

Understanding aquifer systems of Sunderbans- special emphasis on ASR using saline aquifers to improve farmers livelihood

Report of Workshop

December 09, 2019



INDIA-UK
Water Centre
भारत-यूके
जल केन्द्र



Understanding aquifer systems of Sunderbans- special emphasis on ASR using saline aquifers to improve farmers livelihood

Report of Workshop 09-12-2019

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The India-UK Water Centre promotes cooperation and collaboration between the complementary priorities of NERC-MoES water security research.

भारत-यूके जल केंद्र, एनईआरसी-एमओईएस जल सुरक्षा अनुसंधान की मानार्थ प्राथमिकताओं के बीच सहयोग और सहकार्यता को प्रोत्साहित करता है।

Front cover image: River Ganga

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Executive Summary

Groundwater Hydrology Division of National Institute of Hydrology, Roorkee organized a workshop on “Understanding aquifer systems of Sunderbans- special emphasis on ASR using saline aquifers to improve farmers livelihood” on December 09, 2019 at Kolkata (Fig. 1) under IUKWC pump priming project in association with R. Prasari and BGS, UK. Indian Sunderbans comprises of 2 districts having 19 Community Development Blocks, 190 Gram Panchayats and 102 islands is the largest Gangetic delta in the Indian Subcontinent. It also habitat of 2.79 million people living in 48 habitable islands and more than 50% are dependent on agriculture and allied activities of whom 1 million are small and marginal farmers with less than 1 acre monocrop land for cultivation. The livelihoods of the rural population of the Sundarbans are precarious, freshwater aquifers are deep, expensive to exploit and suffering over-exploitation. Farmers use ponds, filled during the monsoon for dry season irrigation, but these have limited capacity. An Aquifer Storage Recovery (ASR) approach that utilises saline aquifers adds resilience to the water supply system, without the challenges inherent in the management of the freshwater aquifers. The approach may be applicable beyond the deltaic systems studied, for instance in areas of irrigation induced salinity or geogenically contaminated aquifers.

In this workshop researchers, academicians and policy makers associated with Indian Sunderbans were invited to share their work experiences and vision for improvement of this region. The panel discussions were also held on the livelihood issues, soil and water conditions of Sunderbans and this workshop outcome are very much useful in development of some innovative techniques for management of soil and water of the region to improve the livelihood of the local inhabitants.



Understanding aquifer systems of Sunderbans- special emphasis on
ASR using saline aquifers to improve farmers livelihood

Venue: Hotel Senses, Salt Lake City, Kolkata Pin-700091 Date: 09-12-2019



Figure 1: Workshop banner

1. Workshop Conveners

The workshop was convened by NIH, Roorkee jointly with Prasari and BGS, UK under India-UK Water Centre (IUKWC) and led by the co-coordinators/Activity Leads:

NAME: Dr. Gopal Krishan
ROLE: Convenor/Coordinator
Organisation: National Institute of Hydrology,
Roorkee
Address: NIH Roorkee-247667, Uttarakhand,
India
Email: drgopal.krishan@gmail.com

NAME: Dr. Purnaba Dasgupta
ROLE: Co-Convenor/Co- Coordinator
Organisation: Raharhat PRASARI
Address: Jadhavpur, Kolkata, India
Email: Purnaba.irdm@gmail.com

NAME: Mr. Andrew Mackenzie
ROLE: Co- Convenor/ Co- Coordinator
Organisation: BGS, UK
Address: Wallingford, UK
Email: aam@bgs.ac.uk

The workshop was held at the Hotel Senses, Salt Lake Kolkata on 09-12-2019.

