Water Resource Management & Supply in Central India

Report of Grassroots Field Exposure Session February 2019

June 2020

INDIA-UK
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भारत-यूके
जल केन्द्र

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

भारत-ब्रिटेन जल कें द्र एमओईएस-एनईसीआरसी (यूके) जल सुरक्षा अनुसंधान के पूरक प्राथमिकताओ के बीच सहयोग और सहयोग को बढ़ावा देने के लिए करना है

Front cover image: Lift irrigation site of Indira Sagar Dam (Emma Bennett, IUKWC)

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Executive Summary

This report presents an overview of the joint India-UK scientific Grassroots Field Exposure Initiative held in Bhopal from 25th-27th February, 2019. The event was convened by the India-UK Water Centre co-coordinators Dr A.K. Sahai (Indian Institute of Tropical Meteorology, Pune, India) and Dr Harry Dixon (Centre for Ecology & Hydrology, Wallingford, UK). The initiative was organised by IUKWC Secretariat in collaboration Dr Pankaj Kumar (Indian Institute of Science Education and Research (IISER) Bhopal, India), Dr Alexandre Gagnon (Liverpool John Moores University, UK) and Dr Sumit Sinha (University of Leeds, UK). The event aimed to gain a closer perspective of the management of water at ground level, its associated issues and the use – and need for - scientific outputs by end users in central India. To tackle the multi-faceted and intertwined nature of the various water related issues in the region the focus of the event was sub-divided into three major sectors for easy and efficient analysis of regional water balance.

- Agriculture & water resource
- Domestic Energy & water resource
- Energy and Industrial water resource

The event was multi-sectoral with focus on water supply and resource management for Agriculture, domestic and energy sectors. This was the field based interactive approach to discuss and understand the grass-root level status quo by scientists from both India & UK. Scientist interacted with the end users and tried to understand their techniques and traditional knowledge and discussed about various socio-economic aspects of the local water user scenario.

Indian Institutions including the National Institute of Hydrology- Roorkee, Jamia Millia Islamia University- Delhi, Indian Institute of Science Education and Research Bhopal, Amity University-Jaipur, TERI School of Advanced Studies- New Delhi, Symbiosis International (Deemed University)-Pune, Indian Institute of Soil Sciences- Bhopal, Central Institute of Agriculture Engineering-Bhopal and Banaras Hindu University- Varanasi participated in the event. UK participants included experts from the Loughborough University, Centre for Ecology and Hydrology, University of the West of England, Liverpool John Moores University, Cranfield University, University of Plymouth, University of Dundee and University of Leeds.

Figure 1: GFES Group in the field visit to Parwaliya village

1. GFES Conveners and Activity Leads

The Grassroots Field Exposure Initiative (GFES) was convened by the India-UK Water Centre (IUKWC) and led by the Activity Leads:

Stakeholder Lead

Dr. Pankaj Kumar

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The GFES was held mainly at the Indian Institute of Science Education and Research (IISER), Bhopal and included visits to various field sites around the city, 25th – 27th February 2019.

2. GFES 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 GFES focused on the themes:

a. The translation and communication of India-UK water security science to end users, notably for policy design;

b. The collection of information on stakeholders' needs to inform future research directions and innovation;

c. The co-design and development of research projects.

The event aimed to address the key scientific needs of the water resource management and supply sector in Central India, from the point of view of the grassroots level. The region demonstrates a complex water nexus with high growth rates in the industrial, agricultural and energy sectors, as well as an increased demand for water. Moreover, the region has experienced continuous warming and a decline in precipitation (though not significant) in recent decades, further influencing the regional hydrological balance.

