SHIV NADAR UNIVERSITY – IDRC FINAL TECHNICAL REPORT

IDRC Grant No. - 108687-001

Abstract

The project developed a unique and sustainable water science and policy program to create a cadre and network of professionals in India with a contextualized, multi – disciplinary understanding of water. In specific, it achieved its objective by training M.Sc., Diploma, Certificate students, including regular, mid-career professionals; created opportunity to conduct student – led research on water and through extensive faculty research, publications, network and bringing on-board experts the project attempted to influence policy thinking and practices

Deepa Hazrati, Program Lead, Water Science and Policy,
Shiv Nadar University
Deepa.hazrat@snu.edu.in

Table of Content

Project Title

M.Sc. in Water Science and Policy, Shiv Nadar University, and Allied Activities

IDRC Grant Number

108687-001

By

Deepa Hazrati, Program Lead, Water Science and Policy, Shiv Nadar University

Report Type

Final Technical Report

Date of submission

May 30, 2022

Country

India

Name of Research Institution

Shiv Nadar University

Address of Research Institution

P.O. Shiv Nadar University, Greater Noida.
Gautam Buddha Nagar, UP, India.
Pin code: 201314

Name of the Project leader

Prof. Ajay Dandekar

Executive Summary

Shiv Nadar University received a Grant of 550 000 CAD from IDRC in August 2018 to carry out the Project, titled, *Shiv Nadar University – Program on Water Science and Policy*. The overall objective of the project was to develop a sustainable water science and policy program to create a cadre and network of professionals in India with a contextualized, multi – disciplinary understanding of water.

The specific objectives of the Project were to

- To train M.Sc. Diploma, Certificate students, including regular, mid-career professionals
- Conduct student – led research on water
- Influence policy thinking and practices.

The Project was envisaged in face of a multi-dimensional water crisis in India, an urgency that reflected in the grant proposal emphasising, if the current pattern of demand continues, about half of the demand for water will be unmet by 2030.

This is the final report of the Project that reflects its journey of three years. It highlights the achievements and impact of the project, reflecting on its success, limitations posed on the project due to the long pandemic period and the resilience with which the Water Science and Policy (WSP) team pulled the project together and made it a success. The successfully trained M.Sc. and Certificate students have shown exemplary performance in jobs, research and both national and international conferences. Students have led research independently, in collaboration with faculty as well as in field during their field training and research dissertation. Their initial success in this very short time can be mapped to their successful publications and participation in international conferences. The project was able to have an impact and contribute significantly to influence policy thinking and practices. Some examples, such as, a National Conference on a New Policy Regime for Water in India in 2018, was conducted and attended by leading thinkers, researchers, policy makers and experts working on water related issues and initiatives. An important team member of the WSP project chaired Task Group to draft the Karnataka State Water Policy for the Government of Karnataka (Final Report submitted May 2019). The Advisor and Distinguished Professor on WSP program was appointed by the Government of India as the Chairman of the Committee to draft new National Water Policy in November 2019. Another faculty member was appointed as member of expert group for formulation of water strategy for Government of Madhya Pradesh. In 2022, a faculty member was invited to chair two sessions at the UNESCO International conference on Groundwater, and deliver a keynote address in May 2022.

In the same year, another faculty member was invited to the International Geological Congress Keynote Speakers on World Water Day (22nd March 2022) at the 36th International Geological Congress.

Overall, the project completed on track as per the grant proposal. Given the pandemic and post pandemic scenario the project objectives did experience a stretch in some of its activity plan but the WSP team was able to pull it together as far as possible. And the project concluded on a successful note.

Synthesis

As the crisis deepens by the day, the old 20th century solutions appear to be distinctly running out of steam. Hence, understanding this requires addressing the new challenges through a lens of paradigm shift in the country's water programs and policies.

The significance of the project lies in the fact that it makes an attempt to address the concern of the lack of qualified professionals who are required if we are to manage the significant challenges of urgently reforming India's water sector. The design of the of the two-year multi-disciplinary post-graduate M.Sc. program on Water Science and Policy (WSP) addresses some of these lacunae by incorporating the essential multi-disciplinary character of water. The *water professionals* are being trained to look at the entire crises from a different lens.

The curriculum structure involves understanding modules across disciplines taught by academics and professionals who have worked on ground realities and enables change in policies. The teaching program has been supplemented by a rigorous research program (another important aspect of the program, wherein SNU faculty as well conduct research into the most pressing problems in the areas of water science and policy.

In summary, the project as stated in the grant proposal continues to, through its varied activities address the **main objective** of creating a critical mass and network of water professionals, coming from diverse backgrounds and locales, and imbuing them with a contextualized, multi-disciplinary understanding of water, which enables them to guide the development of sustainable and just 21st century policies, programs and solutions to growing water crises.

One will need to mention the pandemic scene that could not get ignored during the Project timeline, and hence did pose hurdles especially with regard to the in-field experience and faculty traveling across the country to teach. However, the online mode of teaching to a large extent got well integrated with no compromise on the quality of teaching. To address the field training issue, the project received an approval on 10 month no-cost extension that enabled successful completion of in-field training which was one of the crucial components of the degree program.

As the project timeline progressed, the project activities were largely to address the three broad objectives as noted in the grant proposal.

1) Imparting Training in Water Science and Policy
2) Foster Capacity Building in Research on Water
3) Influencing Policy Thinking and Practice

The Research Problem

The Indian subcontinent, in spite of its rich natural endowments, seems to face a multidimensional water crises. At heart is not only an extremely variable and fickle monsoon (the main water lifeline) but a rising human demand. It's also well understood that India's water challenges are not entirely natural. Besides the mix of an irregular precipitation and population, it is also becoming apparent that much has to be fixed in terms of management and evolving credible water policies.

In effect, if left to drift it is quite probable that the crises of water demand, in particular, will be unmet by 2030. The impact of climate change, moreover, is posing unprecedented pressures problems alongside rapid urbanization and industrialization. Put differently, water conflicts over distribution of and use of water across sectors is fast emerging as another strong likely scenario. There is, in fact, an emerging sense that the old 20th century solutions appear to be running out of steam and compelling many water managers in India to think out of the box and evolve fresh understanding for meeting and containing the challenges. What can be the new responses and thinking to address scarcity, on the one

hand, and respond to the physical, social, cultural, technical and power relations that underlie the crises?

India's water strategy, thus far, has been largely focused on investments in infrastructure. While undoubtedly building one's way out of a crises through concrete and steel appears compelling, the lack of an ecological understanding of water is now becoming almost obvious. Addressing water, in other words, as an ecological relation rather than as merely an infrastructural challenge requires the drastic re-tooling of governance and policy frameworks.

And central to this paradigm shift in policies and knowledge about water systems will also be the ability to develop new perspectives through water education courses that factor in governance reforms, institutional innovations and management. In fact, it can be argued that

India's growth in medium and long term water requirements will depend critically on how quickly the water sector can be reformed by moving away from a simple engineering – centred and supply side approach to that of a conservation, ecological, sustainability and people- centred approach. In recent times, there has in fact been a strong pitch to improve the quality of water education in India in order to address reforms in the water sector.

The grant project is an attempt to address some of these lacunas. Two–year multi–disciplinary, post graduate M.Sc. program on Water Science and Policy (WSP), is an attempt to put together these diversified nature of water and understand it from varied perspectives of local institutions, knowledge systems, and historical, social, cultural institutional practices. The program is a unique attempt because few teaching programs across the country are able to incorporate the essential multi- dimensional character of water. The Water Science and Policy program aims to be the first- of-its-kinds program, globally, and create a critical mass of water professionals with a historically, and socially contextualized, multi-disciplinary perspective and understanding of water, which enables them, to guide development of sustainable and just policies, programs and solutions to address the growing water crises. The teaching program is supplemented by a rigorous research program, wherein SNU faculty conduct research into the most pressing problems in the areas of water science and policy besides other allied activities as noted in the report.

Project Progress towards Milestones

The Project progress and timeline are on track as per the grant proposal. Due to the pandemic situation, the project did receive an approval of 10 months no-cost extension. To a large extent some of the deliverables got possible as things opened up to carry out research and training and travel for the same. At the same time, some deliverables unfortunately got hit in this period because the team was unable to carry out activities freely in the lockdown. One such example is the alumni meet that we wished to hold. But getting together everyone at that scale became challenging after the pandemic.

The results, and success stories are included in length in the report.

Synthesis of research results and development outcomes

The project has achieved prominence and has an impact story to build on. The project is envisioned to continue to have significant output through faculty publications, capacity building, network expansion and policy impact Another key element of the project journey is the student achievement through successful selection in conferences, jobs and their publications by both the current batch and the graduated batch of students.

Towards, the end of the project, one can confidently say, that the project achieved results as per the original grant proposal. To mention a few – Student admissions in M.Sc. program, Certificate trainings, student field training, internships, research, student capacity building, faculty research, continuous outreach through publications, student participation in various domestic and international conferences and workshops, faculty participation in conferences, public talks on topics around the theme of the project.

Having said that, the pandemic phase did pose hurdles in achieving some of the results as they were anticipated. But the Water Science and Policy team did their best under the guidance and support of IDRC Team.

Project implementation and management

Students

Train M.Sc. Diploma, Certificate students, including regular, mid-career professionals

The program on Water Science and Policy has enrolled to-date 5 batches of full time M.Sc. students (with a total of 25 students) in Water Science and Policy. The first batch had two students (who were enrolled before the grant came into being) and they graduated in May 2019. The second and third year WSP program had six students each graduating in 2020 and 2021 respectively. The fourth batch had 10 students who graduated in May 2022 after completing their last semester of in-field training. The fifth and the current batch has one student who will graduate in 2023. The project also trained a total of 77 students in a one-month certificate program in a specific module. Some of these students were technical officers from Government agencies while some were from small Non-profit organizations. An encouraging feedback as to how these students have gone back to the field with a new perspective of water and the newer dimensions from which they are able to view the problem. Some of these certificate students have really appreciated the content and learnings from the faculty that they have come back to take multiple certifications and also encouraged the colleagues from their organization

The project has progressed largely as per the proposed project objective and activity timeline in the grant proposal. There have NOT been any significant deviations from either the project objectives or methodology. The financial and technical reports were submitted within timeline and accepted by IDRC during the time of the project. Due to the pandemic situation, the project received a no extra cost extension of ten months. And this is the final technical report on the project.

Broad list of activities supported under the project

1. *Student admissions to the two-year M.Sc. Program in Water Science and Policy.*
2. *Student Scholarship and Field Training Support.*

3. *The University identifies host organizations for the third semester student field training and student are successfully completing their training in four organizations as a part of third semester.*
4. *Identify organizations through faculty network and opportunity for M.Sc. students for summer internship.*
5. *Student participated in various workshops, domestic and international conferences and field trips.*
6. *Visiting faculty delivered lectures and guidance to students in online mode.*
7. *Public lectures were organized.*
8. *Faculty research projects both - individual and group. The grant supported faculty travel, accommodation and logistics.*
9. *To enable all above activities, the project relies on smooth and prompt administration. MoUs with organizations are signed, formal letters of scholarship to the students are issued from the*

10. *Foundation, and formal letters of engagement are issued to the faculty from the Foundation besides others.*
11. *Enabling an important step towards Policy impact.*

Conduct Student – led Research on Water

Following are the Project outputs and dissemination in the form of activities as reflective of stated objectives in the grant proposal. The activities through research, publications, participation etc. fall within the broad categories of - training; capacity building; information dissemination etc.

Some Key success stories are highlighted below:

1. Following are some student experiences, which they have shared to elaborate what and how they understand Water? What it meant to be a part of the program on Water Science and Policy.
   - **Laxmi Sharma**, https://www.youtube.com/watch?v=MntBcSqqNic
   - **Sahil Mathew** - https://www.youtube.com/watch?v=hAfP869oeFo
   - **Nidhi Sehrawat** - https://www.youtube.com/watch?v=b0puo6lZUL4
   - **Anirudh Kishore** - https://www.youtube.com/watch?v=gFyKqrgJQLM

2. **Purvi Thangaraj**, a Water Science and Policy alumnus is working as a Research Assistant at the Indian Council for Research on International Economic Relations (ICRIER), New Delhi, in the Natural Resource/Environment sub-vertical in the Agricultural Policy, Sustainability, and Innovation (APSI) team. She is working on the assessment of sustainability, productivity, and profitability aspects of agriculture specifically from the three resources of land, water, and air.

   She recently contributed to three articles (these articles are shared as separate attachments for your reference):

   - ❖ Green investment for sustainable agriculture: A missed opportunity?
   - ❖ Reviving Punjab's groundwater and agriculture
   - ❖ Making Indian agriculture less GHG emitting

3. **Shreenivas Kd**, a Water Science and Policy alumnus is working in Nature positive farming and wholesome foods foundation, Bengaluru as program officer on consumer promotion.

4. The university in collaboration with the four organizations, enabled to make the field training semester for the students a success.

   All M.Sc. students were able to complete a successful semester, field training in four host Organizations. Following are the Organizations:

Organization	In charge	Module
Samaj Pragati Sahyog, MP	**PS Vijayshankar**	**Watershed Management (and Sustainable Agriculture**
Gram Vikas, Odisha	**Liby T Johnson**	**Rural Drinking Water and Sanitation**
ACWADAM, Pune	**Himanshu Kulkarni**	**Sustainable Groundwater Management**
Development Support Centre, Ahmedabad	**Mohan Ji, Sachin Oza**	**Participatory Irrigation Management**

5. All M.Sc. Students successfully completed their dissertation. The list of students and their dissertation topics is listed in Annexure 1.

6. Manikanta P. Radhakrishna, graduated in May 2022 presented his research thesis work at International Water Resources Association's 17th World Water Congress at Daegu City of the Republic of Korea, November 29 - Dec 3, 2021. Title of his paper was, 'Managing Water Scarcity: Integration of Supply- and Demand-side Options in Kaveri River Basin'.

A brief from the student:

I had an opportunity to present my research thesis work at International Water Resources Association's 17th World Water Congress. The event took place in Daegu City of the Republic of Korea from Nov 29 - Dec 3, 2021. The congress was jointly organized with partnerships from the Ministry of Environment of the Republic of Korea, K-water, Korea Water Resources Association, and the Daegu Metropolitan City.

The central theme of the congress was *Foundations for Global Water Security and Resilience: Knowledge, Technology and Policy*. My paper titled **Managing Water Scarcity: Integration of Supply- and Demand-side Options in Kaveri River Basin** was presented under the sub-theme *Building resilient systems for climate change, growing populations, and epidemics.*

The paper co-authored with Mr. Vijayshankar (faculty on WSP) brings an integrated understanding of the complex relationship between catchment, command area and climate. The main objective was to understand the level of precarity and inequity existing in the canal command areas. In addition to the extensive 145 farmers' interviews, inferences were drawn from the rainfall data, dam level and canal withdrawal data. I also made use of the Soil & Water Assessment Tool (SWAT) and the blue water footprint of principle crops. Both of which provide input into the localization of water resources from the demand and supply side.

The comments from eminent scholar Prof. Christopher A. Scott, on attending my presentation, provided me with strong input on improving my thesis. The interactions with scholars and researchers during the congress were invaluable. The congress ended with a declaration to focus on five critical topics for achieving global water resilience and security. The two most that I would like to associate in the coming future are Disseminating nature-based solutions and second supporting solutions for sustainable agriculture which are respectful of soil health and understanding its independence with water.

The hospitality of the Korean people was immense, warm, and kind. This made my stay in South Korea a beautiful experience to learn and experience their culture and tradition.
I thank both my supervisors Dr. Sharad Lele and Prof.Vijayshankar for supporting my work, without whom I wouldn't have been able to present at the congress.

7. **Manikanta P. Radhakrishna, graduated in May 2022** got selected for a poster presentation at an international conference, titled **Groundwater as a key to the Sustainable Development Goals, held in** Paris Sorbonne-University, France on May 18-20, 2022.

A brief from the student:

I have been selected for a poster presentation for an international conference titled **Groundwater as a key to the Sustainable Development Goals** was held in Paris Sorbonne-University, France, May 18-20, 2022. (http://gw-sdg2022.fr/index.php/en/). The conference was organized by the French Hydrogeology Chapter (CFH) of the International Association of Hydrogeologists (IAH) with the patronage of the French National Commission for UNESCO. The other supporting organizers are the Intergovernmental Hydrological Programme of the United Nations Educational, Scientific and Cultural Organization (UNESCO-IHP) and Sorbonne University

The ongoing research paper is in collaboration with Mr. Vijayshankar and Dr. Devika CM. The paper employs the concept of social and solidarity economy (SSE) to examine the promising designs of cooperative and community-based groundwater management in India. SSE moves beyond the neo-classical focus on measurable impacts on income and pays attention to social mobilization, redistribution justice, and environmental conservation that foster core SDG principles of intergenerational and intra-generational equity in water governance.
I was fortunate to have visited some of these community-based entities managing groundwater during my field module at Samaj Pragati Sahayog (SPS) in Madhya Pradesh.

I thank the faculty of the Center for Public Affairs and Critical Theory (C-PACT) for shaping my knowledge, guiding me, and supporting me in both the conferences.

A brief of the paper is as follows:

Moving Towards SDGs: A Social and Solidarity Economy Perspective of Water Governance in India

Radhakrishna M. (1), Devika C.M. (2), Vijayshankar P. S. (3)
(1) Shiv Nadar University, mr895@snu.edu.in
(2) Institute for Social and Economic Change, devika@isec.ac.in
(3) Samaj Pragati Sahayog (SPS), Shiv Nadar University, p.vijayshankar@snu.edu.in

India's policy focus on food security and economic prosperity hinged crucially on the spread of irrigation. Irrigation expansion involved an accelerated and indiscriminate use of irrigation wells (shallow dug wells and tube wells), with groundwater accounting for over 85 per cent of the country's area expansion since the 1970s. Groundwater development followed a trajectory of what is considered "anarchist" and "atomistic" in its access and governance. The conventional governance paradigms failed to take into

account the integrity and nature of aquifers as ecosystems and the need to govern them as commons. Hence, new frameworks for groundwater management and governance are required.