2. Workshop (or Activity) Aims

The India-UK Water Centre is based around five key cross-sectoral themes and aims to deliver a portfolio of activities across these themes. This activity focused on the theme: Using new scientific knowledge to help stakeholders set objectives for freshwater management; Improving freshwater monitoring frameworks and data for research and management;

The main objectives of the workshop were –

- To identify livelihood issues faced by Sunderban farmers and future plans to tackle these issues
- Crop water management through resource integration
- Finalization of conceptual model of the island aquifer systems collating available evidence on aquifer extent

3. Workshop Participants

{Participants details):

Workshop was attended by participants from Water Resources Investigation and Development Directorate, West Bengal (WRIDD), Panchayati Raj and Rural Development, West Bengal (PR&D), Centre Water Commission (CWC), New Delhi, Centre Ground Water Board (CGWB), Department of Environment and Forests, West Bengal, Department of Science and Technology, West Bengal, Jadavpur University, West Bengal, ICAR-CSSRI, Stakeholders, NIH-Roorkee, BCKV, Kalyani and Prasari. Participants from CWC were Deputy Director, Hydrology, Mr. Abhishek Gupta, Assistant Directors Mr. Ashish and Mr. Vipul (Coastal Management, Directorate) also attended the workshop.

- Participants were Government officials;
- Women leaders of the SHGs, GP members and others associated ground water of the area were invited by the field facilitator appointed for this project

Total 37 participants participated in the workshop.

Workshop was inaugurated by Mr. P.K. Mishra, Principal Secretary; Commissioner MGNREGA;



Figure 2: Inauguration of workshop

Table 1. List of Delegates

List of participants for Workshop on "Understanding aquifer systems of Sunderbans- special emphasis on ASR using saline aquifers to improve farmers livelihood" on December 09, 2019 at Salt Lake City, Kolkata