The development, including grassroots level innovations, of adaptation measures to respond to the spatiotemporal variations in the demand for - and supply of – water requires a more in depth examination of the various hydrological fluxes and states at diverse spatial scales. Furthermore, the implementation of adaptation measures to improve the management of water resources needs more accurate information about water availability during the monsoon and non-monsoon seasons for both surface and groundwater supplies as well as a better understanding of the regional water balance, including groundwater recharge, and runoff variability, amongst others. Every sector requires its demand for water to be met and the challenge for policy makers and governmental institutions is to meet this growing demand in a sustainable manner and without adversely impacting the environment in the face of diminishing supplies due to climate change. Hence, the GFES aimed to address the following issues:

- Role of energy, intensive paddy cultivation, chemical fertilisers/ in increased pressure on and heavy deterioration of ground and surface water quantity and quality in the region;
- The impact of increase in the exploitation and use of groundwater resources by different sectors, as seen by an increase in electric pumps, submersible and tube wells etc., on the regional water security;
- The impacts of extreme weather conditions, like droughts, short-term rain and flooding in fields on food production. The current initiative aims to improve our understanding of the hydrology and water management system in the region by engaging with water resource managers and the main users of water.

The event was planned to be a community as well as field-based approach, which involved visits to different sites and interactions with key stakeholders, including local communities. In this initiative the team of scientists aimed to gain a closer perspective of the management of water at ground level, its associated issues and the use – and need for - scientific outputs by end users.

The specific objectives of this GFES were:

- To gain a better understanding of the grassroots scale management, operations and use of water resources in the region;
- To understand the contribution of the Indira Sagar Dam to assuage water needs of the three sectors and understand the competing and interlinked nature of water demand between the food, water and energy sector;
- To examine how plausible scenarios of future climate and socioeconomic development will impact on the water resources supply and demand in Central India;

- To formulate research ideas for future joint India UK collaborative projects on the basis of end users' requirements

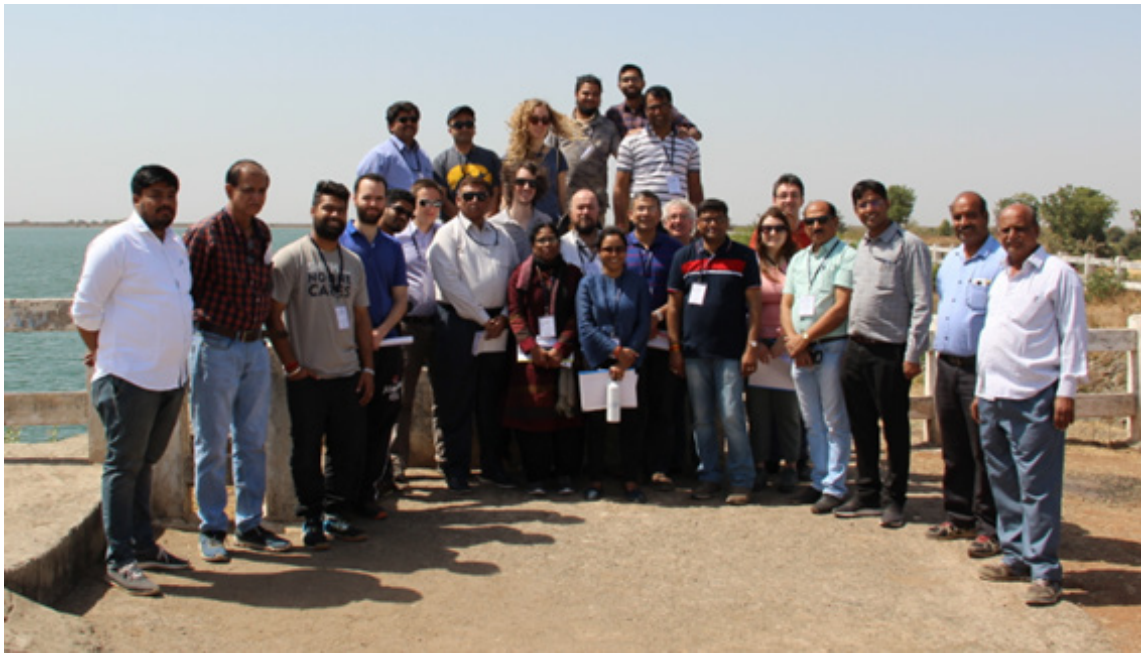

Figure 2: Field visit in lift irrigation site of Indira Sagar Dam

3. GFES Participants

An open call was held amongst the IUKWC Open Network Community and about 17 scientists from both the countries were shortlisted (9 Indian and 8 UK attended the GFES); a total of 26 participants including the activity leads and IUKWC secretariat participated in the event.