This paper employs the concept of social and solidarity economy (SSE) to examine the promising designs of cooperative and community-based groundwater management in India. SSE moves beyond the neo-classical focus on measurable impacts on income and pays attention to social mobilization, redistribution justice, environmental conservation that foster core SDG principles of intergenerational and intra-generational equity in water governance. The Arwari Water Parliament and Pani Panchayats among others are cases that have worked on a sound understanding of the commons. Decoupling water and land rights, restrictive crop irrigation and community councils are indicative solutions that have emerged from these practices. Although they are context-specific and defined by water resource typology and the dynamic socio-economic contexts, these experiences represent a scale-appropriate attempts at management given the decentralized nature of aquifers. The prevalence of such bottom-up approaches of governance demonstrates how social solidarity economy can facilitate the delivery of Sustainable Development Goals (SDGs). Particularly, parameters that reflect the broad water governance principles of Effectiveness, Efficiency, Trust and Engagement, crucial for protecting aquifers (SDG 6.6) through community participation (SDG 6. B) that were only marginally addressed by Millennium Development Goals.

Our paper argues that the adoption of SSE parameters is indispensable as India incorporates the notion of water trusteeship in its National Water Policy, which marks a paradigm shift in water accountability towards a future built on the edifice of strong polycentric environmental governance institutions.

8. Centre for Public Affairs and Critical Theory (C-PACT) ***Water Bulletin***[1] newsletter was initiated to circulate water related news on international and national scale, stories, articles including upcoming conferences, scholarships etc. This is largely an effort of class of Water Science and Policy. The first, newsletter was circulated within the university in Feb 2019. And subsequently, five issues were released.

9. **Greater Noida – Carnival** on Science and Technology was organized by Greater Noida Industrial Development (GNID) authority. The batch of 2019 of WSP participated by putting up a stall and actively shared information about the program on Water Science and Policy that was highly appreciated. The carnival was held during January 25-28, 2019 and was open to University/ college/ school students, people and farmers from villages in the vicinity.

[1] All issues of Water Bulletin are compiled in the annexure

10. Three M.Sc. students **participated and presented posters at the National Conclave** - Academic Engagement on Decentralized Sanitation, organized by NIUA and CEPT in Ahmedabad, March 8-10, 2019. One student J. Catherine was awarded best poster while Bhavani Seenivasan and Shruti Singh from second year presented posters.

11. Two M.Sc. students J. Catherine and Tenzing Saldon **presented a full paper in the Workshop** on "Environmental Justice, Ecological Economics and Water Infrastructure in Northeast India: Hydropower and Waterways" in Guwahati, March 2-4, 2019.

12. Canals of Alleppey referred to as **CANALPY, a two-week program, was conducted by IIT Bombay and Kerala Institute of Local Administration (KILA).** This was a platform that invited water professionals from all sectors to work towards a common goal, i.e. saving the lives of the dying canals. The program used modern survey techniques along with smart tools to monitor the quality and assess the conditions of the canals. The program was held during December 16-23, 2018 and was attended by five students of the current second year batch of WSP.

13. Several local field trip (Billakbar pur and Chithera) were conducted (August - October, 2019) to collect water samples to capture the seasonal variation of algal assemblages. This is a very interesting student project to document the Biodiversity of Chithera. Some of these visits with pictures have been covered in the Water Bulletin newsletter. The WSP M.Sc. students (2019-21) also took a day trip to visit the wetlands in Surajpur, Dadri, and Ramghar etc in October 2019.

14. Students attended lecture by Prof. Douglas Hill (WSP visiting faculty) on Himalayan River Basins on August 26, 2019 at IIC.

15. An Open lecture by Prof. Mahesh Rangarajan, "Beyond making spaces for Nature", on October 24, 2019.

16. Environmental Justice Movements in India and the world - The EJAtlas organized by Shiv Nadar University and Universitat Autonoma de Barcelona on November 13, 2019.

Faculty

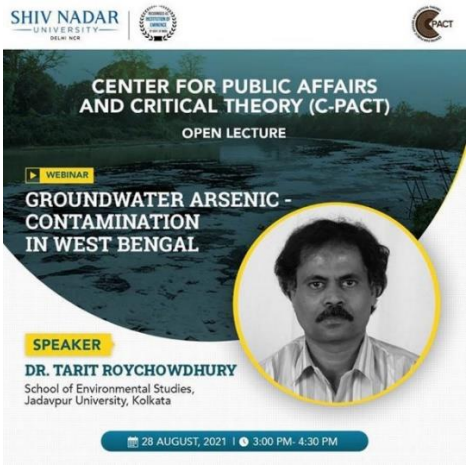
The faculty on board of Water Science and Policy has played a significant role in making this project a success. From actively conducting and participates in seminars, to deliver talks, take class lectures, supervise and mentor student work to conduct research - Research being one of the important component of this project as noted in the grant proposal.

To bring an exciting input to this program, an on-going lecture series was conducted. It brought on board experts in the field and comprised of interesting set of lectures and experiences from experts. This enabled students to gain greater exposure beyond the classrooms, at the same time helped in extending network for both students and faculty. This has been a great learning experience for students.
Following section is divided into some of the key features that were a part of the project. Namely, **guest lecture series; research highlights; key publications followed by Impact stories.** A detailed publication list is attached as an annexure.

Guest Lecture Series

1. C-PACT Talk on 'Groundwater Arsenic-Contamination in West Bengal

A talk on **Groundwater arsenic-contamination in West Bengal, India with special reference to its status, magnitude, distribution, health effects, food chain contamination, and remedial measurements** was held on August 28, 2021 @ 3 Pm.
The talk was delivered by **Dr. Tarit Roychowdhury**, School of Environmental Studies, Jadavpur University, Kolkata.



Abstract

Natural groundwater arsenic contamination and the resulting toxic effects have become one of the staggering challenges to human health in modern times, with large parts of the Ganga-Meghna-Brahmaputra plain of India with an area of 569,749 km2 and population over 500 million has been exposed to this devastating calamity. The calamity in these places, particularly in Bengal delta, with over 100 million people living in zones has assumed gargantuan proportions as arsenic levels in drinking water has overshot far above the guidelines set by World Health Organization at 10 µg/L. Arsenic concentration in groundwater initially increases up to a certain depth (approximately 40 m below ground level), then decreases with increase of depth. Moreover, arsenic concentrations in many tube wells had been increased 5-20 folds within a span of 3-7 years. The presence of deep tube well in the rural areas has somewhat ensured the arsenic-contamination problem in groundwater, but it varies on hydro-geographical conditions. Furthermore, what is worrisome is that arsenic-contaminated groundwater is increasingly being used to irrigate the fields. Thus, arsenic has begun to seep into crops and food chain which could trigger a large scale environmental tragedy, fatally affecting future generations. Arsenic is a naturally occurring element and arsenic levels in foods generally reflect its natural accumulation from the environment. It is very common knowledge that the arsenic-contaminated groundwater, which is mainly used for drinking, is a major route of arsenic exposure but when the same water is being used for agricultural purposes, mainly for the 'boro' cultivation of paddy, the problem of arsenic accumulation aggravates. Arsenic accumulation in paddy plants at different phases of pre-monsoon cultivation has been further extensively studied. Arsenic is translocated from root to aerial parts in descending order. Leaf, stem, root, root soil and surface soil showed a similar trend in their change of

arsenic concentration throughout the cultivation period. Arsenic concentration was highest in vegetative phase; sharply declined in reproductive phase; followed by moderate increase in ripening phase. Thus, soil arsenic concentration increases in the final phase of cultivation which in turn contributes to increased concentration in plant parts. However, during monsoonal cultivation, the synergistic effect of groundwater and rainwater makes a diffused approach to the nature of arsenic flow in plants, which provides least arsenic enriched grain irrespective of the variety of cultivar and area of cultivation, compared to the pre-monsoonal grain and much safer for consumption with respect to arsenic. Mitigation technologies need to be addressed for reduction of arsenic in soil-plant system to restrict its entry in rice grain. Use of synthesized nanoparticle(s) like Fe-and Si-nanoparticles and other agrochemicals (organic and minerals) in soil can be experimented to reduce the arsenic flow from root to shoot and investigate the effect on antioxidant activities under arsenic stress condition in paddy and other vegetable plants. Hydro-priming of rice seed with potassium humate for germination enhancement, seedling growth promotion and better antioxidant defense system under arsenic stress can be investigated. The overall goal is to address the problem of arsenic contamination in food chain, especially the rice grain which is a staple food suggesting a plausible guideline in preparing management mitigation plan, which could be adaptive for the society.

2. **Webinar Series: Bulandshahr Legacy- Jal Jeevan**

   A webinar on '**Bulandshahr Legacy- Jal Jeevan**' was held on **August 27, 2021, 2:30 - 4:00 pm.**

   The webinar had a panel discussion by eminent environmentalists, artists, economists, and sociologists.

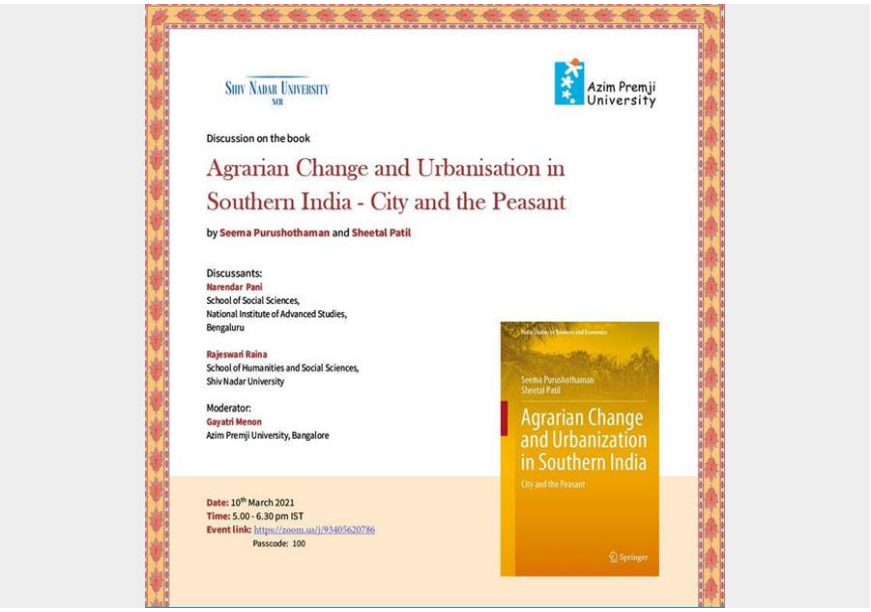
   'Bulandshahr Legacy' is a journey led by citizens, with academics, environmentalists, and social entrepreneurs as collaborators for collective reappropriation of the history of a Tier B town in Uttar Pradesh through community participation. The panel discussed key social, cultural, and economic systems in Bulandshahr, an administrative unit flanked by the Ganges on one side, the Yamuna on the other, with two rivers the Kali Nadi and the Neem Nadi that run through it.

Discussion points
• The rivers and their natural and social relationships with other systems in the region • National and international importance of this intervention in our climate challenged planet • Vision for the region and its water systems • Action areas and how implementation will be done • How stakeholders and actors would like to engage in this intervention
Who is it for?
• City Planners, Public Water Utilities • Arts, Cultural, Ecological and Sustainability Practitioners • Archaeologists, Economists, Sociologists • Environmental Scientists and Paleo-limnologists • Historians, Researchers, Students, Educators • CSOs, NGOs, Consultants • Start-ups, Entrepreneurs

3. **Book Discussion: Agrarian Change and Urbanization in Southern India - City and the Peasant**

The Center for Public Affairs and Critical Theory (C-PACT) at Shiv Nadar University and Azim Premji University collaborated on discussion of the book titled *Agrarian Change and Urbanization in Southern*

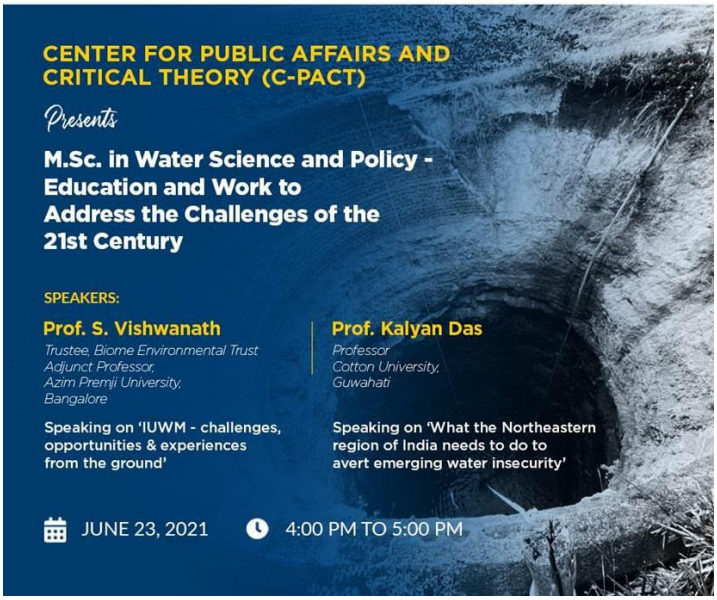
India - City and the Peasant, authored by Seema Purushothaman and Sheetal Patil. The Discussants addressed some of the core concerns that the farm sector and the city space/dwellers face.



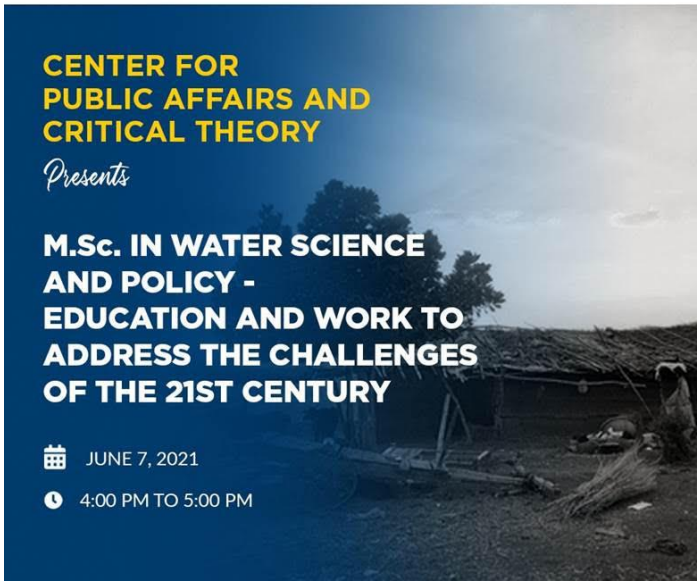
4. C-PACT Webinar: 'M.Sc. in Water Science and Policy - Education and Work to Address the Challenges of the 21st Century' on June 23, 2021 at 4.00 PM

The need for water professionals equipped with a robust understanding of the complexity and multiple dimensions of water has been expressed time and again over the past couple of decades. As the water crisis of the 21st century is worsening with alterations of the hydrological regime, land use change, growing population, urbanization, environmental pollution and degradation, and global climate change, the webinar focuses on these crises and possible solutions.

Two scholars, eminent thinkers and campaigners in environmental, social and economic change, addressed the critical water challenges we face today. **Prof. S. Vishwanath**, Trustee, Biome Environmental Trust and Adjunct Prof., Azim Premji University, Bangalore, spoke on '**IUWM - challenges, opportunities and experiences from the ground';** and **Professor Kalyan Das**, Prof., Cotton University, Guwahati on '**What the Northeastern region of India needs to do to avert emerging water insecurity'.**



5. C-PACT Webinar on 'M.Sc. in Water Science and Policy' on June 7, 2021



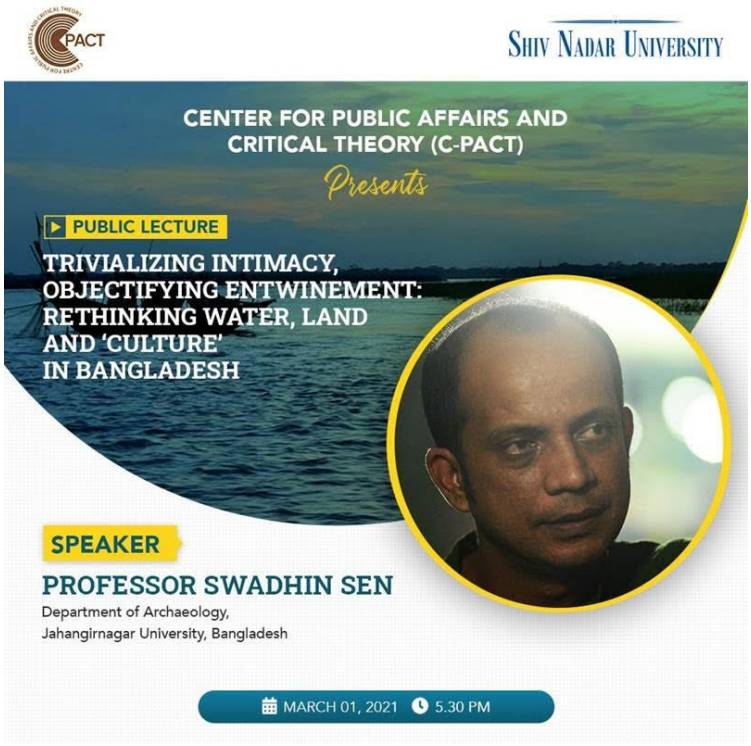
6. C-PACT Open Lecture on **'Trivializing Intimacy, Objectifying Entwinement: Rethinking Water, Land and 'Culture' in Bangladesh' by Prof. Swadhin Sen, Department of Archaeology, Jahangirnagar University, Bangladesh**.