S.no	Organization name	Participant name	Designation / Role	Contact number	mail-id
✓ 1	Panchayat and Rural Development Department	Mr. Kaushik Saha	Commissioner, MGNREGA	8697748383	comm.nuguna@wb.gov.in
✓ 2	WREDD	Mr. Prabhat Kr. Misra	Principal Secretary	9868800099	mishrpbk@gmail.com
✓ 3	West Bengal Department of Science and Technology and Bio-Technology	Dr. Dipankar Choudhury	Commissioner		dcchoudhury@data.mail.com
✓ 4	Panchayat and Rural Development Department	Ms. Suktishita Bhattacharya	Joint Secretary	9433841268	suktishita@gmail.com
✓ 5	Panchayat and Rural Development Department	Ms Indrani Sarkar	Deputy Secretary	8697720038	indranirega2018@gmail.com
✓ 6	Jadavpur University	Prof. S. Hazra	Professor	9830200692	suata_hazra@jvu.ac.in
✓ 7	Bidhan Chandra Krishi Viswavidyalaya	Dr. Lahu Das	Professor, Agri-Physicist	6289364437	dayalahu@yahoo.co.in
✓ 8	Central Ground Water Board	Dr. Amlanjyoti Kar	Regional Director	9903304966	amlanjyoti@gmail.com
✓ 9	Central Soil Salinity Research Institute	Dr. Dhiman Burman	Principal Scientist - ICAR	8240525306	burman.d@gmail.com
✓ 10	Central Soil Salinity Research Institute	Dr. Subhasis Mondal	Principal Scientist - ICAR	9073071278	subhasish2005@gmail.com
✓ 11	Central Soil Salinity Research Institute	Dr. U.K. Mondal	Principal Scientist - ICAR	8697311030	uamr_icar@yahoo.com
✓ 12	Liverpool John Moores University	Dr. Alexander Gagnon	Professor, Agri-Physicist	044-7871088198	agagnon@lmu.ac.uk
✓ 13	California University, UCDAVIS	Dr. Sharon Hamrey			
✓ 14	State Water Investigation Directorate	Mr. Subrato Halder	Director		director@swid.gov.in
✓ 15	Water Resource Investigation Development Directorate	Mr. Debasish Roy	Assistant Project Director		debasishroy@wrid.gov.in
✓ 16	RKMVERI	Dr. Rupak Goswami	Assoc. Prof.	9674954840	gswamin@rkmv.ac.in
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✓ 18	Centre Water Commission	Mr. Abhishek Gupta	Deputy Director	757931097	agupta@cwcom.in
✓ 19	Centre Water Commission	Mr. Vinod Vijaygandhi	Asst Director II	9822247762	vvinod@cwcom.in
✓ 20	Centre Water Commission	Mr. Ashish Ranjan	Asst Director	8022667979	ashishranjan@cwcom.in
✓ 46	Sankal Mandal - Sankal Mandal				
✓ 47	H.H.H. - Anshuman Das - Prg. Manj - 9051094424 - Wb. de				
✓ 48	Dr. K.C. Saha - Subodh Chandra Saha - 9432924660 - 04/06/2019				
✓ 21	Dept. of Environment and Forest	Dr. Dipanjana Mondal	Sr. Scientist	9830212784	dipanjana@wbepb.gov.in
✓ 22	District Nodal Officer, MGNREGA - South 24 PGS	Dr. Sourav Chakraborty	DNO		mgnregadistrictoffice@south24pgs.co.in
✓ 23	Asst. Engg., MGNREGA-South 24 PGS	Mr. Swarup Mondal	Asst. Engg., MGNREGA		mgnregadistrictoffice@south24pgs.co.in
✓ 24	District Nodal Officer, MGNREGA - North 24 PGS	Mr. Shubhajit Ghosal	DNO	620977827	mgnregadistrictoffice@north24pgs.co.in
✓ 25	Asst. Engg., MGNREGA-North 24 PGS		Asst. Engg., MGNREGA		mgnregadistrictoffice@north24pgs.co.in
✓ 26	British Geological Survey	Dr. Andrew McKenzie	Pt. Hydrogeologist	044-7044021827	amckenzie@bgs.ac.uk
✓ 27	National Institute of Hydrology	Dr. Gopal Krishna	Scientist - C	9634254939	gkrishna@nhri.res.in
✓ 28	National Institute of Hydrology	Mr. A S Mehra	Personal Secy, Head GWHID	9897842897	amr.mehra25@gmail.com
✓ 29	PRASARI	Mr. Saikat Pal	Executive Director	9830807100	saikat2009@gmail.com
✓ 30	PRASARI	Mr. Gouranga Banerjee	Research Manager	9836029598	gouranga@prasari@gmail.com
✓ 31	PRASARI	Dr. Purnabha Dasgupta	Research Director	8777834291	purnabha@prasa@gmail.com
✓ 32	PRASARI	Mr. Sashanka Gayen	Para-hydrogeologist	8517978017	
✓ 33	PRASARI	Ms Kalpana Howly	Para-hydrogeologist	6295759763	
✓ 34	PRASARI	Ms Sujata Mondal	Para-hydrogeologist	7679091231	
✓ 35	PRASARI	Mr. Gautam Banerjee	Research Assistant	9064201804	
✓ 36	PRASARI	Mr Dulal Mondal	Research Assistant	8768042656	dulalmondal@gmail.com
✓ 37	PRASARI	Ms. Pratima Mondal	Para-hydrogeologist	7872746878	
✓ 38	PRASARI	Ms. Astami Mondal	Para-hydrogeologist	7584902903	
✓ 39	PRASARI	Ms. Alpina Mali	Para-hydrogeologist	7679002624	
✓ 40	WBADMIP	Mr. Sourabh Jyoti Gogoi	Training & communicating sp	9831772000	
✓ 41	PRASARI	Subrata Be - Damsakha - 943237007 - subrataprasari@gmail.com			
✓ 42	P & R D	Pradip Halder - 915 Coordinator - 8240381145 - pradip@pandp.gov.in			
✓ 43		Pranabishaha - 8777834291 - pranabishaha@gmail.com			
✓ 44	Govt	Govt. Mandal - Anur Mondal			
✓ 45		Pradip Halder - Pradip Halder			

4. Activity Structure

Activity started with welcome address, overview of programme and introduction by Dr. Gopal Krishan. Complete programme schedule is given in Fig. 3.