	Name	Institution
	UK	
1	Dr. Diganta Das	Loughborough University
2	Prof. Harry Dixon	Centre for Ecology and Hydrology
3	Dr. Mark Everard	University of the West of England
4	Dr. Alexandre Gagnon	Liverpool John Moores University
5	Dr. David Jenkins	University of Plymouth
6	Mr Nikolaos Mastrantonas	Centre for Ecology and Hydrology
7	Dr. Manoranjan Muthusamy	Cranfield University
8	Mr. Nathan Rickards	Centre for Ecology & Hydrology
9	Dr. Sophie Sherriff	University of Dundee
10	Dr. Sumit Sinha	University of Leeds
11	Miss Paula Arce Vicente	University of Exeter
	INDIA	
10	Prof. Dr. Shakeel Ahmed	Jamia Millia Islamia University

11	Dr. R.S Chaudhary	ICAR – Indian Institute of Soil Sciences, Bhopal
12	Dr. Vijaya Lakshmi Koneru	Development Alternatives Group
13	Dr. Pankaj Kumar	Indian Institute of Science Education and Research Bhopal
14	Dr. Akhilesh Mishra	Amity University
15	Dr. K.V.Ramana Rao	ICAR – Central Institute of Agricultural Engineering
16	Mr. Md Saquib Saharwardi	Indian Institute of Science Education and Research Bhopal
17	Dr. Dharmaveer Singh	Symbiosis International (Deemed University)
18	Miss Swati Singh	TERI School of Advanced Studies
19	Dr. T. Thomas	National Institute of Hydrology, Roorkee

4. GFES Structure

The GFES session was spread out over three days and involved discussions with various stakeholders on field, involved in the monitoring and management of water supply. The stakeholders represented 3 key sectors of water resource management in the region: Agriculture, Energy and domestic - industrial uses.

The event involved visits to three villages where three different projects are underway to improve land and water resources management through grass-roots initiatives with farmers. The group also visited the Indira Sagar Project, a multi-functional dam that provides irrigation to over 1200 km2 of land. Scientists met with the managers on the ground and visited the power generation and irrigation sites.

The specific sites visited during the GFES included:

Site 1: Parwalia - Indian Institute of Soil Sciences, Bhopal has adopted Parwalia Sadak Village for its technology dissemination on organic farming, vermicomposting, soil health card-based fertilizer application to crops and efficient methods of irrigation to crops.

Site 2: Sehore - An active site under the Rajiv Gandhi Watershed Management Mission (RGWMM), initiated in 1994, aims at improving the land and water resources in environmentally degraded villages. RGWMM has adopted direct people's participation as a core element of its strategy. The institutional arrangements, procedures and processes adopted for programme implementation are geared to a participatory bottom-up approach, in which communities exercise control over programme activities at each stage and government and non-government agencies play catalysing, facilitating and coordinating roles.

Site 3: Pandhana - The site is an example of working in Public Private Partnership mode delivered through a private company by creating a group of farmers interested in modern farming practices. The company took lead in preparation of DPR (detailed project report) in a cluster approach which was submitted to State Horticulture Department and Financial institutions for support. The farmers are trained at Government departments in these farming techniques. The farmers get day to day technical support and buy back of produce at market rate by the Company. Thus the farmers are benefited by adopting modern farming techniques but also get the knowledge of crop management and marketing strategies.