Abstract

Bangladesh is axiomatically known as the land of rivers and the land of floods and disasters. Yet, despite the intimate association of human lifeways and water-river, little is known of the pre-modern/pre-colonial perceptions and practices of managing environment, floods and rivers. Most projects about water have been 'present' centric even though they have aimed at solving the problems of the past. The lecture highlighted the need for transgressing the binary of nature and culture and interrogate the taken-for-granted narratives of disaster management. An archaeological understanding of water and river through case studies from various ecozones of Bangladesh, and focus upon the ways in which we can devise conceptual and methodological tools for exploring the relational aspects of landscape and waterscape. Considering that human actions, perceptions, emotions and embodied experiences are inseparable, we need to historicize intimacy and the living in our searches of past notions and praxis of water. It is only then we can begin to see the myriad complexities that nurture the relationships between land, water and culture. (Photograph: Kirtonkhola by Firoz Ahmed)

About the Speaker:

Dr. Swadhin Sen is a Professor of Archaeology at Jahangirnagar University, Bangladesh. He builds upon methodologies of Social Anthropology for enquiring into the geoarchaeology and field archaeology of rivers and water, and also specializes in palaeoecology, heritage studies and the archaeologies of religion and ritual.



7. **C-PACT Talk on 'A pan-Canadian comparison of cyanobacteria bloom management policies, programs, and practices' by Ms. Rebecca Gasman, Master's Degree candidate at York University, Canada**

8. C-PACT Lecture - Water Worlds: Vijayanagara Landscapes And Change

Professor Kathleen Morrison, Sally and Alvin V Shoemaker Professor of Anthropology, University of Pennsylvania

9. C-PACT Open Lecture on 'Wetland Restoration and Management - Case of Vembanad Wetland'

Mr. Jojo T.D., Coordinator, Ashoka Trust for Research in Ecology and the Environment (ATREE)

Research Highlights

1. **Dr. Moumita Karmakar,** (WSP, C-PACT, SoHSS, Shiv Nadar University) **and Dr. Sudeepto Bhattacharya,** Department of Mathematics, SoNS, Shiv Nadar University along with a team are working on a research question - Social-ecological system (SES) in Tehri Garhwal district of Uttarakhand: a network theoretic approach. A joint manuscript is under preparation by Moumita Karmakar, Rajeswari Raina, Neeraj Aswal, Sudeepto Bhattacharya.

A study of community–based resource management of water in the Uttarakhand Himalayas: A network-theoretic perspective (funded by IDRC), is a collaborative work with Dr. Sudeepto Bhattacharya at Shiv Nadar University.

The project aims to obtain a scientific understanding of the community based natural resource management (CBNRM) as applied to sustainable and resilient management of water resources in the Uttarakhand Himalayas, where sustainable water management is currently a social-ecological challenge. Due to COVID-19, field related work was not possible during 2020-2021 but was undertaken in May 2022.

2. **Dr. Ajay Dandekar**

Dr. Dandekar and Dr. Bhattacharya undertook a project, on for Jaisalmer – Deccan region.

The project essentially comprises of the disciplines of mathematics, history, sociology and ecology, and seeks to explore the evolutionary behaviour of pastoral nomadism in the South Asian context, specifically as it sustains today in the Indian Thar Desert region. The project aims to study and understand the interaction dynamics of the Solanki Rajput pastoralism social-ecological system of Jaisalmer district of Rajasthan state, India, from a complex system-theoretic perspective. In this project, the question is articulated proposes to examine the extent to which the collective behaviour emerging out of a range of polyadic interactions of the constituents of this social-ecological system exhibits the defining signatures of a complex adaptive system. The field work and research brought forth a publication that puts forth an argument in the context of the Thar, and especially of the sub-region of Ramgarh, Jaisalmer district, regarding the necessity for understanding the issue of the pastoralists not in binaries but as an integral and perhaps central tenet of the eco-system of the area. The questions articulated in the project examined the extent to which the collective behaviour emerging out of a range of polyadic interactions of the constituents of this social-ecological system exhibits the defining signatures of a complex adaptive system.

A brief on the project is as follows:

Complexity, Water, Pastoralism and Adaptation: Arid Regions Study of Ramgarh Area in the Thar Region.

Introduction:

Even though the world's largest nomadic population reside in South Asia and given that the range of herds found in the subcontinent is astonishingly diverse, pastoral nomadism in the South Asian context has remained a marginalised field of study. The Indian Thar is a region with a fabulously rich prehistory and history where a range of cultures have coexisted and interacted with one another. Pastoralism and nomadism, the mainstay of the culture and the moral economy of contemporary western Rajasthan, originated in the Mesolithic age that began in 9000 B.C. After Harappan civilization's possible conflicts and interactions with nomadism, the next high point in the history of the Thar is represented by the origin and consolidation of Rajput polity. In this project we articulate questions that propose to examine the extent to which the collective behaviour emerging out of a range of polyadic interactions of the constituents of this social-ecological system exhibits the defining signatures of a complex adaptive system especially in water starved regions of arid belts and semi-arid belts.

Area of Study and Research issues

We have chosen the arid region of Ramgarh, in Jaisalmer district of Rajasthan, and surrounding terrain which also falls under the command area of the IGNP Canal as the prime area of study and later this will be supplemented with another regional study in a semi-arid belt of the Deccan.

The research issues, apart from studying complexities involves the actual mapping of water points and sources in the Solanki Rajput areas of Ramgarh near Jaisalmer and analysing the community evolved customs and traditions around usage and protection of water resources as an evolutionary process. The study would also consider the changing nature of subsistence in the region and would focus on the adaptation adaptive capacity of the Solanki pastoralism social-ecological system towards securing its sustainability.

Method:

Extensive field work spanning over almost one calendar year would be done after a scoping visits. The field work will involve documentation of narratives, mapping of structures (wells, ponds, Khadins and

pasture lands) of the Solanki areas of Ramgarh in a lineage mode and recording of extensive interactions. The study would involve a formal modelling of the Solanki pastoralism social-ecological system to understand the adaptations, resilience and related structural concepts as causes and drivers, that are key to securing a sustainable future for the focal system.

Outcomes:

At least two to three research Notes/Articles.

A beginning of Community Archive Recordings

People:

Dr Ajay Dandekar and Dr Sudeepto Bhattacharya (PIs), Dr Rahul Ghai (Area Expert)

3. **Dr. Moumita Karmakar and Dr. Sudeepto Bhattacharya**

Name of the researcher	Title of the project (Ongoing)	Expected outcome
Dr Moumita Karmakar (WSP, C-PACT, SoHSS, Shiv Nadar University) Dr Sudeepto Bhattacharya (Department of Mathematics, SoNS, Shiv Nadar University)	A study of community–based resource management of water in the Uttarakhand Himalayas: A network-theoretic perspective	The project aims to obtain a scientific understanding of the CBNRM as applied to sustainable and resilient management of water resources in the Uttarakhand Himalayas, where sustainable water management is currently a social-ecological challenge. The role of social-ecological networks in governance and sustainable management of water. Quantitative assessment of sustainability of water management practices through structural indices of the specific SENs.

4. A workshop on '**Water-Waste Cognition and Action**' was organized by the Centre for Public Affairs and Critical Theory and the Department of Civil Engineering (DCE-SoES), Shiv Nadar University. Some in-house faculty and experts from the area presented in the workshop. Event was held on May 26-27, 2019 at India International Centre, New Delhi and was sponsored by the National Institute of Urban Affairs and Shiv Nadar University.

Key Publications; Guest/ Special Lectures and workshops by Faculty

1. Dr. Mihir Shah

Dr. Mihir Shah, *Distinguished Professor, Shiv Nadar University chaired the Committee to draft the new National Water Policy set up by the Ministry of Jal Shakti in 2019. He* wrote a series of five articles on New National Water Policy for Business Standard covering a wide range of issues and debates around Water resource and management.

I. 'A new water policy for India', Business Standard, September 20, 2021 @ https://www.business-standard.com/article/opinion/a-new-water-policy-for-india-121092001544_1.html

II. 'Nature-based, people-centred solutions for water', Business Standard, September 29, 2021 @ https://www.business-standard.com/article/opinion/nature-based-people-centred-solutions-for-water-121092801506_1.html

III. 'Focus on water quality & demand management', Business Standard, October 6, 2021 @ https://www.business-standard.com/article/opinion/focus-on-water-quality-demand-management-121100501495_1.html

IV. 'River rejuvenation and other innovations', Business Standard, October 13, 2021 @ https://www.business-standard.com/article/opinion/river-rejuvenation-and-other-innovations-121101301324_1.html

V. "Water governance reform", Business Standard, October 20, 2021 @ https://www.business-standard.com/article/opinion/water-governance-reform-121102001564_1.html

2. Dr. Shah interview appeared in *the Hindu*, 'Need to shift focus to demand management, says water policy panel chief Mihir Shah'. The published interview is dated October 17, 2021 @ https://www.thehindu.com/news/national/need-to-shift-focus-to-demand-management-says-water-policy-panel-chief-mihir-shah/article37024880.ece

3. Dr. Shah interview appeared in *the Wire*, 'Nationalization of Water Is Not an Option for India'. The published interview is dated October 19, 2021 @ https://thewire.in/environment/interview-national-water-policy-management-mihir-shah

4. Dr. Shah interview appeared in the IndiaSpend, 'New Water Policy Proposes IT-Enabled Distribution & Leak-Plugging, Warns against Privatisation of Water'. The published interview is dated October 23, 2021 @ https://www.indiaspend.com/indiaspend-interviews/new-water-policy-proposes-it-enabled-distribution-leak-plugging-warns-against-privatisation-of-water-783206

5. 'What India's new water policy seeks to deliver', *Indian Express*. The article was published on October 30, 2021 @ https://indianexpress.com/article/opinion/columns/what-indias-new-water-policy-seeks-to-deliver-7595819/

6. 'Assessing the case for a legal MSP', *Business Standard*. The article was published on December 3, 2021 @ https://www.business-standard.com/article/opinion/assessing-the-case-for-a-legal-msp-121120201440_1.html

7. Dr. Shah presented a Keynote Address, 'Transforming Soil Imagination for Sustainable Prosperity', World Soil Day, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on December 6, 2021. This can be accessed at https://www.youtube.com/watch?v=M4xrXN4sjbM

8. Dr. Shah presented a Keynote Address, 'New National Water Policy' at the 7th CII Water Innovation Summit on December 6, 2021 @ https://www.cii.in/PressreleasesDetail.aspx?enc=lhqV2bJ7zlNJvqsmboQQx5Gj42hAJliV2ZBFM/GIUHOF9JL32Ku+bd8OC8UzyNEL+paPE+kkT0C8gt7VZP38lg==

9. Dr. Shah, Thematic Essay, 'Dismantling Barriers to Upscaling Agro-ecological Farming in India', *Ecology, Economy and Society*, 5 (1), January 2022, @ https://ecoinsee.org/journal/ojs/index.php/ees/article/view/618

10. Dr. Shah delivered a lecture and led discussion, 'New National Water Policy' with leaders of PRADAN, on January 17, 2022

11. Dr. Shah in Conversation with Ashwini Kulkarni, 'India's new National Water Policy: A paradigm shift', *Ideas for India Conversations*, fifth Edition, January 20, 2022 @ https://www.ideasforindia.in/topics/governance/india-s-new-national-water-policy-a-paradigm-shift1.html

12. Dr. Shah delivered a keynote Address, 'Sustainable Groundwater Management in India', at the 36th International Geological Congress, New Delhi, World Water Day, March 22, 2022

13. Dr. Shah delivered a keynote Address, 'How Natural Farming holds the key to Resolving the Interlinked Crises of Water and Farming in India', Training Program organised by MANAGE, Government of India, April 6, 2022

14. Dr. Shah delivered a Keynote Address, 'Natural Farming', workshop organized.by Chief Minister of MP, Bhopal, April 13, 2022

15. Helped NITI Aayog organize high-level conference on *Innovative Agriculture*, attended by Governor of Gujarat, Chief Ministers of UP, MP, AP and UKD, Minister for Agriculture, Government of India and experts and practitioners from across the globe, Vigyan Bhavan, New Delhi, April 25, 2022

16. Delivered lecture: "Water and Farm Crisis in India: Understanding the Inter-connections", *ICSSR sponsored Invited Lecture Series on Challenges and Issues in Indian Agriculture*, Centre for Development Studies, Thiruvanthapuram, May 11, 2022

2. Dr. Himanshu Kulkarni, Executive Director and Advisor in ACWADAM. He is adjunct faculty, Water Science and Policy, SNU

NOTE: Most of the following were **not** funded through the IDRC grant (unless specified) but have relevance to the subject of the grant. Often, students and some of the faculty from WSP-SNU participated in some of these activities.

1. At Shiv Nadar University Dr. Kulkarni coordinated summer internships and the field –based module, sustainable groundwater management – at Pune in April-May 2022 – and through Mr. Siddharth Patil (Senior Scientist, ACWADAM) who conducted sessions on groundwater and field modules during the field module in Odisha with Gram Vikas

2. Dr Kulkarni has been invited to many organizations and institutes to deliver lectured or conduct special training relayed to ground water.

i. International Workshop Series: Reimagining Groundwater Governance (gwG) with special emphasis on India. These were *four web-based workshops on groundwater governance involving the top groundwater scientists*
ii. Several trainings, lectures and workshops on groundwater, organized by government institutions under Atal Bhujal Yojana (Government of India and The World Bank).
iii. Several lectures on, 'Springshed Management', by Niti Aayog, Government of India (Ministry of Jal Shakti, River Development and Ganga Rejuvenation), Government of Manipur – online and offline (face-to-face).
iv. Urban groundwater – many sessions for various stakeholder groups including the officers of Pune Municipal Corporation.
v. Four keynote addresses and panel discussions – all on groundwater management, governance and policy – for ICIMOD, NewWave, Atal Jal (Haryana), Government of Maharashtra – on 22nd March 2022, World Water Day and the UNESCO Year of Groundwater.
vi. Keynote talk: 'Plurality of Trajectories - Concepts, Approaches and Strategies from Community Management to Local Groundwater Governance', as part of the theme Plurality of Postures and Approaches to Support Concerted Local Governance of Groundwater. *UNESCO International Conference on Groundwater, Key to Sustainable Development Goals, 18-20 May 2022. He chaired two sessions during the conference including one on Collaborative governance and groundwater, peace and sustainable development.*

Dr. Kulkarni's Key publications

I. **Chapter for Water Governance in India which is part of the Series on Water Resources Development and Management in India:** Kulkarni H., Joshi D., Aslekar U., Patil S. (2021) Catalysing Groundwater Governance Through People's Participation and Institutional Reform. In: Chadha G., Pandya A.B. (eds) Water Governance and Management in India. Water Resources

Development and Management. Springer, Singapore. https://doi.org/10.1007/978-981-16-1472-9_1.

II. **Chapter for Section on Sustainable Approaches, Tools and Techniques for the book Water, Climate Change and Sustainability**: Kulkarni, H., Desai, J. and Siddique I. M. (2021) Rejuvenation of springs in the Himalayan Region. In: Pandey, V.P., Shresthan, S. and Wiberg, D. (Eds.) Water, Climate Change and Sustainability, 6 (Section II – Sustainable Approaches, Tools and Techniques): 97-108, John Wiley & Sons Inc.

III. Kulkarni, H., Bhave, N., Upasani, D. and Gupta, R. (2022) Aquifers: forging the convergence between groundwater and communities in the heterogeneous groundwater systems of Western and Central India. Journal Geological Society of India.

3. **Dr. Rajeswari Raina**

NOTE: Most of the following were **not** funded through the IDRC grant (unless specified) but have relevance to the subject of the grant. Often, students and some of the faculty from WSP-SNU participated in some of these activities.

- **Conferences and /or workshops attended or organized**

I. "Prioritizing Sustainable Relationships: SDGs and STI", discussion/presentation in the session on Presentation of evidence and experiences of STI prioritizations and pathways from different contexts and organizations, at the STRINGS Project Workshop on "Perspectives and Policies to steer science, technology and innovation for the SDGs," organized online by the STRINGS project, UNDP and UKRI , 28th Feb., and 1st March 2022.

II. "Multifunctional agriculture in the rainbow economy" presentation made at the RySS-CIRAD-FAO (UN) Foresight Study "AgroEco2050", organized by the RySS (Rythu Sadhikara Samstha) and A.T.E Chandra Foundation, at the 5th Virtual Expert Workshop on the 27th April 2021.

III. Invited Lecture: "Holding Out Against the Global Fundamentals of Growth: Knowledge and Technology in Asia's Agri-food systems" Seminar paper presented online at the Seminar on Technological Globalization from Below, organized by CEPED, Universite de Paris, Paris, 23rd February 2022.

IV. "From Un-Sustainable Consumption to Sustainable Production-Consumption Systems", as part of a three part Webinar Series on "How to Talk about Sustainable Consumption in the Global South?" Organized by the Future Earth Knowledge and Action Network on Systems of Sustainable Consumption and Production.15th September 2021.

- Organized a Joint Workshop on "Socio-Ecological Transformations: Perspectives from Ecological Economics and the MINE Framework," Shiv Nadar University and

Heidelberg University in collaboration with the Indian Society for Ecological Economics, October 11-12, 2021.

- Working as member of a sub-group of the National Coalition on Natural Farming, working on the Baseline Information and Benchmarking exercise before the launch of the Madhya Pradesh natural farming pilots led by a coalition of Civil Society Organizations, to strengthen the national and State level policy goal of natural farming (February-May 2022).