Workshop on "Understanding aquifer systems of Sunderban-special emphasis on ASR using saline aquifers to improve farmers livelihood" on December 09, 2019 at Salt Lake City, Kolkata

Organizers: NII-Roorkee, BGS-UK, Rajarhat Prasari-Kolkata
 Coordinator: Dr. Gopal Krishan, Scientist C, NII-Roorkee
 Coordinator: Dr. Parabha Das Gupta, Prasari

Date		December 09, 2019				Venue	Sonus Hotel Salt Lake City, Kolkata		
Address: Hotel Sonus, DN-26, Sector V, Salt Lake, Kolkata, West Bengal 700091									
Registration: 9.30 am to 10.00 am									
Sr no	Topic/Paints to be covered	Speaker & Organization	Moderator	Facilitators	Method	Time	Start Time	End Time	
1	Inauguration	Dr P K Mishra, Principal Secy, WRIDD, Mr. Kanakchok Saha Commissioner, MGNREGA, Mr. Sukrishna Bhattacharya J.S, P.A RD			Lighting of the lamp	10 mins	10am	10.10a m	
2	Overview of the programme and introduction	Dr. Gopal Krishan, NII			Presentati on	15mins	10.10a m	10.20a m	
3	Overview of WRIDD on irrigation	Dr P K Mishra		NA		15mins	10.20a m	10.35a m	
4	Water Resource Assessment in Sunderban	Prof. S. Hama, Jadavpur University				15mins	11.15a m	11.30a m	
5	The livelihood issues facing Sunderban farmers	Ms. Subarna Dutta, DSI-BT		Ms. Kanakchok Saha(Commissioner, MGNREGA), Dr. Subhasish Mondal, Mr. Sankar Pal, Ms. Sukrishna Bhattacharya	Panel Discussion	30mins	10.35a m	11.05a m	
6	Concept feasibility and modeling of the groundwater response	Co-PE. Dr. A. Mackenzie, BGS		NA	Presentati on	15min	11.30a m	11.45a m	
7	Groundwater conditions of West Bengal	Dr. Arindrajit Kar (RD CGWB)		NA	Presentati on	30min	11.45a m	12.15p m	
8	Panel Discussion on Crop Water	Dr. Parabha Das Gupta		Dr. Subhasish	Presentati on/panel	30min	12.15p m	12.45p m	
9	Influence of monsoon on freshwater availability in Sunderban under changing climatic condition	Prof.Lalu Das, BCKV		Dipanjana Mondal, Ms. Subarna Dutta	Presentati on	15min	12.45p m	1.00p m	
Lunch Break (1.00pm-1.45 pm)									
10	Groundwater issues of the Sunderban	NA	Dr. Gopal Krishan, NII Dr. Parabha Das Gupta	Parashyot Dasgupta, Mr. Govind Banerjee, Mr. Dilip Mondal, Dr. Arindrajit Kar, Ms. Sukrishna Bhattacharya	Panel Discussion	15min	1.45p m	2.00p m	
11	Artificial Recharge and Aquifer Storage and Recovery Introduction	Dr. Gopal Krishan, NII	Dr. Gopal Krishan, NII	NA	Presentati on	15min	2.00p m	2.15p m	
12	Soil conditions and water quality in Sunderban	Dr. Dhriten Barman, CSSRI	Ms Indrani Sarkar, Deputy Secy, P&RD	NA	Presentati on	15min	2.15p m	2.30p m	
13	Next steps – a pilot study proposal	Dr. Parabha Dasgupta, Prasari		NA	Presentati on	15min	2.30p m	2.45p m	
14	Interactions with the stakeholders and discussions	WB, P A RD	NA	NA	Panel discussion	15min	2.45p m	3.00p m	
Vote of thanks by Dr. Gopal Krishan, NII									

Figure 3: Programme schedule

After the overview of the programme, Mr. P.K. Mishra, emphasized on the issues of Sunderban, followed by panel discussion on topic "The livelihood issues facing Sunderban farmers" and the discussion was done as per the Table 2.