Site 4: Indira Sagar Project (ISP) Dam - Provides irrigation in 1,230 square km of land with annual production of 2.7 billion units in the districts of Khandwa and Khargone in Madhya Pradesh and power generation of 1,000 MW (8x125 MW) installed capacity. The reservoir of 12,200,000,000 m^3 was created; in terms of storage of water, it withholds the largest reservoir in India, with capacity of 12.22 billion cu m. (source: http://www.khandwa.nic.in/indirasagar.htm)

To facilitate discussions with the stakeholders, the scientific team shortlisted for the session was divided into three groups based on their expertise and research interests. Each group was asked to finalise on the theme of their group and took lead in discussions with stakeholders relevant to their group theme and aim to understand the current and potential uptake of scientific outputs at the ground level.

Some of these key questions considered were:

a. What is the nature and magnitude of the issues(s)?

b. What are the current monitoring and management measures in place to counter evolving and anticipated adverse scenario?

c. What data/tool and analysis can further improve the present state of the system?

d. What are the key research needs, format of the required results that could be of ready-use by policy makers and stakeholders?

A working group document was the key output from each group highlighting the groups discussions, key take backs and future needs.

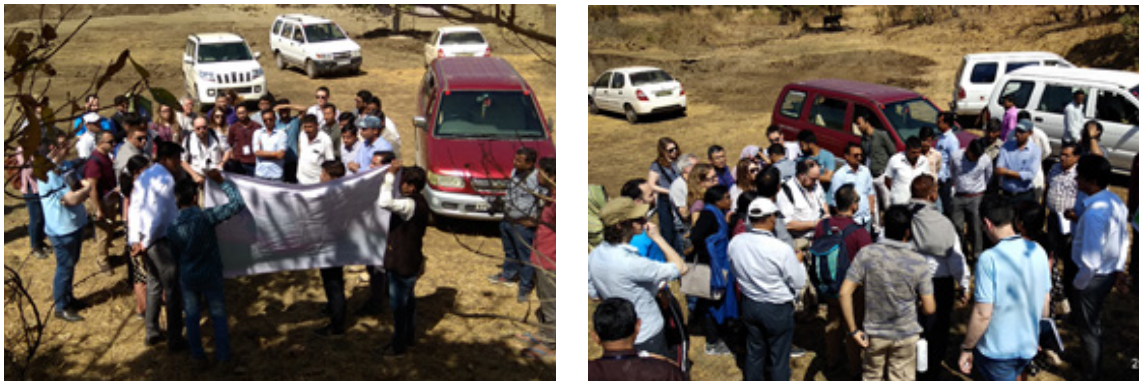

Figure 3: Demonstration and discussion at Sehore (Rajiv Gandhi watershed site)