Dr. Raina's key Publications:

- Rajeswari S. Raina 2021. "Conserving Economics for Biodiversity: Reflections on "The Dasgupta Review," *Ecology, Economy and Society* – the INSEE Journal. Vol 4 (2): 13-19.

(https://doi.org/10.37773/ees.v4i2.464)

- Rajeswari S. Raina and Keshab Das 2021. Whither Rural India? The Developmental State and Labour at the Margins, in Padmini Swaminathan and Uma Rani (Ed.s) *State Capital Nexus: Implications for Labour*, Anveshi Broadsheet on Contemporary Politics, March 2021, pp.9-12.

(https://www.anveshi.org.in/broadsheet-on-contemporary-politics/broadsheet-pdfs-english-and-telugu/)

- Rajeswari S. Raina. 2022. "Not Weathered: Towards Learning and Change", Review of Agarwal, R. and Goyal,O. (Ed.s) "Weather Report: The Crisis of Climate Change" (IIC Quarterly Winter 2019-Spring 2020) in *The Book Review*, Vol. 46 (2): 4-5.

Impact Stories

Following are some examples of faculty and students' contribution and effort to talk about the program and the Grant and through their expertise create an opportunity to make a larger impact from a long range perspective.

1. Dr. Mihir Shah, advisor and a distinguished Professor on the Water Science and Policy program was invited to the International Geological Congress Keynote Speakers on World Water Day (March 22, 2022) at the 36th International Geological Congress. It was organised virtually this year. The talk titled, *bringing the Science back into Water: Challenges of Sustainable Groundwater Management in India* - https://youtu.be/W36o2jdHq6s

2. Dr. Shah was the Chair of Jury Address: FICCI Water Awards Function, March 3, 2022

3. Dr. Shah played a key role in with NITI Aayog to organize high-level conference on *Innovative Agriculture*. Governor of Gujarat, Chief Ministers of U.P., M.P., A.P. and UKD, Minister attended the conference for Agriculture along Government of India and experts and practitioners from across the globe, Vigyan Bhavan, New Delhi, April 25, 2022

4. Dr. Himanshu Kulkarni was invited to chair two sessions at the UNESCO International conference on Groundwater, key to Sustainable Development Goals, May 18-20, 2022. He was delivered a key-note address, titled, 'Plurality of Trajectories - Concepts, Approaches and Strategies from Community Management to Local Groundwater Governance'.

5. A National Conference on a New Policy Regime for Water in India organized by Shiv Nadar University at India International Center, August 27, 2018. Leading thinkers, researchers, policy makers, attended the workshop and experts working on water related issues and initiatives. The workshop included dialogue to deliberate on Government's Water Policy, need for change in Water Management, and what does Mihir Shah Committee report mean to an average Indian who is dependent on agriculture. Dr. Nitin Gadkari, Honourable Minister for Water Resources, Government of India was a part of the workshop. The closing session at the conference had the who's who from various government organization and government of India as panel members.

6. Dr. Shah chaired Task Group to draft the Karnataka State Water Policy for the Government of Karnataka (Final Report submitted May 2019).

7. C-PACT in collaboration with National Institute of Urban Affairs (NIUA), New Delhi organized a brainstorming on curriculum development on 'decentralized sanitation management' at Shiv Nadar University, October 8, 2018.

8. Dr. Shah, has been appointed by the Government of India as the Chairman of the Committee to draft new National Water Policy in November 2019. First draft was prepared and submitted in October 2020. This is indeed been a significant step.
The Jal Shakti Hon. Minister Gajendra Singh Shekhawat in a recent interview published in Indian Express3 speaks about the committee all set to deliver a robust National Water Policy.

Another faculty on the Program, Dr. Himanshu Kulkarni is also an important member of the core team working on the report.

9. Vijay Shankar, is a Member of the Expert Group for Formulation of Water Strategy for Government of Madhya Pradesh (2019).

10. Dr. Kulkarni, led the discussions during the two day workshop on 'Urban aquifers: with special reference to Pune's groundwater resources', in collaboration with Bhoojal Abhiyan and Centre for Environment Education. The workshop was attended by people from Civil Society Organisations, representatives from the Central Ground Water Board (Government of India), Groundwater Surveys and Development Agency (Government of Maharashtra), PMC officers, Academic and Research Institutions from Pune.

Challenges during the period of the Project

The entire team of Water Science and Policy was very excited throughout the period of the Project to create something sustainable and long lasting. Over all, the Project progress was on track as per the grant proposal. One will need to mention, when the project was picking up good speed the impact of onset of pandemic in March 2020 could not get ignored on the Project timelines. The pandemic did pose hurdles especially with regards to the student field experience, summer projects, travel for conferences, faculty travel for research and the experts who were unable to travel across the country and from abroad to teach.

To resolve this to some extent, the project did receive an approval of 10 months no-cost extension. To a large extent some of the deliverables got possible as things opened up to carry out research, training and travel for the same. For example, to address the field training issue, the program received an approval from the University academic board to swap the semesters so that Students could travel when things opened up. This enabled the successful completion of in-field training which was one of the crucial components of the degree program. At the same time, the online mode of teaching to a large extent got well integrated making sure that there is no compromise on the quality of teaching.

However, at the same time, some deliverables unfortunately got hit in this period because the team was unable to carry out activities freely in the lockdown. One example is the alumni meet that we wished to hold. But getting everyone together at that scale and number became challenging. At the same time, the organizations were unable to freely participate and nominate candidates for the certificate program, since it being an in-house program for a month.

One can confidently comment that overall, the project completed on track as per the grant proposal. Given the pandemic and post pandemic scenario the project objectives did experience a stretch as mentioned above and in some of its activity plan but the WSP team was able to pull it together as far as possible. And the project concluded on a successful note.

Final Reflection

The Water Science and Policy team has been excited to be a part of this very critical project to create something significant. We are grateful to IDRC for their constant support and guidance throughout the project.

The project has achieved prominence and has an impact story to build on. The project is envisioned to continue to have significant output through faculty publications, capacity building, network expansion and policy impact. Another key element of the project journey is the student achievement through successful selection in conferences, jobs and their publications by both the current batch and the graduated batch of students. Through the small but confident cadre of students who graduated, the project will continue to write its success story – by way of their achievement in academics, jobs, projects and research.

The faculty network and research collaboration will continue to grow and produce significant publications and at the same time, create policy impact through participation at various domestic and international platforms and forums.

Annexure – 1

LIST OF PUBLICATIONS AND TRAINING CONDUCTED BY CORE TEAM OF FACULTY ON PROJECT

(This is over the entire period of the project)

Faculty Team

1. Dr. Mihir Shah, Distinguished Prof. & Chair, Water Science and Policy Programme
2. Dr. Ajay Dandekar, Director, Center for Public Affairs and Critical Theory (C-PACT)
3. Dr. Himanshu Kulkarni, Adjunct Faculty
4. Dr. Moumita Karmakar, Assistant Professor
5. Dr. Rajeswari Raina, Professor
6. Dr. Kaveri Gill, Associate Professor
6. Dr. Sudeshna Guha, Professor
7. Vijay Shankar. Adjunct Faculty
8. Dr. Sreedeep Bhatacharya, Associate Professor

Dr. Mihir Shah

1. Panellist at Webinar "Humanising Resource Distribution", Ashoka University, August 15, 2020.

Fundamental questioning of Economics as an academic discipline and the dominant global paradigm of development from an ecological and sustainability perspective.

2. Panelist at Webinar **"Does the Water of our Rivers flow "Wastefully" into the Sea?"** hosted by Water Practitioners Network (September 17, 2020)

Explained how the long-standing engineering axiom "let us not allow river water to flow wastefully into the sea" is an unscientific myth, which has caused enormous harm already and could potentially endanger the very integrity of India's monsoon cycle.

3. Virtual Lecture on "New Directions for Water Policy in India", December 17, 2020 organized by SRIJAN
4. Inaugural KN Raj Memorial Lecture "Reading KN Raj in the Age of Free Market Fundamentalism", Centre for Development Studies, Thirvananthapuram, March 10, 2021

Showed how the discipline of Economics needs to change to deal adequately with issues concerning natural resources, especially water and agriculture

Related Publications

1. "Symbiosis of Water and Agricultural Transformation in India", Paper commissioned by the FAO and NITI Aayog, presented at National Policy Dialogue, **January 21, 2021** (will be soon published in the EPW)

This paper develops the argument for twin propositions: (a) that the crisis in Indian agriculture cannot be resolved without a paradigm shift in water management and governance, and (b) that solving India's water problem requires a paradigm shift in agriculture. If farming takes up 90 percent of India's water and just three water-intensive crops continue to use 80 percent of agricultural water, basic water needs of millions of people, for drinking water or protective irrigation, cannot be met. The paper outlines the constituent elements of each of the existing paradigms of water and agriculture, explains why they need to be transformed and then describes the nature of the paradigm shift required in both areas. The paradigm shift in agriculture requires shifting cropping patterns towards crops suited to each agro-ecological region, a movement from monoculture to poly-cultural crop bio-diversity, widespread adoption of water-saving seeds and technologies, a decisive move towards natural farming and greater emphasis on soil structure and green water. At the same time, the paradigm shift in water must include rejuvenation of catchment areas of rivers, a shift towards participatory approaches to water management, while building trans-disciplinarity and overcoming hydro-schizophrenia in water governance.

2. "Mere Paas Sarkaar Hai: State Intervention in Indian Agriculture: Why it is needed and how it must change", *The India Forum*, January 15, 2021

3. "Reading KN Raj in the Age of Free Market Fundamentalism", *Economic and Political Weekly*, April 3, 2021

4. "Plough to plate, hand held by the Indian state", *Indian Express*, April 9, 2021

2. Dr. Himanshu Kulkarni

NOTE: Most of the following were **not** funded through the IDRC grant (unless specified) but have relevance to the subject of the grant. Often, students and some of the faculty from WSP-SNU participated in some of these activities.

1. **Lectures, presentations, panel discussions for outreach, dissemination and awareness building as part of ACWADAM's Aquifer Literacy effort – mostly through webinars (a few are listed below)**

- An Introduction to Groundwater; Groundwater and Geology: Potential Work Ideas; Groundwater and Management Aquifer Recharge; and, Groundwater Science – Participation – Policy, for various branches of Rotary Club, Pune and Nagpur (Webinar in collaboration with Bhujal Abhiyan, Pune)

- Groundwater, Inaugural Lecture for the Centre for Water Research, Indian Institute of Science Education and Research (IISER), Pune

- Introduction to Springshed Management, for RRAN – Himachal Pradesh

- Springshed Management: A Conceptual Framework, for GB Pant Institute of Himalayan Ecology (GBPIHE)

- Aquifers & Communities and Action Research on Groundwater, for Tata Steel Rural Development Society (TSRDS)

- Groundwater, Aquifers and Ecosystems, for Ecological Society of India (ESI), Pune

- India's Aquifers: Recognizing Their Value as a Resource and as a System, Special Lecture on World Water Day organized jointly by Groundwater Surveys and Development Agency (Government of Maharashtra) and UNICEF

- Aquifers, Groundwater Recharge and Base Flow, for the FICCI Water Webinar

- Groundwater, Ecosystems and Recharge, for IUCN – ITC Training Webinar on Sustainable Agriscapes for The Future: Agriscape Solutions

- Participatory Science for Managing Groundwater Resources in India, as part of the panel session on Community Action: An Entry Point to Holistic Solutions; *Summer Academy – Land, Security, Climate, for Geneva Centre for Security Policy, Geneva, Switzerland and Initiatives of Change (as part of CAUX Forum)*

- Three training sessions for the SPMU - TSA Inception Workshop for the State of Madhya Pradesh on the topics of Aquifers, Equity, Efficiency and Sustainability in groundwater management and Impact assessment indicators of ABHY. The training was facilitated by the National Project Management Unit (NPMU) and CGWB in close co-ordination with the Water Resources Department of Madhya Pradesh.

- Three key presentations as part of the GSDA-UNICEF initiative of subject-matter webinars on a variety of policy and programme relevant topics, particularly on groundwater. Three key presentations were made

    - Aquifer-based participatory groundwater management for basalt aquifers in Maharashtra
    - Deccan basalt aquifers: integrating aquifers with JJM through ABHY
    - The significance of groundwater balance for village water budgeting

2. In Person workshops

- Made a key presentation during the two-day workshop jointly organised by Gram Gourav Pratishthan (Pani Panchayat), Paryavaran Samruddhi Manch and SAPACC, Maharashtra on the subject of various topics related to Climate, Environment, Water, Energy and Livelihoods.

- GSDA workshop related to Village Water Security Plans (VWSPs) and the information / data required to enable robust VWSPs under the Atal Bhujal Yojana (ABHY).

3. Trainings conducted (as part of ACWADAM's training portfolio) – all trainings/session pertain to groundwater science/hydrogeology/groundwater management

- Two online versions of ACWADAM's 15-day Foundation Training on groundwater management. The online versions were of a duration of a week each in July and August 2020. About 80 persons from Civil Society Organisations, students, researchers and professionals from other walks of life attended these trainings.
- One online training session on Groundwater Governance, in lieu of the actual annual version that ACWADAM has been conducting during the last three years. Some 30 people, mostly from Civil Society Organisations and Research Institutes attended the training.
- Contributed significantly, with modules on capacity building in a variety of training programmes for Government of Meghalaya under The World Bank project MCLLMP; virtual trainings and guided mentoring sessions were conducted on the subject of springshed management as a means of reviving springs in the State of Meghalaya.
- Training and capacity building on Springshed Management in partnership with ICIMOD, Nepal for The Department of Forests and Soil Conservation, Government of Nepal.
- Training and follow-up capacity building on Springshed Management for The Department of Forests and Soil Conservation, Royal Government of Bhutan. This was in partnership with ICIMOD.
- Training for Water Aid (Karnataka) on quick planning of Managed Aquifer Recharge for locations in Raichur and Gulbarga districts.
- Training on groundwater – energy – agriculture nexus for Sustain+ team under the Tata Trusts programme
- Special trainings for participatory groundwater management for partner organisations working in some of the most socio-hydrologically challenged regions of Maharashtra – RAAH Foundation in Mokhada taluka of Palghar district and Khoj Foundation and Maitri for Melghat region in Amravati district, both in Maharashtra; this was under the APPI Grant to ACWADAM.

4. Key publications:

1. Tambe, S., Rawat, G. S., Bhutia, N. T., Sherpa, P. N., Dhakal, S., Pradhan, S., Kulkarni, H. and Arrawatia, M. L. 2020. Building sustainability in the Eastern Himalaya: linking evidence to action. *Environment, Development and Sustainability, 22: 5887-5903.*

2. Kulkarni, H. and Gokhale, R. 2020. Managing Deccan Basalt aquifers: understanding aquifer heterogeneity, iniquitous access and groundwater competition. *e-Journal of Geohydrology, INC-IAH, v.1 (2): 9-23*.

3.Tambe. S., French, L., Wyborn, C., Scarlett, L., Defries, R., Nagendra, H., Kulkarni, H., Srivastava, P., Agrawal, N. K., Rathore, B. M. S. and Kinhal, G. 2021. India's environmental policy standoff: reimagining the stakeholder engagement spaces. *International Forestry Review, v. 23(2): 219-229.*

4.Kulkarni H., Joshi D., Aslekar U., Patil S. (2021) Catalysing Groundwater Governance Through People's Participation and Institutional Reform. In: Chadha G., Pandya A.B. (eds) Water Governance and Management in India. Water Resources Development and Management. Springer, Singapore.

5.Kulkarni, H., Desai, J. and Siddique I. M. (2021) Rejuvenation of springs in the Himalayan Region. In: Pandey, V.P., Shrestha, S. and Wiberg, D. (Eds.) Water, Climate Change and Sustainability, 6 (Section II – Sustainable Approaches, Tools and Techniques): 97-108, John Wiley & Sons Inc.

4. Dr. Kaveri Gill

Publications:

Gill Kaveri. First Published 4 May 2021. *The Environment* as Disingenuous Trope: Tracing Waste Policy and Practice in a Medium Hill Town of the Himalayas, India. *Journal of Developing Societies*. https://doi.org/10.1177/0169796X211001246

5. Dr. Sreedeep Bhattacharya

Publications:

C*onsumerist Encounters*: *Flirting with Things and Images'*, **Oxford University Press**, September 2020. (Book).

After the Tourists Depart: Visual Postmortem of a New Tourist Destination, **Journal of Contemporary Archaeology**, 7.1. 2020. P 61–78. **(Journal Article)**

6. Dr. Rajeswari Raina

Webinars/Seminars/ Conferences (online)

1. Panelist in the Prakash Gole Memorial Discussion Series, on "Food sufficiency, nutrition deficiency and distributional inefficiency: What does it mean in an ecological context?" Organized by the Friends of Ecological Society and Ashoka Trust for Research on Ecology and Environment (ATREE), November 26, 2020. (https://www.facebook.com/ecologicalsociety/posts/1419004961767336)
2. Panelist in the Session on "Reflections: Making change happen," (3rd Sept.) at the ISEE (International Society for Ecological Economics) Conference on Economy and livelihoods after Covid-19 - A global on-line symposium of the International Degrowth Network and the International Society for Ecological Economics. September 1-4, 2020, University of Manchester, UK.

Invited Lectures

1. Invited lecture delivered (online) as part of the 50th Foundation Year lecture series, at the Centre for Development Studies (CDS) Trivandrum, on "Institutions and the Evolution of Indian Agriculture", January 29, 2021.

2. Invited lecture delivered to the faculty and students in the School of Economics, at the Kumaraguru College of Liberal Arts and Science, Coimbatore on "The Economics of Sustainable Agriculture in India," January 27, 2021.