Table 2. Discussion format and questions asked for panel discussion no. 1

Sr no	Topic/ Points to be covered	Moderator (Name and Organization/ Department)	Panelists	Questions
1	The livelihood issues facing Sunderbans farmers	Dr Dipanjana Moulik, Scientist Dept. of Env. and Forest	1. Mr. Kaushick Saha (Commissioner, MGNREGA) 2. Mr Saikat Pal, 3. Ms. Suktishita Bhattacharya	1A. Sir, what in your opinion are the livelihood related issues of Indian Sunderbans and how your team is working together to tackle those issues? B. Impact of MGNREGA on creating livelihoods of the people in Indian Sunderbans? C. Future plan under MGNREGA to attain sustainable development goals for Indian Sunderbans? 2A. What problems farmers of Indian Sunderbans are facing right now? B. What strategies do you think can be taken to mitigate their problem? 3A. How do you think MGNREGA can contribute to mitigate those issues highlighted by Mr. Pal? B. How in your opinion Govt. Dept.(s) and civil society organizations can work together to create a common platform to ensure participatory development in the area?

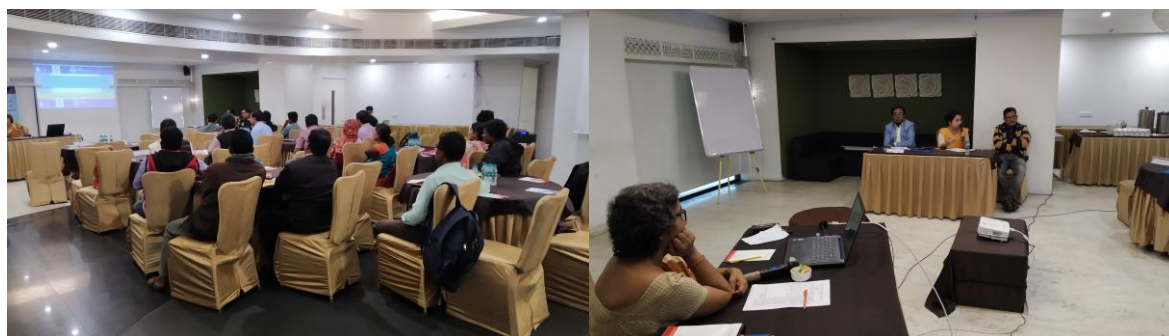


Figure 4 Panel discussion no. 1

After discussion, there were talks delivered by Prof. Lalu Das on “Influence of monsoon on freshwater availability in Sunderbans under changing climatic conditions”, Dr. K.K. Satapathy on “Agricultural scenerio of West Bengal” and Mr. A.J. Kar on “Groundwater conditions of West Bengal” Dr. D. Burman on “Soil conditions and water quality in Sunderban” Prof. S. Hazra on “Water Resource Assessment in Sunderbans”, Dr. Purnabha on future prospects and are shown in Fig. 5. and 6