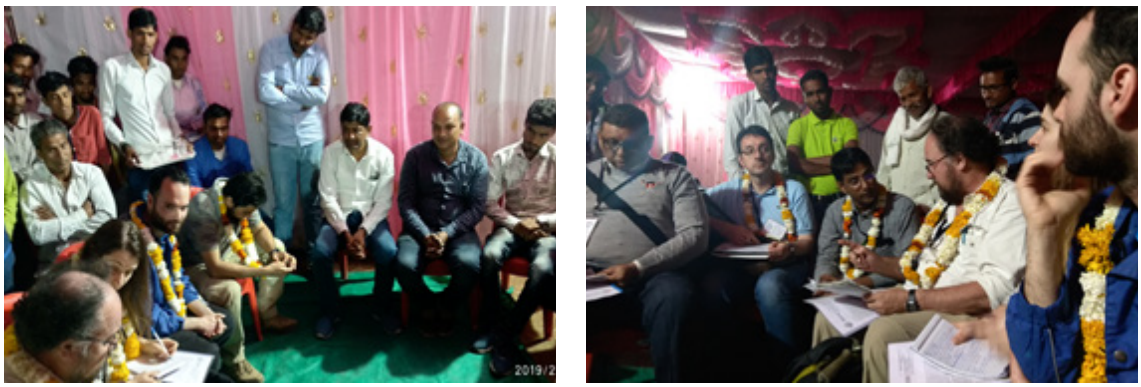

Figure 4: Discussion with farmers at Pandhana site

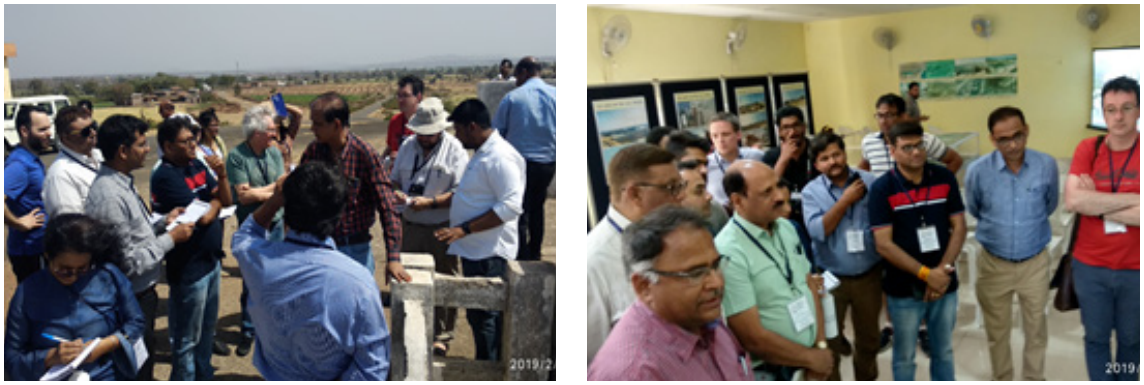

Figure 5: Demonstration and discussion at Indira Sagar dam Site

Figure 6: Last day group discussion and presentation at IISER Bhopal

5. GFES Conclusions and Outputs

5.1. Key themes/Points/outcomes arising

As mentioned GFES entailed visiting four different sites in MP covering both Ganga and Narmada river basins. The main aim of these visitations was to identify the challenges that are being currently faced by the basin stakeholders and to identify the role of scientific research in alleviating the identified problems. The key outcomes arising from different site-visits are listed here in a point wise fashion.

- Site 1: Parwalia village, Betwa basin, Bhopal - This site is dedicated to conservation agriculture. The Indian Institute of Soil Science (IISS) adopted Parwalia village in 2004 as a pilot project to promote the practice of sustainable organic farming. This involves the use of pressurised irrigation systems, such as sprinkler and drip, and a less intensive approach to crop cultivation. It is hoped that by shifting to such methodologies and by further reducing the use of chemical fertiliser and replacing it with vermi-composting the pollutants entering the natural environment and water courses will be diminished, positively impacting upon the water quality of Bhopal Lake, as well as improving soil health/soil organic carbon content in the surrounding watersheds. However, switching from traditional agricultural practice to organic farming is time consuming and the biggest impediment is the low yield in the initial years. Given, this the farmers with small land holding might be reluctant to make the switch.
- Site 2: Indian Tobacco Company (ITC) partnership, Sehore, Betwa basin - This site is dedicated to watershed management. Water quality and soil erosion are considered to

be the key issues at this site. As a result, this large area of scrubland has seen a number of water infrastructure modifications. These activities are fully funded by the government, and form part of the integrated watershed management program phase 7 (IWMP7), targeting upstream reaches. One of the aims of the project is the conservation and efficient use of water. Approximately 700 ha of waste land has been converted to arable as a result of the use of water collecting in the farm ponds. The scheme has reportedly been successful in preventing sediment erosion from the watershed, as monitored by 3 sediment traps towards the downstream area of the watershed. Details were given of over 3300 ha being protected from erosion. It is however unclear as to how this is measured from a watershed of 20k ha.