Conferences/Seminars Organized:

1. Organised and participated in a book discussion on "Agrarian Change and Urbanisation in Southern India – City and the Peasant," Springer: India, as a collaborative event between Shiv Nadar University and Azim Premji University, on 10th March 2021.

Publications:

Rajeswari S. Raina 2021. "Conserving Economics for Biodiversity: Reflections on "The Dasgupta Review," *Ecology, Economy and Society* – the INSEE Journal. Vol 4 (2): 13-19. (https://doi.org/10.37773/ees.v4i2.464)

Rajeswari S. Raina and Keshab Das 2021. Whither Rural India? The Developmental State and Labour at the Margins, in Padmini Swaminathan and Uma Rani (Ed.s) *State Capital Nexus: Implications for Labour*, Anveshi Broadsheet on Contemporary Politics, March 2021, pp. 9-12. https://www.anveshi.org.in/broadsheet-on-contemporary-politics/broadsheet-pdfs-english-and-telugu/)

Rajeswari S. Raina (2021) Science, Technology, and Policy for Sustainable Development. In: Leal Filho W., Azul A.M., Brandli L., Lange Salvia A., Özuyar P.G., Wall T. (eds) No Poverty. Encyclopedia of the UN Sustainable Development Goals. Springer, Cham. https://doi.org/10.1007/978-3-319-69625-6_39-1

II). Dr. Mihir Shah

Articles

1. 'Interlinking of rivers: A dangerous idea', Business Standard, August 9, 2019
2. 'Flood policy needs complete overhaul', *Business Standard, August 23, 2019*
3. 'Urban water: A formidable challenge', *Business Standard, September 6, 2019*
4. 'Industrial growth could flounder on water', *Business Standard, September 20, 2019*
5. 'Water laws still stuck in the 19th century', *Business Standard, October 4, 2019*
6. 'Water needs trans-disciplinary governance', *Business Standard, October 18, 2019*
7. 'India's water problem is in the mind', *Seminar,* January 2020
8. 'Democratise Water', *Annual State of India's Environment 2020 Down to Earth*

Lectures Delivered

1. Solutions for India's Water Crisis: Smart Philanthropy for Enduring Impact, Indian Philanthropy Initiative, Mumbai, September 21, 2019
2. Water Crisis in India: Solutions for the 21st Century, at IIT Bombay, October 9, 2019
3. Tackling Rural Distress in the 21st Century: A New Trans-disciplinary Multi-stakeholder Paradigm of Development, ADB Rural Development and Food Security Forum, Manila, October 29, 2019
4. Saving the Cauvery: What it will Take, Asian College of Journalism, Chennai, November 23, 2019
5. A New Water Strategy for India, Public Lecture, India International Centre, New Delhi, November 28, 2019
6. A New Water Strategy for India, 10th Water Talk organised by the National Water Mission, Government of India, December 20, 2019, New Delhi
7. India's Water Problems have Simple Solutions, Confluence Lecture, Science Gallery, Bengaluru, January 28, 2020
8. Bhartiya Kisan Ko Gussa Kyon Aata Hai?, Ninth Ram Sakha Gautam Memorial Lecture, Madhya Pradesh Institute for Social Science Research, Ujjain, February 17, 2020

III). Dr. Sudeshna Guha

1. Delivered a public lecture on November 30, 2019. 'Nineveh in Bombay; Local Histories and Transnational Antiquities'. Bhau Daji Lad Museum, Mumbai.
2. Participant, Panel Discussion on January 18, 2020. Exhibition by Seema Kohli, 'A Cricle of our Own', Sunder Nursery New Delhi. Organised by Gallery Ragini, New Delhi.
3. Webinars for SoHSS, SNU. Organised and moderated. May 24 – June 4. (Guest speakers Achi India, Ladakh; Feisal Alkazi, theatre director; Dr Swapna Liddle, INTACH Delhi Chapter)

IV). Dr. Himanshu Kulkarni

NOTE: Most of the following were **not** funded through the IDRC grant (unless specified) but have relevance to the subject of the grant.

Salient special lectures (on invitation)

a. Aquifers: the ubiquitous buffer to droughts and floods – *TISS Water Talk Series, Mumbai – September 2019.*
b. A series of lectures on springs, spring-revival and springshed management – *as part of the ICIMOD-ACWADAM partnership based training for springshed management in Bhutan – for the Department of Soil Conservation under the Environment and Forests Ministry. This training was conducted in Thimphu, Bhutan in April 2019.*
c. Pune's aquifers: lead presentation for two workshops on Urban Groundwater involving participants working on this theme from various parts of India, PMC and PMRDA officials and researchers from Pune. *The workshop also released the ACWADAM report on Pune's Aquifers in the public domain – June-July 2019.*

d. Mountains and water: springs – *Key note lecture for the Special Session on Water Solutions for the 21st Century in Indian Himalayan Region, during the Water Future Conference organized by The Sustainable Water Future Programme of Future Earth in partnership with Indian Institute of Science – September 2019.*
e. The transdisciplinary methodology for inventory and mapping of springs and management of spring-water in the Himalayan Region – *Talk at the workshop on Springshed Management in the Himalayas – integrating practice, research and policy; National Workshop organized by ACWADAM in partnership with IHCAP-SDC and involving NMSHE-DST and Niti Aayog, Delhi, September 2020.*
f. Groundwater management and governance in India: bringing people closer to their aquifers. *Special Talk under the Water Talk Series at the invitation of Ministry of Jal Shakti, Government of India, New Delhi, November 2019.*
g. Urban groundwater: the case of Pune city – *Lead presentation for the International Workshop under FUSE Programme – Food-Water-Energy for Urban Sustainable Environments involving Stanford University, USA, IIASA, Austria, UFZ Leipzig and OFSE, Vienna, January 2020.*
h. Groundwater governance – setting the context – *lead presentation for the national workshop on groundwater governance organized by ACWADAM, January 2020.*

4. Special invitee – by CAG office*: As one of the two reviewers of the CAG conducted Performance Audit on Groundwater Management and Regulation in India.*

Key publication:

- Tambe, S., Dhakal, S. Dhakal, D., Sharma, G., Sherpa, P.N., Kulkarni, H., Bhutia, N. T., Dhakal, D., Pradhan, S., Sinha, U. K., Tiwari, A., Kharel, G., Phukan, I. and Arrawatia, M. L. 2020. Scaling up Spring Revival in the Himalaya: Graduating from Spring-Centric to Aquifer-Centric Nature-Based Solutions. In: Dhyani, S., Gupta, A. K. and Karki, M. (Eds.), *Nature-based Solutions for Resilient Ecosystems and Societies, Springer Nature Singapore Pte Ltd. 2020.*

5. Member, drafting committee, *National Water Policy (2020), Ministry of Jal-Shakti, Government of India.*

V). Dr. Sreedeep Bhattacharya

Title of Project/ Paper: *After the Tourists Depart: Visual Postmortem of a New Tourist Destination,* Journal of Contemporary Archaeology, 7.1. 2020. P 94–111.

Disciplinary Orientation: Sociology, Visual Culture, Consumer culture

Main Research Result: Published in a leading academic journal

Research money spent on this specific project/activity: One of the field visits conducted in September-2019, was supported by International Research Development

Centre's research grant to the Water Science and Policy Program at Shiv Nadar University (INR 25,000 approx)

VI). Vijay Shankar

1. Panelist on National Webinar on "Stimulus Package in Five Installments: Does it Make the Economy More Self-Reliant?", organised by Centre for Development Studies, Thiruvananthapurm, May 27, 2020
2. Paenlist, Samvaad 4, "Preparing the Ground for Kharif Sowing: Challenges and the Way Forward" organised by Indian Council for Research on International Economic Relations (ICRIER), New Delhi, June 11, 2020
3. Panelist, National Webinar "Re-Imagining the Next Generation of Watershed Development in India", organised by National Rainfed Area Authority (NRAA) and the Revitalising Rainfed Agriculture Network (RRAN), July 28, 2020
4. Organised two workshops on Data Monitoring and Cropwater Budgeting for Water Practitioners Network (WPN), June-July 2020.

KEY PUBLICATIONS

- 'Tribal Agriculture in Central India: Context and Challenges', paper presented at National Conference organised by the Network of Rural and Agrarian Studies (NRAS) at the Indian Institute of Technology (IIT) Delhi, September 26th-28th 2019
- 'Groundwater Governance and Small Farmers', paper presented at the National Workshop on *Groundwater Governance in India: Synthesising Experience and Looking Ahead*, organised by ACWADAM, Pune, January 9-10, 2020
- 'Rebuilding the Rural Economy after COVID: The Role of MGNREGA', paper written for the volume, *Commentary on India's Economy and Society Series 15*, Centre for Development Studies, Thiruvannanthapuram, June 2020
- 'Water in Agriculture', Background Paper for the FAO *National Dialogue: Indian Agriculture Towards 2030*, (co-authored with Dr. Mihir Shah), Food and Agriculture Organisation, Rome, July 2020

VII). Dr. Kaveri Gill

Paper written for a National Seminar

The Environment as Disingenuous Trope – Tracing Contemporary Waste Discourse and Urban Policy in India
THE ENVIRONMENT AS META NARRATIVE, Department of Sociology, Delhi School of Economics, University of Delhi, Sponsored By ICSSR, HBS & CEC, 5-6 March 2020. Paper Submitted to *Journal of Developing Societies,* As a part of a Special Issue: THE ENVIRONMENT AS META NARRATIVE, tilted: *The Environment* as Disingenuous Trope – Tracing Waste Policy and Practice in a Medium Hill Town of the Himalayas, India

VIII). Dr. Rajeswari Raina

1. IC3 (International Careers and College Counselling) training programme: "Evidence of Successful Science based Policy/Programme: Water Science and Policy", (lecture delivered online), 1st April 2020. Shiv Nadar University.
2. Keynote Address, "Policy Incongruence as Problem: Climate Change and a Possible Paradigm Shift in Indian Agriculture," at the *National Seminar on Agriculture in India: Problems, Policies and Prospects,* BJB Autonomous College, Bhubaneswar, February 29, 2020.
3. Address to Economics Faculty, "Economics and Environmental Decision Making: Post-growth Thinking", at the MESMAC International Conference 2020, on *Applying Theory: Paradigms, Practices and Faultlines,* at Muslim Education Society (MES) College, Mampad, Calicut, January 15, 2020.
4. Delivered a lecture on "The Accused Accursed: Farmers and the Evolution of Indian Agriculture," at the CSH (French, Centre for Social Sciences and Humanities), New Delhi, 5-7pm, December 16, 2019.
5. Panellist in BBC – the Real Story, on India's Pollution Problem, aired on November 8, 2019. (https://www.bbc.co.uk/programmes/w3csyddt).

6. As part of the Zero Budget Natural Farming (ZBNF) experiment in Andhra Pradesh, Dr. Rajeswari Raina, is member of the Expert Panel of the study "AgroEco2050: Foresight on Natural Farming in Andhra Pradesh, being carried out by the RySS (Rythu Sadhikara Samstha) Government of Andhra Pradesh, CIRAD and FAO (UN) India.

Conferences

(i) Chaired and conducted the Seminar on "Milk and Dairy in India's Development Path: Lessons, Challenges and Perspectives," organized by a team of French scholars from SupAgro, CIRAD, CSH, ENSFEA and INRA, at the India International Centre (IIC), 17-18 December 2019.

(ii) Presentation as a panelist (25th Nov), in the session on Urban Planning Structures, Informality and Sustainability, at the National Consultation on Sustainable Urban Water Management Systems- Planning for Healthy and Livable Cities, organized by the TRCSS, JNU, at the Convention Centre, Jawaharlal Nehru University, New Delhi, 25th-27th November 2019.

(iii) Delivered the lecture on "Agriculture" at the Roundtable on India's Climate Challenges, Organised by All India Peoples Science Network (AIPSN) and Focus on the Global South, Delhi, at India International Centre, 20th November 2019.

(iv) "Agricultural sciences, technology and administration – centralization and consolidation as a policy process problem" paper presented at the session on "Making Inclusive, Localised Policy Processes and Strategies" in the NRAS Conference "Beyond Productivity and Populism: Reimagining India's Agricultural and Rural Policies," in IIT Delhi, 26-28 September 2019.

Publications

(i) Rajeswari S. Raina and Debanjana Dey 2020. "How we know Biodiversity: Institutions and Knowledge-Policy Relationships," Sustainability Science, Vol. 15: 975-984. (https://rdcu.be/b3txq)

---

1. Dr. Mihir Shah, prepared paper for the International Water Management Institute, November 2018: *Reforming India's Water Governance to meet 21st Century Challenges* - Practical Pathways to Realising the Vision of the Mihir Shah Committee.

2. Dr. Mihir Shah, delivered a keynote address, *Understanding 21st Century Water for Meaningful Water* Stewardship at Tata Sustainability Group Annual Meeting, Mumbai, January 2019.

3. Dr. Mihir Shah, delivered a plenary address *The Crisis of Water is a Crisis of Farming in* India at Annual Conference of Revitalising Rainfed Areas Network, New Delhi, February, 2019.

4. Shah, Mihir (2019a): 'Crafting a Paradigm Shift in Water', *Water Governance: Challenges and Prospects,* Singh *et al* (eds), Springer.

5. Shah, M. (2019b): 'Reforming India's Water Sector: Which Way Forward?' *India's Water Futures: Emergent Ideas and Pathways,* Joy *et al* (eds), Routledge.
6. Dr. Kaveri Gill was an expert advisor on a successful international AHRC research bid looking at waste recyclers in Dharavi, Mumbai, 2019.

7. Dr. Gill was invited by the Joint Secretary, Ministry of Drinking Water and Sanitation (MoDWS), for expert advice on a national solid waste and plastic waste management policy, 2018.

8. Dr. Gill was invited to participate in a National Level Consultation Workshop on Solid and Liquid Waste Management, Ministry of Drinking Water and Sanitation (MoDWS), Government of India, 2018.

9. Dr. Sreedeep Bhattacharya, presented on 'Waste as Matters on the Move' at Teri University, September, 19, 2018.

10. Dr. Bhattacharya, Documentary Production (related to environmental issues and agrarian crisis), 'Matters of Life and Debt', 2019, 33 mins.

11. Dr. Rajeswari Raina was a discussant at the T2 Lab Workshop and Exhibition on 'Urban Water System in Gurgaon- Pathways to Sustainable Transformation', organized by the Transdisciplinary research Centre for Sustainability Studies, JNU, Department of Science and Technology (Govt. of India), STEPS Centre, Sussex, International Social Science Council, and Centre for Technology and Development, with the Gurgaon Water Forum, in Swantantrata Senani Zila Parishad Hall, Civil Lines, Gurgaon, September 29-30, 2018.

12. Rajeswari S. Raina, 'The Metabolism of Agro-ecological Systems: Reforming Institutions and the Sciences in India,' 15th Conference of the International Society of Ecological Economics, on Ecological Economics and Socio-Ecological Movements: Science, policy and challenges to global processes in a troubled world, organized by the Universidad Autónoma Metropolitana and the Benemérita Universidad Autónoma de Puebla, in Puebla, Mexico, September 10-12, 2018.

13. Dr. Raina, as member RAC: Participated in the Research Advisory Committee meeting of the Central Research Institute for Dryland Agriculture (CRIDA), of the Indian Council of Agricultural Research, Hyderabad, and November 10-11, 2018.

14. She also participated in the meeting of the Regional Committee for Asia-Pacific (RCAP), as an elected member of the Regional Office for Asia – Pacific of the International Science Council (ISC, Paris), November 20-21, 2018.

15. Dr. Raina is a part of ICSSR sponsored Major Research Project on "Millet-based Nutrition Programmes: Theoretical Challenges and Policy Problems in Rainfed Agriculture," in collaboration with Srijit Mishra (NCDS, Bhubaneswar) and A. Ravindra (WASSAN, Hyderabad, March 2017-March 2019, extended to September 2019. (Total grant amount: 40 lakhs).

16. Dr. Raina organized a workshop on 'Environmental Justice, Ecological Economics and Water Infrastructure in Northeast India: Hydropower and Waterways', as a collaborative workshop by the Forum for Policy Dialogue on Water Conflicts in India (SOPPECOM, Pune), Coventry University (UK), Aaranyak (Guwahati), Water Resources Management Group of Wageningen University (Netherlands), C-PACT of Shiv Nadar University (Dadri), IIT Guwahati and Peace and Conflict Studies of Sikkim University (Gangtok), at the Indian Institute of Bank Management, Guwahati, March 2-4, 2019

17. Himanshu Kulkarni is an adjunct faculty on Water Science and Policy, some of the key activities are listed as follows:

    i. Kulkarni, H., Aslekar, U. and Joshi, D. (2018) Specific Yield of Unconfined Aquifers in Revisiting Efficiency of Groundwater. In: D. Saha et al. (eds.), Clean and Sustainable Groundwater in India. Springer Nature Singapore Pte Ltd. 2018. Springer Hydrogeology, DOI 10.1007/978-981-10-4552-3_10

    ii. Kulkarni, H., Aslekar, U. and Patil, S. (2018) Groundwater Management in India: Status, Challenges and a Framework for Responses. In: Mukherjee, A. (ed.), Groundwater of South Asia. Springer Nature Singapore Pte Ltd. 2018 Springer Water, DOI https://doi.org/10.1007/978-981-10-3889-1.

    iii. Joshi, D., Kulkarni, H. and Aslekar, U. (2019). Bringing Aquifers and Communities Together: Decentralised Groundwater Governance in Rural India. In: Singh, A., Saha, D. and Tyagi, A. V. (eds.), Water Governance: Challenges and Prospects. Springer Nature Singapore Pte Ltd. 2018. Springer Water, DOI https://doi.org/10.1007/978-981-

13-2700-1.

iv. Panelist, Groundwater Management – Challenges of implementing NAQUIM – *Inaugurating a new policy regime for water in India* – Organized by Shiv Nadar University, August 27, 2018.

v. Springs and spring shed management – keynote lecture – *National Workshop on spring water organised by ACWADAM under the SDC-IHCAP + Ministry of Science and Technology, GoI. November 27, 2018.*

vi. Keynote address on Water Reforms in India (on behalf of Dr. Mihir Shah) AND 3 invited presentations on the subject of groundwater management and governance - *IWMI-Tata Partners Meet, Anand, Gujarat – December 4-6, 2018.*

vii. National workshop on spring water – lead talk on spring shed management – CGWB, Ministry of Water Resources, Dharamshala, H.P., March 14-15, 2019.

viii. Urban Groundwater – convener and lead, in collaboration with Biome Trust, Bengaluru, April 25-26, 2019.