Figure 5 Talks by invited speakers

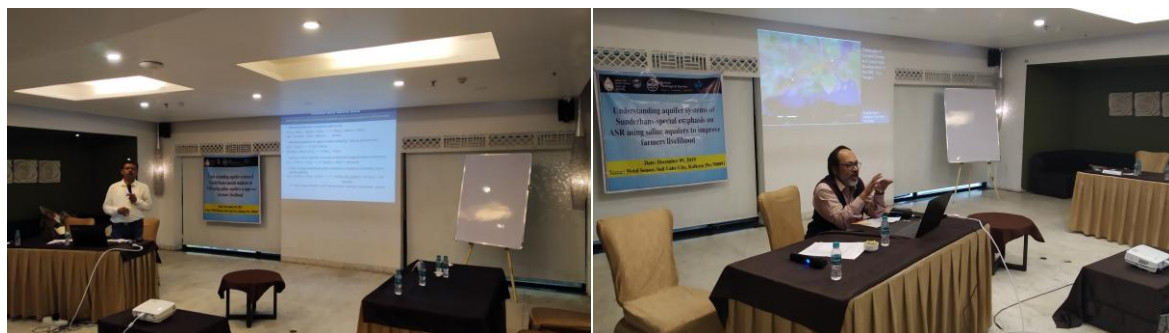


Figure 6 Talks by invited speakers

Table 3. Discussion format and questions asked for panel discussion no. 2

2	Crop Water Management in Saline Condition	Dr Gopal Krishan, NIH Dr. Punabha Das Gupta, Prasari	1. Dr Dhiman Burman, 2. Dr Lalu Das 3. Para-hydrogeologists, 4. Ms. Kalpana Maity, 5. Mr. Dulal Mondal, 6. Prof. S. Hara	1A. Sir, what are the possible options for crop water management for small farmers of Indian Sunderbans? B. Sir, what in your opinion are the possible solutions to increase per drop crop productivity in Sunderbans' context? 2A Sir, What measures CSSRI had taken so far to manage crop production under water stressed condition in Indian Sunderbans? B. What are the actions CSSRI had taken to manage crop production under submergence condition of Indian Sunderbans? 3A. How resource integration can impact small farmers of Indian Sunderbans in managing production under water stress or submergence condition? B. What in your opinion are the sustainable ways to manage water for crop production in Indian Sunderbans? 4A. How rainfall is impacting crop production in Indian Sunderbans? B. What measures farmers can take to tackle increased intensity of rainfall in the area?
3	Groundwater issues of Indian Sunderbans			1A. How ground water situation has changed over the years in your area? 2A. What are the immediate problems related to ground water and salinity in your region? 3A. What is the current situation of ground water in Indian Sunderbans? 4A. How ground water use has changed cropping system in the area?

Second and third panel discussions were held on crop water management and ground water issues respectively as Table 3.



Figure 7 Discussions during workshop

5. Activity Conclusions and Outputs

The workshop was very fruitful. Some useful tips were taken talks and deliberations by the researchers, academicians and policy makers and are given in the outcomes of the workshop.

5.1. Key themes/Points/outcomes arising

Main occupation is agriculture; cropping pattern paddy (Khanrif) and vegetables (Rabi); most of the times it is mon cropped; and some issues are:

Soil salinity:

Acid saline soils:

Water availability:

Climate Change threats:

It has been decided that it would be useful to to run a field experimentation of ASR in some of the selected islands based on the vulnerability criteria of the islands due to the less availability of water during lean or dry period starting from November to May each year. Since sweet water is available very deep then few well off farmers extract water from these aquifers whereas

small, marginal or medium farmers suffer badly or forcibly buy ground water from those well off farmers to cultivate in that period. This has also led to change in occupation from cropping to brackish water fish culture in their land.

5.2. Conclusions and next steps/recommendations from the activity

With the research output of the Pump Priming Project; National Institute of Hydrology, British Geological Survey and PRASARI designed the next phase of field experiment with the following objectives - i) Field testing of the model Aquifer Storage and Recovery (ASR) system in the saline aquifers of Indian Sunderbans, ii) Impact measurement of ASR in two different context through Ground water modelling, iii) Monitoring of the water quality parameters of the ASR water throughout the year, iv) Capacitating local cadres to facilitate water conservation in the islands of Indian Sunderbans and v) Dissemination of research outcome with the community and vi) Facilitating policy makers to use the research outcomes.

5.3. Stakeholders feedback (where applicable)

At the conclusion of the Activity, stakeholders from Sunderban were asked to provide comment on:

- the Workshop content; **very much useful and all appreciated**
- the meeting venue and organisation; **Venue was excellent and experienced it for the first time**
- networking opportunities; **Happy to see all working in Sunderbans at one platform**
- provide an overall score out of 10 for the workshop. **10**

6. Annexes

ANNEX A: Photographs



Registration



Felicitation of speakers and invited guests



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