing obstacles from the main canals of <i>beels</i> in the catchment	3
	Connecting the main canals of <i>beels</i> to the tidal rivers in the catchment	4.4
	Connecting upstream and downstream rivers in the catchment	4
	Connecting the catchments and developing the network system	3.8
	Learning from facing problems of past TRM project	2.8

Opinion Survey, 2017

Table S14. Pairwise correlations of SITRM indicators (Water Governance, Riverbank Erosion, Awareness and Coordination, and Rotation of TRM Beel)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	
(1) WG1	1.000																		
(2) WG2	-0.121 (0.611)	1.000																	
(3) WG3	0.300 (0.199)	-0.243 (0.303)	1.000																
(4) WG4	-0.087 (0.715)	0.169 (0.477)	-0.261 (0.266)	1.000															
(5) WG5	-0.104 (0.662)	0.455* (0.044)	-0.209 (0.378)	-0.445 (0.137)	1.000														
(6) RE1	0.121 (0.611)	0.559* (0.010)	-0.364 (0.115)	0.274 (0.242)	0.455* (0.044)	1.000													
(7) RE2	0.000 (1.000)	0.257 (0.275)	-0.481* (0.032)	0.36* (0.015)	0.440 (0.555)	0.90* (0.028)	1.000												
(8) RE3	0.000 (1.000)	0.177 (0.455)	-0.209 (0.378)	0.073 (0.761)	0.013 (0.070)	0.83* (0.001)	0.61* (0.041)	1.000											
(9) RE4	0.144 (0.544)	0.140 (0.556)	0.289 (0.217)	-0.427 (0.060)	0.391 (0.088)	0.140 (0.556)	-0.161 (0.641)	0.361 (0.118)	1.000										
(10) AC1	0.000 (1.000)	-0.103 (0.664)	0.320 (0.169)	0.315 (0.175)	-0.289 (0.217)	0.362 (0.117)	0.123 (0.605)	0.378 (0.100)	0.277 (0.237)	-	1.000								
(11) AC2	-0.118 (0.621)	0.343 (0.139)	0.000 (1.000)	0.287 (0.220)	-0.447 (0.535)	0.200 (0.398)	0.068 (0.776)	0.225 (0.918)	0.272 (0.246)	0.578* (0.008)	1.000								
(12) AC3	-0.189 (0.689)	0.046 (0.89)	-0.189 (0.89)	-0.145 (0.45)	-0.220 (0.20)	-0.298 (0.98)	-0.277 (0.77)	-0.277 (0.77)	0.191 (0.91)	-0.42 (0.42)	-0.23 (0.23)	1.000							

	425	848	425	136	934	202	593	455	420	139	063									
(13)))))))))))))))))))))
AC4	-	-	0.5	0.1	0.0	-	-	-	0.0	0.6	0.4	-	1.0							
	0.1	0.0	21*	09	22	0.0	0.0	0.0	90	00*	67*	0.3	00							
	04	51				51	60	22				15								
	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.							
	662	832	018	648	928	832	801	928	705	005	038	176								
(14))))))))))))))))))))	
RTB	0.0	0.5	-	0.0	-	0.0	0.1	-	-	-	0.1	0.3	-	1.0						
1	00	60*	0.2	50	0.0	35	11	0.2	0.1	0.1	02	55	0.3	00						
			89	90				11	67	85			91							
	(1.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.							
	000	010	217	833	705	884	641	373	482	436	669	125	088							
(15))))))))))))))))))))	
RTB	-	0.2	-	0.0	0.2	0.2	0.2	0.0	-	0.0	0.3	0.0	0.2	0.2	1.0					
2	0.2	65	0.3	63	02	65	57	51	0.3	26	43	46	02	10	00					
	43		64						85											
	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.							
	303	259	115	791	392	259	275	832	094	914	139	848	392	374						
(16))))))))))))))))))))	
RTB	0.0	0.1	-	-	0.5	0.1	0.1	0.0	0.0	-	-	0.3	-	0.1	0.3	1.0				
3	00	57	0.3	0.3	38*	57	24	00	00	0.5	0.6	66	0.5	86	13	00				
			87	37						50*	09*		38*							
	(1.	(0.	(0.	(0.	(0.	(0.	(0.	(1.	(1.	(0.	(0.	(0.	(0.							
	000	510	092	146	014	510	602	000	000	012	004	113	014	432	179					
(17))))))))))))))))))))	
RTB	-	-	-	0.1	0.0	-	0.2	-	-	0.2	0.3	-	0.2	-	0.7	0.1	1.0			
4	0.3	0.0	0.2	69	76	0.0	57	0.0	0.3	84	43	0.1	02	0.1	06*	57	00			
	64	29	43			29		76	85			83		40						
	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.					
	115	902	303	477	751	902	275	751	094	224	139	439	392	556	001	510				
(18))))))))))))))))))))	
RTB	0.1	-	0.2	0.2	-	-	-	-	0.1	0.6	0.3	-	0.3	-	-	0.1	1.0			
5	07	0.1	13	23	0.1	0.1	0.0	0.0	85	59*	27	0.0	78	0.1	0.1	0.4	55	00	0	
		03		78	03	21	44					40	85	03	13					
	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.	(0.					
	655	664	367	345	453	664	932	852	436	002	160	866	100	436	664	070	514			
)))))))))))))))))))	

* $p < 0.1$

WG= Water Governance; RE= Riverbank Erosion; AC= Awareness and Coordination; RTB= Rotation of TRM beel

Table S15. Statistics of parameters of SITRM

Parameters of SITRM	Obs	Mean	Std. Dev.	Min	Max
WG	20	.72	.057	.6	.8
AC	20	.512	.06	.44	.64
RE	20	.384	.074	.24	.48
RTB	20	.48	.061	.4	.56

Table S16. Data source of the indicators

Component	Indicator	Sub-indicator	Source of data	
Tidal River	Tidal flow	High tide	SD	
		Low tide	SD	
	Drainage capacity	Depth	SD	
		Width	SD	
	Riverbank erosion	-	OS, DFO	
Sediment Management	Sedimentation	-	OS, DFO	
	Waterlogging	Monsoon	RSD	
		Post-monsoon	RSD	
	Land reclamation	-	OS, DFO	
Environment	Crop production	Paddy (Boro)	PD	
		Vegetables	PD	
		Shrimp + Prawn	PD	
	Vegetation with settlement	Monsoon	RSD	
		Post-monsoon	RSD	
	Rising sea levels	-	SD	
	Employment	-	PD	
	Salinity	-	SD	
	Terrestrial biodiversity	Live-stock	Birds	PD
			4-legged	PD
		Trees	Fruit	PD
			Timber	PD
Migration	Temporary	PD		
	Permanent	PD		
Human Health	Health impact	-	PD	
Institution (Community participation)	Awareness and coordination	Awareness	OS	
		Coordination	OS	
	Compensation	Marginal farmers	DFO	
		Other farmers	DFO	
	LUC	Paddy (<i>Boro</i>)	OS	
		Vegetables	OS	
	Alternative livelihoods	-	OS, DFO	

Note: Primary data = PD, Secondary data = SD, Opinion survey = OS, Direct field observation = DFO, and Remote sensing data = RSD.