18. Salient special lectures (on invitation)

a. Management and regulation of India's groundwater: growing dependencies, depleting resources – *for Workshop on Audit of India's Groundwater with special reference to water management programmes – Controller and Auditor General of India Teams – Jaipur (August 7, 2018) and Chennai (August 13, 2018).*
b. Groundwater governance - addressing water distress – *TISS Water Talk Series, Mumbai – September 1, 2018.*
c. Urban groundwater – with special reference to Pune city – *Special, invited talk for Institute of Engineers, Pune Chapter, Pune – October 10, 2018.*
d. Making groundwater visible (Rendre l'eau souterraine visible) – Key note lecture for the workshop on *Making Groundwater Visible under the French Institute for Biodiversity, Paris, France, November 6, 2018.*
e. Groundwater: from management to governance – *Special lecture, IM2E Seminar, UMR-G'EAU, Montpellier, France, November 8, 2018.*
f. Aquifers, communities and ACWADAM's story – special lecture, inception workshop, T2GS – Transition to groundwater sustainability – *International Programme under the aegis of UNESCO-IHE; ACWADAM is one of the partners under this programme – lecture on 3rd December 2018, Pune.*
g. Groundwater: science, politics and governance – *Special lecture, India Philanthropic Initiative, March 19, 2019, WIPRO, Bengaluru.*

Annexure – 2

IDRC WSP M.Sc. Student List				
S. No.	**SNU Application ID**	**Student Name**	**Gender**	**Year**
1	1710120124	J Cathrine	Female	2017-19
2	1710120108	Tenzing Saldon	Female	2017-19
3	2018PGSNU002765	Sartaj Ahmad	Male	2018-20
4	2018PGSNU000790	Pratik Gajanan Umbarkar	Male	2018-20
5	2018PGSNU002256	Shruti Singh	Female	2018-20
6	2018PGSNU002594	Bhavani Seenivasan	Female	2018-20
7	2018PGSNU002716	Siddharth Panda	Male	2018-20
8	2018PGSNU002730	Meena Kumari Chouhan	Female	2018-20
9	2019PGSNU002233	Purvi Thangaraj	Female	2019-21
10	2019PGSNU002287	Shreenivas Kd	Male	2019-21
11	2019PGSNU002476	Jayashree G	Female	2019-21
12	2019PGSNU003221	Shubham Deshpande	Male	2019-21
13	2019PGSNU003399	Shipra Singh	Female	2019-21
14	2019PGSNU003594	Kumar Satyam	Male	2019-21
15	2010PGSNU120812	Bhavya Joshi	Female	2020-22
16	2010PGSNU120202	Laxmi Sharma	Female	2020-22
17	2010PGSNU120841	Shivangi Pandey	Female	2020-22
18	2010PGSNU120891	Sahil Mathew	Male	2020-22
19	2010PGSNU191211	Anirudh Kishore	Male	2020-22
20	2010PGSNU120859	Nidhi Sehrawat	Female	2020-22
21	2010PGSNU121134	Manikanta P R	Male	2020-22
22	2010PGSNU120913	Siddhant Bajpai	Male	2020-22
23	2010PGSNU121207	Falak singh	Female	2020-22
24	2010PGSNU121161	Abhyuday Singh	Male	2020-22
25	2021PGSNU000283	Harsh Anil Bhadange	Male	2021-23

Annexure – 3

List of Certificate Candidates on WSP Program			
S.No.	**Candidate Name**	**Organization**	**Module**
1	Abhisek Panda	Foundation for Ecological Security	MODULE 1 Water Cycle + River Systems (WSP 501)
2	Avijit Das	Bharat Rural Livelihoods Foundation (BRLF)	
3	Deep Basu	Bharat Rural Livelihoods Foundation (BRLF)	
4	Deepanshu Srivastava	IIHMR University	
5	Dhurjati Nandan Mandal	Central Ground Water Board	
6	Ganesh Dilip Barangale	Bharat Rural Livelihoods Foundation (BRLF)	
7	Narendra S Patel	Samaj Pragati Sahayog	
8	Niraj Anurag Lakra	Bharat Rural Livelihoods Foundation (BRLF)	
9	Satya Narayan Sardar	Bharat Rural Livelihoods Foundation (BRLF)	
10	Shirsendu Bhattacharya	Bharat Rural Livelihoods Foundation (BRLF)	
11	Shreerang Kamalakar Hegde	Foundation for Ecological Security	
12	Sudip Banerjee	Bharat Rural Livelihoods Foundation (BRLF)	
13	Sunil Toppo	Central Ground Water Board	
14	Supriya Garain	Bharat Rural Livelihoods Foundation (BRLF)	
15	Abhishek Kumar	IIHMR University	MODULE 2 Watersheds & Aquifers (WSP 503)
16	Aman Jain	Foundation for Ecological Security	
17	Arup Pal	Pradan	
18	Barni Chatterjee	Pradan	
19	Bivas Mahato	Bharat Rural Livelihoods Foundation (BRLF)	
20	Chhabila - Bhoi	Janamukti Anusthan (BRLF)	
21	Dibyendu Mahata	Pradan	
22	Krushna Chandra Dash	Lokadrusti (BRLF)	
23	Madhusudan Mahato	Bharat Rural Livelihoods Foundation (BRLF)	
24	Nikhilesh Rathod	Samaj Pragati Sahayog	
25	Pramod Ramdas Shende	Bharat Rural Livelihoods Foundation (BRLF)	
26	Prince Singh	Pradan	
27	Radheshyam Patel	Samaj Pragati Sahayog	

28	Shambhu Ghatak	Common Cause India	
29	Suman Gayen	Pradan	
30	Bhabani Shankar Mishra	Bolangir Gramodyog Samiti (BRLF)	MODULE 3 Lakes & Wetlands + Water & Ecosystem Services (WSP 505)
31	Binayak Dutta	Development Research Communication and Services (BRLF)	
32	Gourav Mohan Sinha	Bharat Rural Livelihoods Foundation (BRLF)	
33	Jairaj Vijay Rajguru	ACWADAM	
34	Murlidhar Kharadia	Samaj Pragati Sahayog	
35	Rucha Deshmukh	ACWADAM	
36	Chowdhury Saifuddin Anwar	Bharat Rural Livelihoods Foundation (BRLF)	MODULE 4 Historical, Social, Institutional and Legal Dimensions (WSP 507)
37	Harshala Jambhulkar	Samaj Pragati Sahayog	
38	Mahendra Hans	SSS, BADBANKI (BRLF)	
39	Padma Uttam Uike	Foundation for Ecological Security	
40	Raghav Chakravarthy	Samaj Pragati Sahayog	
41	Sandip Goswami	Bharat Rural Livelihoods Foundation (BRLF)	
42	Sujit Kumar Baitharu	Lokadrusti (BRLF)	
43	Sumanta Dey	Bharat Rural Livelihoods Foundation (BRLF)	
44	Deepak Sharma	Samaj Pragati Sahayog	MODULE 6 India's groundwater resources and problems I and II (WSP 509)
45	Pendor Sree Hari	Foundation for Ecological Security	
46	Brindavan Mahato	Bharat Rural Livelihoods Foundation (BRLF)	MODULE 7 Issues in India's Water Policy; Discrimination, Exclusion and Conflict (WSP 510)
47	Dulal Chandra Mahato	Bharat Rural Livelihoods Foundation (BRLF)	
48	Manoj Kumar Dani	Social Education For Women's Awareness (SEWA) (BRLF)	
49	Suhas K S	Foundation for Ecological Security (BRLF)	
50	Sunil Kumar Sharma	Samaj Pragati Sahayog	
51	Abhimanyu Bag	Janasahajya	MODULE 9 Participatory Watershed Management (WSP 512)
52	Anirudh Netam Baisakhu Netam	Bastar Sewak Mandal, Jagdalpur	
53	Braja Sundar Sahu	SIDI	
54	Kalyani Hemant Thatte	Maharogi Sewa Samiti, Warora	
55	Sraban Kumar Behera	Ideal Development Agency	
56	Surjeet Pandey	Gram Sudhar Samiti	
57	Sury Lal Yadav	Sarguja Gramin Vikas Sansthan	

58	Vivek Singh	Manav Jeevan vikas samiti Katni (BRLF)	
59	Dharmendra Gehlot	Samaj Pragati Sahayog	MODULE 11 Sustainable Ground Water Management (WSP 514)
60	Dindayal Nayak	Samaj Pragati Sahayog	
61	Ankush Ravi Suryawanshi	Development Support Centre (DSC)	MODULE 12 Participatory Irrigation Management (WSP 515)
62	Rajkumar Doliya	Samaj Pragati Sahayog	
63	Sunil Kumrawat	Samaj Pragati Sahayog	
64	Sunil S Sahare	Development Support Centre (DSC)	
65	Rucha Deshmukh	ACWADAM	MODULE 8 Climate Change - Urban and Industrial Water and Rural Water Suppy and sanitation (WSP 511)
66	Rucha Deshmukh	ACWADAM	MODULE 4 Historical, Social, Institutional and Legal Dimensions (WSP 507)
67	Aditi Sajwan	SPS	
68	Maria Siddiqui	Shiv Nadar University Graduate	MODULE 5 Large Dams In India and Research Methodology (WSP 508)
69	Maria Siddiqui		MODULE 6 India's groundwater resources and problems I and II (WSP 509)
70	Maria Siddiqui		MODULE 7 Issues in India's Water Policy; Discrimination, Exclusion and Conflict (WSP 510)
71	Maria Siddiqui		MODULE 8 Climate Change - Urban and Industrial Water and Rural Water Suppy and sanitation (WSP 511)
72	Rucha Deshmukh	ACWADAM	MODULE 1 Water Cycle + River Systems (WSP 501)
73	Rucha Deshmukh		MODULE 2 Watersheds & Aquifers (WSP 503)
74	Rucha Deshmukh		MODULE 5 Large Dams In India and Research Methodology (WSP 508)
75	Rucha Deshmukh		MODULE 6 India's groundwater resources and problems I and II (WSP 509)
76	Rucha Deshmukh		MODULE 7 Issues in India's Water Policy; Discrimination, Exclusion and Conflict (WSP 510)
77	Rucha Deshmukh		MODULE 12 Participatory Irrigation Management (WSP 515)

Annexure – 4

S.No	Name	Batch	Dissertation Title
1	J. Cathrine	2017-19	Drought Management Study Using Ecosophical Approach
2	Tenzing Saldon		The Political Ecology of Water: Gender and Agriculture in Tharad, Gujarat
3	Bhavani Seenivasan	2018-20	Ecosystem Services, Policy and Status of Wetlands and Hillocks in two Villages
4	Pratik Gajanan Umbarkar		Understanding the Sustainability of Groundwater in similar Agro-Climatic conditions over different Hydrogeological settings in Akola District, Maharashtra
5	Sartaj Ahmad		Socio-Economic impact on People in Rural Areas due to Arsenic contamination of Groundwater
6	Shruti Singh		Gender Dynamics in State Irrigation Acts of Gujarat and Madhya Pradesh: 'Blind' versus 'Fluid'
7	Siddharth Panda		Understanding Water, Energy and Food Nexus: Modeling approach for Beas in Punjab
8	Jayashree G	2019-21	The Watershed development projects in Karnataka: A study to understand the process and implementation of successful models by Foundation for Ecological Security (FES)
9	Shubham Deshpande		Understanding the water crisis in Marathwada region of Maharashtra
10	Shipra Singh		Urban-peri urban dynamics, water bodies and Urban climate resilience- A case of Gorakhpur
11	Shreenivas KD		Transformation of Rural to Semi-Urban and the impact on Water: A case of Rajapalayam
12	Purvi Thangaraj		Industrial Water Use: Conceptualisation and Estimation
13	Kumar Satyam		1. Aside from the environmental advantages of solar powered irrigation systems, how effective is it from an aquifer point of view particularly in a typical alluvial setting of Bihar and Jharkhand? 2. How will the aquifer typologies effect the solar pumping scenario in crystalline and alluvial aquifer setting? 3. How can the behavioural change models help in changing large farmers' attitude towards solar based irrigation?
14	Bhavya Joshi	2020-22	An Environmental History Of Urban Lakes In Semi-Arid Region: A Study Of Siliserh And Jaisamand Lake, Alwar (Rajasthan)
15	KM Shivangi Pandey		Social Impact On People And Health Risk Due To Arsenic Contamination Of Groundwater
16	Nidhi Sehrawat		Soil Moisture: Socio Cultural Contexts And Material Perceptions In Indo- Gangetic Plains
17	Sahil Mathew		The Evolution of Adaptive Water Governance in Bangalore City
18	Siddhant Bajpai		Understanding The Political Economy Of Ganga Pollution With Special Emphasis To Kanpur
19	Manikanta Radhakrishna		Knowledge Plurality in a Canal Irrigation Systems: Case study of Visvesvaraya Canal Network
20	Abhyuday Singh		Drinking Water Supply Approach and Strategy, with reference to the Implementation of Jal Jeevan Mission (JJM) in Lucknow district, UP
21	Anirudh Kishore		Institutional Adaptations to Changing Water Relations in Peri-Urban Commons: The Case of Thazhambur Lake
22	Laxmi Sharma		The Upper and Madhya Ganga Canal System: A Political Economy of Water in Bulandshahr District, Uttar Pradesh
23	Falak Singh		Assessment of Soil Erosion in Mathura District using remote Sensing and uderstanding local perspective toward Soil Erosion

Annexure 5 – Water Bulletin Newsletters

#0001 | February 2019

C-PACT WATER BULLETIN

CPACT & WSP (Water Science Program) presents a monthly news bulletin of latest news from India and abroad on debates, concerns, and events related to water.

Wetlands: The Kidneys of our Landscape

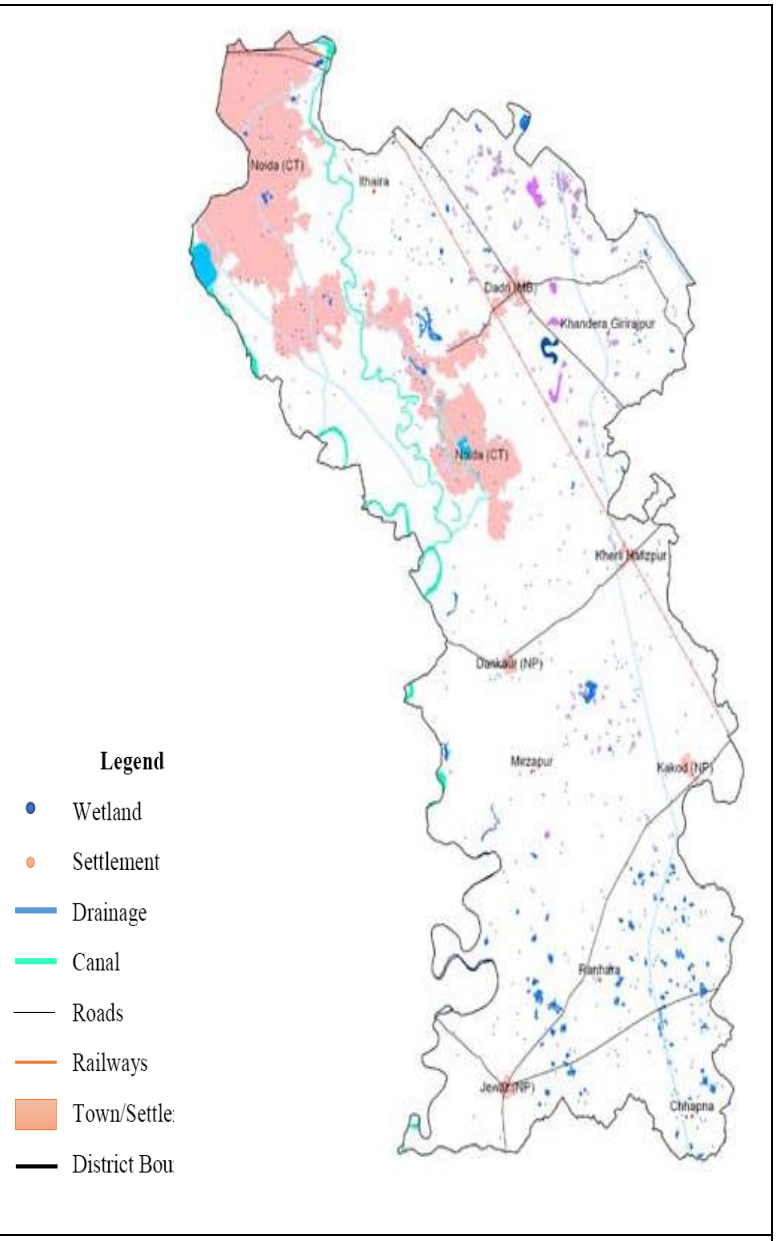
Moumita Karmakar and Pratik Umbarkar

Wetlands are unique; they are our living heritage. Marked by standing water at least during some periods in the year, unique soil conditions and vegetation, they act as an ecotonal boundary between terrestrial and aquatic systems. Because of a wide range of hydrologic conditions, sizes, and locations, a legal definition has become a norm for the protection of wetlands. The ecological significance of wetlands includes the role they play in the global carbon cycle, hydrological cycle, nutrient cycle, trophic interactions, and in maintaining high species diversity. Often called "nature's kidneys," wetlands support millions of people by providing food, water, controlling floods and storm surges. With growing population, urbanization, environmental pollution and degradation, and global climate change, urban wetlands are under tremendous pressure.