- Site 3: Pandhana village, Narmada basin - This site explained the latest technological intervention in horticulture farming. The project aims to give farmers, controlled conditions for horticultural crop production. When the weather/climate is not suitable for plant growth, this scheme gives farmers a lead time of up to two months over other growers. A cluster approach is adopted where plants are grown in polyhouses, aka sidenets, subsidised by the state government. This scheme is currently being run in 4 states across India, all managed by the private company NEER. Farmers are educated in different growing methods/technologies, and have a guaranteed buyer for their produce. However, farmers complained that the selling price was not guaranteed and is influenced by the changing market conditions, contrary to information given by the NEER representative.
- Site 4: Indira Sagar Project (ISP), Narmada basin - This site visit focused on water distribution and water management. The ISP dam is a multi-purpose project in the Narmada basin, first commissioned in 2004. It is the largest gravity dam in the basin, and has a hydro-electric capacity of 1000 MW generated by 8 x 125 MW turbines, supplying domestic, agricultural and industrial sectors with both water and electricity. It has a capacity of 12.22 BM3 from a catchment area of 61 642 km2, and a canal network stretching over 248 km. The dam has a command area of 123000 ha supplying 564 villages, and is also used for flood prevention and high flow moderation for its downstream area. ISP is classed as the mother dam for 3 downstream projects. In its absence, the Sardar Sarovar (SSP) project would have lost 17.8% of its water yield. The system seems to be working in the desired and intended fashion, however, some research is required for examining the long-term sustainability of the system.

5.2. Conclusions and next steps/recommendations from the activity

The GFES activity conducted has covered multiple sites and has covered issues related to water supply that is of consequence for agricultural production and energy generation. From the research point of view, it is recommended, that an integrated approach that combines monitoring and modelling should be adopted to examine the long-term sustainability of various interventions and practices that has been put in place. For example, it is very much worth investigating the long-term viability of the hydro power project associated with ISP in face of changing climate. This will warrant hydrological modelling of the watershed that would examine the impact of future climate on the streamflow that is of consequence for power generation. Furthermore, a validated hydrological model could then also be used for simulating water quality and sediment transport issues that is critical for the catchment under consideration.

5.3. Participant feedback

At the conclusion of the Activity a feedback form was circulated to participants who were asked to provide comment on:

- The content of the event;
- The meeting venues and organisation;
- Networking opportunities; and
- Provide an overall score out of 10 for the workshop.

A total of fifteen respondents rated the activity an 8.8 out of 10, highlighting the ability to understand ground level impacts of scientific interventions; especially the opportunity to be exposed to and interact with people working in public, private and government partnerships for ground level interventions as key positive. The participants appreciated the best practices oriented nature of the visits however, they also expressed a need to visualise issues which are still unresolved and representative of the water problems of the region. The respondents all appreciated the level of organisation and the quality and location of the venues, despite the remote locations and the challenges therein. Some of the areas that should be considered for improvement Management of travel times, which were considered too long and impinging upon the quality of engagement

"Stakeholder interactions were very useful, along with the field visits; opportunities to learn and discuss with those on the ground. Also found the discussion session on final day very useful for processing the previous 2 days"

Participant feedback quote

6. Annexes

Annex A: Agenda

Day 0 – Sunday 24th February 2019

Time	Agenda item
18.30	Briefing session followed by Dinner at IISER, Bhopal

Day 1 – Monday 25th February 2019

Time	Agenda item
07.00	Depart from IISER
08.00 - 21.00	Field Site visits Site 1 : Parwalia Village Site 2: Sehore Village Site 3: Pandhana Village
22.00	Check into hotels and guesthouses

Day 2 – Tuesday 26th February 2019

Time	Agenda item
08:00	Checkout and depart for field sites
10.30 - 12.30	Irrigation and canals systems associated with the ISP
12.30 - 13.30	Lunch
13.30 - 17.30	Dam Power generation operations
17.30 - 18.00	Tea
18:00	Depart for IISER, Bhopal

Day 3 – Wednesday 27th February 2019

Time	Agenda item
09.30 - 12.30	Working Group Discussions
12.30 - 13.15	Lunch
13.15 - 15.00	Plenary presentations, conclusion and wrap up
	End of GFES

Back cover image: Lift irrigation site of Indira Sagar Dam (Emma Bennett, IUKWC)

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