> The Ramsar Convention (1971), an international treaty for the conservation and sustainable use of wetlands, adopted the following definition of wetlands in Article 1.1 of the Convention of Wetlands (Finlayson and Moser, 1991): *For the purposes of this Convention wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish, or salt including areas of marine water, the depth of which at low tide does not exceed six meters.* Article 1.2 of the Convention provides that wetlands *may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six metres at low tide lying within the wetlands.*

Wetlands, especially urban wetlands, are among the most threatened water bodies in India. Urban wetlands can be referred to as coasts, estuaries, shallow lakes, water source protection areas, natural and artificial ponds, and sewage treatment systems within urban settings (Wang and Xianguo, 2007). In India, the first scientific mapping of wetlands was carried out by Space Applications (SAC, ISRO), Ahmedabad, during 1992-93 (Ministry of Environment and Forests, MoEF, Govt. of India) using remote sensing data from Indian Remote Sensing satellite (IRS-series). A classification system based on the Ramsar Convention was used, because there was no comprehensive inventory of wetlands. The entire country (including islands and union territories) was considered for the inventory and assessment of wetlands. Mapping was carried out on 1:50,000 scale. The areas of various wetland categories were estimated using GIS layers of wetland boundary, water-spread, aquatic vegetation, and turbidity. A total of 2,01,503 wetlands were mapped and 5,55,557 wetlands (<2.25 ha) identified. Although numerous wetlands have been identified in India, only 26 are Ramsar sites (Ramsar, 2013).

A total 23,890 wetlands have been mapped and 97,352 smaller wetlands (smaller than 2.25 ha) identified in Uttar Pradesh (NWIA, 2011). Gautam Buddha Nagar (GBN) in Uttar Pradesh is home to several wetlands; approximately 4,153 hectares of wetland, natural and man-made. Many of them are spectacular (like Surajpur) habitats to birds, amphibians and reptiles and several herbivores ranging from rabbits to deer. Along with rivers and streams (24.87%), natural wetlands include lakes/ponds (17.29%), waterlogged areas (6.65%), and oxbow lakes. Man-made wetlands include waterlogged areas, reservoirs, and tanks/ponds. 702 small wetlands (<2.25 ha) were also identified (NWIA, 2011). The GBN forest department has listed 720 water bodies (2016), marshes, and semi-wetland patches in the district as wetlands, according to District Forest Officer K.K. Singh (2016, told to *Times of India*). Dhanauri, a wetland, was discovered by Mr. Anand Arya (a bird watcher); he proposed that the National Green Tribunal list it as a wetland. Dhanauri, a great habitat for the Sarus Crane, is under the jurisdiction of the Yamuna Expressway Industrial Development Authority.



Map of GBN with wetlands marked by blue dots (NWIA, 2011)

The Water Science and Policy course in Shiv Nadar University, gives students the opportunity to understand and work towards knowledge and policy, including decentralized and participatory governance mechanisms for conservation of wetlands. As part of the course on Lakes and Wetlands, students conducted a field trip to different wetlands near Dadri, Rampur and Surajpur and found that environmental impact assessments of these wetlands, natural lakes or reservoirs are very important under the current context of development and environmental change. GBN wetlands could serve as a model system for long-term ecological assessment study which may be applicable on a larger regional, perhaps national scale. To conduct research there is a need for collaboration with the local development authorities, who have an economic and ethical obligation to ensure that our landscape has healthy functioning kidneys and life.

References

1) Finlayson, M., and M. Moser, eds. 1991.Wetlands. Facts on File, Oxford, UK. 224 pp 2) AC/EPSA/ABHG/NWIA/ATLAS/34/2011 3) Ramsar Secretariate, 2013. The list of wetlands of international importance. The secretariat of the convention on wetlands. Gland, Switzerland. 4) Wang Jianhua, Lv Xianguo. 2007. The concept and functions of urban wetlands and wetland protections in China[J]. Journal of Ecology, 26: 555-560

Latest News

Over 490 of 1,123 samples of packaged drinking water non-conforming to food safety norms, LS told

Read more

Environment department proposes to set up body to protect Delhi's wetlands

Currently, the responsibility of preserving and restoring wetlands in the city lies with several agencies, including the Delhi Jal Board (DJB), Delhi Development Authority (DDA), Public Works Department (PWD) and the municipal corporations.

Read more

Water in major reservoirs of 10 states below 2017 levels: CWC

Ten states have lesser water stored in their reservoirs when compared with levels in the corresponding period last year. The water level in reservoirs of these 10 states is also less than the average storage of last ten years around the same period, says the data released by CWC on December 27, 2018.

Read more

SAC approves Rs 186 cr project for rejuvenation of river Devika, Tawi

The State Administrative Council (SAC) which met in Jammu on Friday under the chairmanship of Governor, Satya Pal Malik approved the proposal of the Housing & Urban Development Department for Implementation of the project namely "Pollution Abatement of River Devika and River Tawi at Udhampur Town " under the National River Conservation Plan (NRCP).

Read more

931 More Villages Declared 'Drought-Affected' In Maharashtra

The Maharashtra government on Thursday, 3 January, announced another 931 villages in the state as "drought-affected", which will entitle them to several benefits and concessions.
Read More:

Tamil Nadu Govt. opposes new dams at Mekedatu, Mullaiperiyar : Governor

The Tamil Nadu Government on Wednesday strongly opposed the recent move by the Central Water Commission (CWC) giving clearance to Karnataka to prepare the Detailed Project Report (DPR) for constructing a reservoir at Mekedatu..
Read more:

Academic news: scholarships

Philomathia Trillium Scholarship

Incoming international Ph.D. students will be eligible to apply for a Philomathia supported Trillium Scholarship. The scholarship is worth CAD$40,000 per year for 4 years and will be awarded to an incoming student at McMaster University undertaking studies in water policy or water-based research.. Read More:

Rotary Scholarships for Water and Sanitation Professionals

The strategic partnership between The Rotary Foundation (TRF) and IHE Delft Institute for Water Education aims to tackle the world's water and sanitation crisis by increasing the number of trained professionals to devise, plan, and implement solutions in developing and emerging countries.

Read more:

UWE Millennium Scholarship for International Students

The University of the West of England, Bristol offers the Millennium Scholarship to international students who will be required to undertake an internship working within the International Office or other departments, and will also be required to undertake ambassadorial activity for the University throughout the duration of the course.

Read more:

Conference/call for papers:

ICSWRM 2019: International Conference on Sustainable Water Resources Management

The International Research Conference is a federated organization dedicated to bringing together a significant number of diverse scholarly events for presentation within the conference program. Events will run over a span of time during the conference depending on the number and length of the presentations.

Read more:

Water Resources Management 2019

10th International Conference on Sustainable Water Resources Management

7 - 9 May 2019

Alicante, Spain

Read more:

WaterEX World Expo

February, 20-23, 2019

Bombay Convention & Exhibition Centre, Mumbai

Read more:

Course/ Training Seminar Workshop/Contest:

Call for Content – IWA Water and Development Congress & Exhibition

Colombo, Sri Lanka, 1-5 December 2019

.

The IWA Water and Development Congress & Exhibition is the global event that brings together over 3,000 international water professionals to discuss, debate and present on water solutions for low and middle income countries.
The International Water Association calls for submission of content for the 5thedition of the Congress to take place in Colombo, Sri Lanka, 1-5 December 2019. Read more:

Career as a Water Science Policy Professional

Water is an essential element of life as well as the ecosystem, we live in. Without it, life cannot be imagined on this earth. Freshwater comprises only 2-3% of total amount of water found on this earth. Thus this resource has to be used judiciously. According to UN World Water Report 2018, the global demand for water is increasing at the rate of 1% per year and it will continue to grow in future as well.

Read more:

Upcoming Training & Workshops for Industrial RO Drinking Water Plants

To understand various water streams which are planned in a new manufacturing facility; business risks arising from water scarcity
Effective water utilization and process optimization
Read more:

Student Highlight

M.Sc. Students (Water Science and Policy) conducting fieldwork in Surajpur wetlands (October 2018)

For any comments or queries please contact:
Dr. Kaynat Qazi, Water Programme, C-PACT (Email id: Kaynat.qazi@snu.edu.in Office phone: +91-120 2663 846)

****

#0002 | March 2019

C-PACT WATER BULLETIN

CPACT & WSP (Water Science Program) present a monthly news bulletin of latest news from India and abroad on debates, concerns, and events related to water.

Aquifer Based Groundwater Management

Cathrine J. and Tenzing Saldon
(MSc. students Water Science and Policy, 2017-2019)

Recognizing the pressing need to manage ground water efficiently, the Government of India along with the World Bank launched *Atal Bhoojal Yojna* in March 2018.[1] This is the first scheme in the country to address groundwater management; the planned investment of Rs. 6000 crores is aimed at sustainable groundwater management in groundwater stressed areas.

A central concern in managing groundwater, is how we know what aquifers are and how they behave. Students in the Water Science and Policy (M.Sc.) programme in Shiv Nadar University, spend one month in the field during the 3rd semester in their 4 semesters long MSc programme, studying aquifer based groundwater management. This report on the training in Advanced Center for Water Resources Development and Management, Pune (ACWADAM) brings out the bio-geophysical and socio-economic, as well as political dimensions of groundwater management. As a part of the training the students were involved in elaborate field exposure along with discussions and deliberation with various stakeholders on ground.

Figure 1: ACWADAM Surveyor with Well owner and local youth showing the wells and helping with the measurement, Pokharkarwadi, Maharashtra

Figure 2 - Geological Observation during the field visit - Compact Basalt (top), Vesicular Amygdaloidal Basalt (bottom) and Red tuffacious layer in between.

[1] Press Information Bureau, Government of India, March 15, 2018

The field visits in ACWADAM were designed to give students an understanding of the rural and urban groundwater situation and the associated human behavior.

i. The rural visits which involved dug well inventories in seven villages (Table 1) for a project on drinking water by *UNICEF, ACWADAM and Bridgestone*[2] in Maharashtra. The major data collected included the location of the dug

ii. wells, *shivalik* tanks and borewells (latitude, longitude and elevation), depth of the well, static water level , post and pre monsoon water levels, the drinking water sources, water quality (pH, electrical conductivity, TDS, salinity and temperature), diameter of the well, casing and the power of the pumps installed. Also, information regarding the post and pre monsoon water levels was noted. The use of the wells and also the period when it is dry were noted. These villages are located in high rainfall areas - greater than 1000 mm/year. Still, there is a major drinking water problem at least in two of the three villages. Also, among the villages visited one village had a reverse osmosis (R.O.) plant set up for water supply and in other villages people were still using water from dug wells and bore wells directly for drinking.

iii. Cultivation of irrigation intensive cash crops, predominance of exotic (cross-bred) cows, was the norm in these villages, all dependent on groundwater. Since 2018 has been declared a drought year in various parts of Maharashtra, the groundwater recharge and water availability for next summer is expected to be low, with major implications for drinking water availability.

iv. The apathy of urban dwellers and impact of rapid urbanization on the springs situated within Pune was evident in the field study. The springs and wells in *Omkareshwar* temple and *Shanivar wada,* in the flood plains at the confluence of *Mulla* River and *Ramnadi*, in *Bhudan* and at the origin of *Ramnadi* River, revealed massive pollution and negligence of springs and wells. Even with civil society organizations attempting to revive the river bodies and the springs, the general apathy, disregard and negligence of spring management has been undermining their underlying geological and cultural significance. The policies along the lines of polluter pay principles are still being applied by the ULBs with regard to the destruction of springs and rivers. But obviously urban pollution and destruction of groundwater is allowed first, to entitle the polluter to pay! The confluence of the Omkareshwar spring, the *Muta* River, and Pune's urban sewerage water right in the middle of the city, is a painful evidence of negligence.

Figure 3 - Women taking water using hand pumps. The mouth of the pump is covered with cloth that to filter the water that comes out with red sediments

Location	Key water related aspects identified
Verude (Village)	Drought prone, major cash crops – potato
Gadakwadi (Village)	Drought prone, faulty watershed interventions, traditional onion cultivation
Javulke (Village)	Drought prone, heterogeneous (caste) community
Dhakale (Village)	Drinking water problem - no sustainable option, only seasonal
Kashik (Village)	Very high rainfall, spring water dependency for drinking water and agriculture
Phatalewadi (Village)	High Rainfall, Paddy, Community R.O, Partial drinking water Pipeline coverage
Phokarkarwadi (Village)	Drinking water shortage, onion cultivation area
Pune (City)	Pollution, Spring destruction by construction debris, construction on recharge zones of the aquifer

Table 1: The villages visited during ACWADAM Training Programme in Pune, Maharashtra, and the key issues related to water

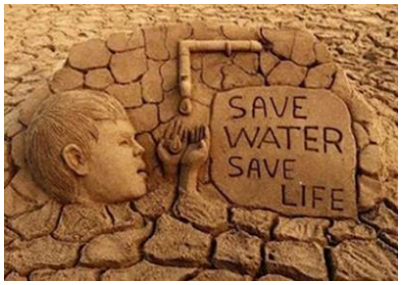
Major lessons were about (a) some counter intuitive causal relationships such as, how high rainfall need not necessarily mean better water security, (b) need for disciplines such as geology, hydrogeology, geomorphology etc. to understand nature's behavior, (c) people's preference for groundwater (for drinking water and irrigation) over surface water, (d) gendered division of labour and gender discrimination in access to and economic use of groundwater, (e) institutionally and historically differentiated roles, power and interests of stakeholders, with various degrees of desperation and involvement, and (f) misplaced policies and interventions, like the *Jal Yukt Shivar* Scheme in Maharashtra, which defines drinking water scarcity based on tanker water demand statistics, which is actually misleading.

Prevalent groundwater management practices highlight the need for nimble footed policies and democratic knowledge, which have space for understanding the bio-geophysical basis and social-economic nuances of the problems, and can provide solutions accordingly.

Latest News

World Water Day: India is 3rd largest groundwater exporter, but 21 cities are running out of water by next year!

The theme for World Water Day 2019 is 'Leaving no one behind.' 21 Indian cities, including Delhi, will run out of groundwater by 2020, affecting 100 million people.



Read more

Depletion of lake, rivers plunge Chennai into water crisis

The rise of a parallel water economy and the depletion of wells, lakes and rivers have plunged Tamil Nadu capital's into a crisis

Read more

Penna, Godavari rivers to be interlinked soon: CM Naidu

While asserting his government's commitment over interlinking of all rivers in the state, TDP National president N. Chandra Babu Naidu has said that people of Kadapa are going to conduct farming operations with Godavari waters as government is going ahead for interlinking Penna river with Godavari very soon.

Read more

Premise of SC ruling on forest dwellers wrong: UN Special Rapporteur

Victoria Tauli-Corpuz, UN rapporteur on the rights of indigenous people, says tribals are treated like squatters all around the world.

Read more

J&K among 7 states without water-testing labs.

J&K is among the seven states which are yet to establish state-level laboratories under the National Rural Drinking Water Programme to check the quality of water being supplied to people in rural areas.

Read More:

Friday, 22 March
World Water Day 2019

Sustainable Development Goal 6 is crystal clear: water for all by 2030. By definition, this means leaving no one behind. But today, billions of people are still living without safe water – their households, schools, workplaces, farms and factories struggling to survive and thrive.

Read More:

Academic news: scholarships

Bill & Melinda Gates Foundation (BMGF) Scholarship

This scholarship is for the one-year Master in (non-sewered) Sanitation only.

Read More:

Joint Japan Worldbank Graduate Scholarship Programme (JJWBGSP)

The next call for applications for a JJWBGSP Scholarship is scheduled to open from 7 March till 11 April 2019.

Read more:

Rotary Scholarships for Water and Sanitation Professionals

The specializations of the following IHE Delft MSc programs are eligible for a 2019-2021 Rotary Scholarship:

Water Management and Governance

Urban Water and Sanitation

Water Science and Engineering

Read more:

Conference/call for papers:

The 5th International Conference on Water Resource and Environment (WRE 2019) will be held in Macao, China from July 16th to 19th, 2019.
Read more:

3rd world water summit 2019 on 21-23 august 2019

Read more:

Towards a Sustainable Water Future' in Bengaluru, India.

24 - 27th September 2019 Bengaluru, India

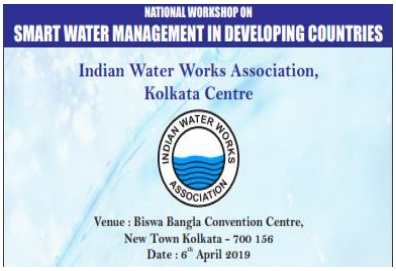
Read more

:

Course/ Training Seminar Workshop/Contest:

National Workshop on "Smart Water Management in Developing Countries" 6th April, 2019 - Kolkata

Read more:



"Centre for Education & Research in Geoscience invites entries for JAL KATHA 2019 - International short film festival on water".

Read more:

Water Innovation Summit
18-19 Sep 2019

The Lalit New Delhi, New Delhi, India

Read more:

For any comments or queries please contact:

Dr. Kaynat Qazi, Water Programme, C-PACT (Email id: Kaynat.qazi@snu.edu.in Office phone: +91-120 2663 846)

****

#0003 | May 2019

C-PACT WATER BULLETIN

CPACT & WSP (Water Science Program) presents a monthly news bulletin of latest news from India and abroad on debates, concerns, and events related to water.

CANALPY: The Canals of Alleppey Can Live

Siddharth Panda (MSc student, Water science and Policy)

Canals are not Drains

Rapid urbanization and urban migration has resulted a sharp increase in water demand in Indian cities. With the ever-increasing water demand and usage, the volume of sewage also increases. It is worse in the urban areas due to the population density, limited waste management facilities as well as failure in the functioning of the few that do exist. The deteriorating health of the surface and ground water is a major concern in urban cities of Indian. As per the Central Pollution Control Board (CPCB) 'organic pollution as indicated by biochemical oxygen demand (BOD) continues to be the major quality issues. This is mainly due to discharge of untreated wastewater from the urban centers of the country' (CPCB, 2015a). The release of partially treated or untreated sewage (70% of the total pollution load) is one of the main reasons for deterioration of surface and ground water quality (CPCB, 2015a). Liquid waste management has thus become an important but much neglected issue in Indian cities. There is an urgent need to address the challenge of liquid waste management and better sanitation practices in every city in India. A city where this problem is painfully evident, is the city of Alleppy, the Venice of the East!

CANALPY: A Way Forward?

The canal revival programme in Alleppey, referred here as CANALPY, is an initiative taken by the citizens of Alleppy District in Kerala state. The intention is to reclaim and enliven the canals of their town. These canals hold and bind this city between the Arabian sea and the Vembanad Lake. With the tagline that translates to "Canals are not drains", this initiative includes a two-weeks long training and community mobilization programme conducted by IIT-Bombay along with Kerala Institute of Local Administration (KILA), every summer and winter, with the support of the Municipality of Alleppy. In this programme, water professionals from all sectors came together and work towards a common goal i.e. saving, and bringing life back to the dying canals. This program uses modern survey techniques along with smart tools to monitor the quality and assess the conditions of canals. Some of us, from the Water Science and Policy MSc class, were part of the Winter School in December 2018. This news item captures some CANALPY lessons we learnt.

The practice of waste disposal: In order to understand how the canal becomes a drain, the practice of waste disposal at the household level was captured via interviewing local people. Maps were prepared using GIS to enable visual description of the data collected using surveys. A detailed questionnaire was prepared and the data was collected using a mobile app called 'ODK COLLECT'. The questionnaire was structured using data from a series of pilot projects and services conducted over the previous year. The questionnaire was prepared in a way to understand the regular practice of waste disposal according to the socio-economic status in that particular area. The survey was conducted by four groups (23 members in each group) of students coming from different academic and professional backgrounds. This gave an opportunity of interdisciplinary approach towards understanding a problem. First, all the questionnaires were explained to the members of the house and then the data was collected using 'ODK Collect' over four days. Due to the heterogeneity of the community, the spatial distribution of the samples was checked and a sound distribution ensured during the survey. There was a discussion related to the practices of different waste management at the management site. Few important aspects of waste disposal practices were disclosed after the interactions with the main stakeholders. General observations were recorded during the surveys and interviews which enabled in a detailed socio-economic analysis to emerge. Inferences were made using both primary and secondary data, to come up with a robust understanding of the problems we face in addressing the solid as well as liquid waste management practices of the various economic sectors.

How We See Water: This study of the Alleppy canals, is a classic example of how the value of water has changed over the years. Earlier in the history of this port city, the free-flowing streams of the Vembanad Lake were tamed into canals to make way for the growing spice trade. Now, these canals are used as drains and ironically, these canals are hotspots for tourism. And due to the rapid growth of tourism, the water quality of these canals has deteriorated further. Dumping fecal matter from tourist boats into the lake and the canals has reduced costs and certainly added value to tourism. But this is bound to be a short term gain, as the city and its canals get choked with filth. Eutrophication is one of the major concerns, which again leads to the loss of biodiversity. Efforts by the Kerala Government and projects such as CANALPY are surely making an effort to bring back the beauty of these canals but the progress is slow.

Water Science and Policy: Paradigm Shifts

So, what do we learn from this Winter School, and the overall change in the value of water that Alleppy is attempting now? Can they make the transition from using their canals as drains, to seeing the real value of this precious biophysical system, the flow of water surrounding and constituting their city? Are there similar situations happening all across the country, which can be mitigated, using the lessons learnt from CANALPY? Is there any "one" right approach? One particular scheme that the government can design? Is there a role that the local community has, in safeguarding the canals and other waterbodies in their own cities?

Lessons from CANALPY tell us that there is no single right solution to this problem. If there was one, we would not be studying this course. Certainly, Government plays an important role in both causing the problem and in resolving it. Help in the form of access to information, financial support and institutional

collaboration will help solve this issue in a holistic way. Along with it, increasing awareness of the community, and its willingness to propose changes and adapt to these changes, is crucial. But this, as CANALPY shows, is much easier said than done. Policies have to be framed based on specific predetermined objectives as well as on ease of implementation by taking community participation into the picture. Solutions involving expensive technology may not always be an answer since it lacks community involvement. To conclude, this Winter School experience was informative and most importantly fun. We were exposed to the ground realities of the problems related to water and came back with some answers and a lot more questions to be explored. We enjoyed being in the most scenic and serene environment in Kerala!

Latest News

Just one-third of the world's long rivers run free

More than 60,000 dams obstruct water flow and disrupt ecosystems. Just 37% of the world's 242 longest rivers remain free-flowing, a new study shows, and most of these are restricted to remote regions of the Arctic and the Amazon and Congo basins

Read more
https://cosmosmagazine.com/climate/just-one-third-of-the-world-s-long-rivers-run-free

Govt. spends Rs. 800cr to quench drought-hit villagers' thirst

Mumbai: In the last six months, the Maharashtra government has spent Rs 800 crore to make drinking water available to drought-affected villages, especially in the Marathwada and Vidarbha regions. Since November 2018, the government has spent Rs 672 crore on providing tankers and repairing borewells in villages.

Read more
https://timesofindia.indiatimes.com/city/mumbai/govt-spends-rs-800cr-to-quench-drought-hit-villagers-thirst/articleshow/69192542.cms

Coping with droughts: Gender matters

A study finds women are hit the hardest during droughts due to food and water scarcity, loss of income and a range of health problems resulting from it. Women in rural areas are already burdened with household work and their entry into agricultural labour has further added to their woes. In spite of toiling hard in the fields, women have no land rights nor decision-making powers and their health is often compromised.

Read more
https://www.indiawaterportal.org/articles/coping-droughts-gender-matters

Namami Gange: Only 10 out of 100 sewage projects done

Nearly Rs 28,000 crore has been sanctioned for the sewage management work under the mission but only Rs 6,700 crore spent till date. According to a report on the National Mission for Clean Ganga (NMCG) website, most of the projects completed under the current government's regime are the ones that were commissioned before the Ganga mission

Read more
https://www.indiawaterportal.org/articles/namami-gange-only-10-out-100-sewage-projects-done

Poor rain forces farmers to depend on water tankers to meet irrigation needs

Poor rains and water shortage in the region is forcing farmers to depend on commercial water tankers to meet irrigation needs. Several farmers are forced to spend over 1000 rupees to buy water to prevent drying of crops

In South Delhi, basic issues of water supply, traffic congestion take centre-stage

Water supply remains one of the biggest concerns for the residents of South Delhi

Read more
https://www.thehindu.com/news/cities/Coimbatore/poor-rain-forces-farmers-to-depend-on-water-tankers-to-meet-irrigation-needs/article27041351.ece

Read more
https://www.moneycontrol.com/news/india/in-south-delhi-basic-issues-of-water-supply-traffic-congestion-take-centre-stage-3934881.html

Academic news: scholarships

Policy and Social Modeling Postdoc

A Post-Doctoral Research Associate position is available in Policy and Social Modeling at the University of Vermont as part of an NSF-funded research project on Lake Champlain Basin Resilience to Extreme Events.

For more information
http://www.isecoeco.org/policy-and-social-modeling-postdoc-2/

Rotary Scholarships for water and Sanitation Professionals
Through this partnership, a limited number of scholarships are awarded annually for graduate students at IHE Delft Institute for Water Education's campus in the Netherlands. These scholarships are designed to promote long-term productive relationships between Rotarians and highly skilled water and sanitation professionals in their communities.

For more information
https://www.un-ihe.org/rotary-scholarships-water-and-sanitation-professionals

Conference/call for papers:

IWA-IDB Innovation Conference on Sustainable Use of Water: Cities, Industry and Agriculture
Country: Ecuador, City: Guayaquil
For more information visit: www.globalsustainablewater.org

11th IWA EE YWP Conference: Water for All, Water for Nature, Reliable Water Supply, Wastewater, Treatment and Reuse
Country: Czech Republic, City: Prague
For more information visit: iwa-ywp.eu

Amsterdam International Water Week Conference

Country: Netherland, City: Amsterdam
For more information visit: www.amsterdamiww.com

3rdWorld Water Summit – 2019**,** 21-23rd August, New Delhi, India
Deadline for abstract submission: June 15th, 2019
Full paper before June 30th, 2019
For more information visit:
http://worldwatersummit.in/index.html

Proud graduates: M.Sc. in Water Science and Policy
Tenzin Saldon and Cathrine J. from left to right

For any comments or queries please contact: Dr. Kaynat Qazi, Water Programme, C-PACT (Email id: Kaynat.qazi@snu.edu.in Office phone: +91-120 2663 846)

****

#0004 | August 2019

C-PACT WATER BULLETIN

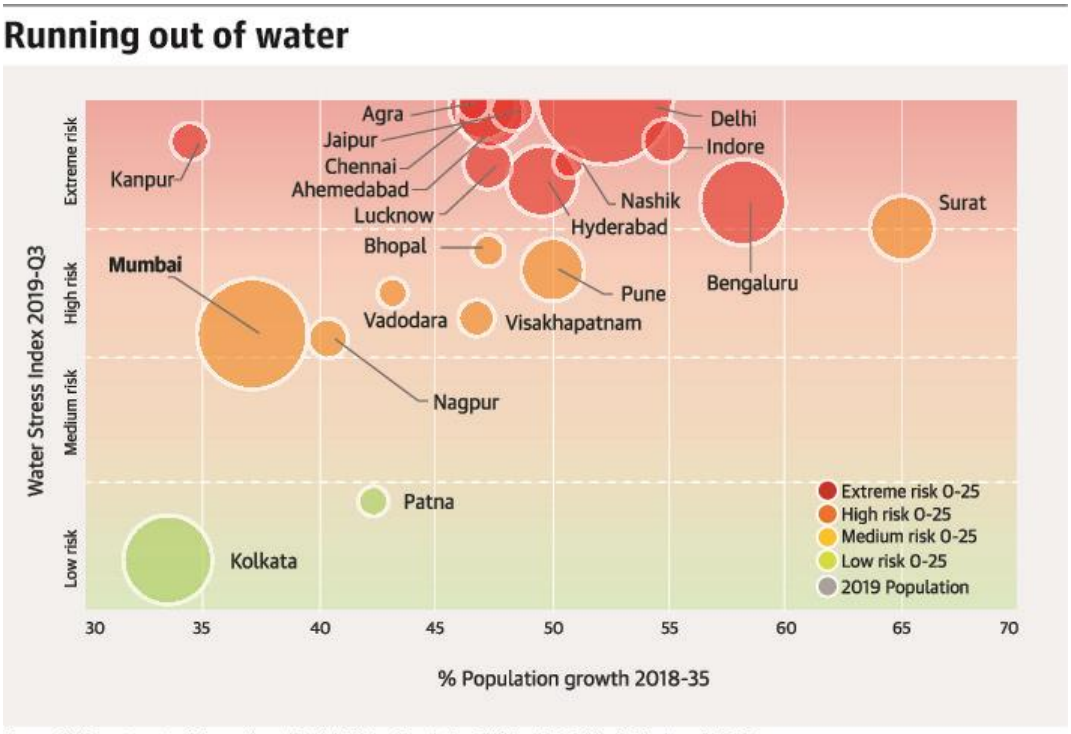
CPACT's WSP (Water Science and Policy) program presents a monthly news bulletin of the latest news from India and abroad on debates, concerns and events related to water.

Urban Water Crisis: Indian Perspective

Purvi Thangaraj, Shreenivas K.D. and Shubham Deshpande (M.Sc. students, WSP, C-PACT)

'There is a water crisis today. But, the crisis is not about having too little water to satisfy our needs. It is a crisis of managing water so badly that billions of people and the environment - suffer badly' states the World Water Vision Report (2000). Furthermore, United Nations reports that the water crisis is caused by insufficient water supply to satisfy basic human needs and growing demands on water resources to meet human, commercial and agricultural needs.

In India today we are witnessing severe urban water crisis because of two primary reasons: demand is increasing for freshwater than its availability, and there is a decline in the availability of freshwater on the surface as well as in the ground water table. The reasons for decline in water quantity and quality in the cities are due to various anthropogenic activities, such as allowing sewage water to drain into various urban water bodies, which results in pollution and contamination, over extraction of underground water, and encroachment of land by closing the wetlands.



Source: UN Department of Economic and Social Affairs, Population Division, 2018; Versik Maplecroft, 2019

Cities such as Bengaluru, Chennai, Delhi, Kolkata and Mumbai are under pressure to face the 'Day Zero' in the near future. As the urban population in India is expected to rise to 590 million by 2030, we anticipate further demand for water and pressure on water sources to also increase. The industrial policies from 1991 paved the way for rapid infrastructure development, which increased the pace of immigration into these cities, and a rise in the demand of water. At the same time, water bodies began to get polluted and encroached, and therefore water resources deteriorated while the cities failed to conserve the water bodies.

A case study of Bengaluru: Historically called the "city of thousand lakes" Bengaluru always had lush green parks, lakes, river and waterfalls, which provided for a moderate climate throughout the year. As the city became the technology-headquarter of India, its population grew and settlements encroached on the green cover. Increasing degradation of water bodies occurred due to the boom in the construction sector, untreated sewage began to inundate the lakes and tanks, and Bengaluru lost over 70% of its green cover, which led to a dip in the water table from 12m to 91m. The city's population has increased from 4 million in 1990 to 11 million in 2019, with a consistent growth rate of 3.24% every 5 years. Therefore, it is time that the residents and government take necessary steps to conserve water and rehabilitate the city's water bodies.

The threat of urban water crisis puts forth various challenges and highlight the importance of addressing the issues immediately, through water conservation schemes. We see the need for a shift in the way we manage urban water system through Integrated Urban Water Management. It demands measures for reviving wetlands, installing rainwater harvesting systems, recycling waste-water, shifting industries to peripheries and outside city limits, controlling extraction of groundwater, and also creating awareness of the importance of water and its conservation, through uses of technology, among the residents.

References:

1. http://www.worldwatercouncil.org/fileadmin/wwc/Library/WWVision/TableOfContents.pdf
2. https://www.un.org/en/sections/issues-depth/water/
3. https://www.basf.com/in/en/who-we-are/sustainability/future-perfect/stories/urban-water-crisis.html
4. https://economictimes.indiatimes.com/news/politics-and-nation/bengaluru-has-lost-79-of-its-water-bodies-in-the-past-four-decades/articleshow/63425049.cms?from=mdr
5. https://timesofindia.indiatimes.com/india/bengaluru-pune-among-200-cities-facing-serious-water-crisis/articleshow/63411386.cms

Latest News

India water crisis flagged up in global report

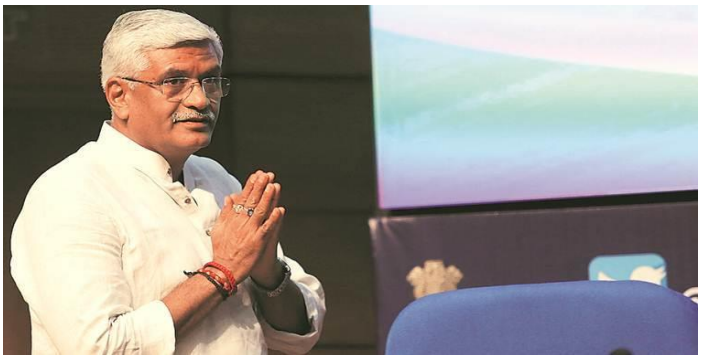
BBC News, 6 August 2019.
The anger over water scarcity is palpable at a farmers' protest in Dharodi village in the northern Indian state of Haryana. Thousands of protesters from several villages have been demanding clean drinking water for nearly a month and half now. Read more at:

River water disputes Bill: Legislation clears Lok Sabha, minister says tribunals didn't do their job

The Indian Express, 1 August 2019

The Lok Sabha passed the Inter-State River Water Disputes (Amendment) Bill, 2019 with a voice vote on Wednesday. The tribunal will be mandated to deliver the final award in two years. Whenever it would pass an order, the verdict would get notified automatically.

Read more at:



New Mexico faces extreme water scarcity on par with the United Arab Emirates. Experts warn more 'day zeros' are looming.

Business Insider, 7 August 2019

Morgan McFall-Johnsen

Sandbars fill the Rio Grande north of Albuquerque, New Mexico. Weather forecasters said sparse rainfall in the US Southern Plains since autumn had caused drought conditions to worsen, especially in the Four Corners region of Colorado, Utah, Arizona and New Mexico.

Read more at:

India world's 13th most water-stressed country: WRI

Down to Earth 8 August 2019

India placed thirteenth among the world's 17 'extremely water-stressed' countries, according to the Aqueduct Water Risk Atlas released by World Resources Institute (WRI). The country is under 'extremely high' levels of baseline water stress, followed by the neighbouring Pakistan.

Read more at:

Chief Minister underlines need for water conservation

The Hindu, 8 August, 2019

Chief Minister Edappadi K. Palaniswami on Wednesday underlined the need for rainwater harvesting and water conservation. Speaking at the 30th anniversary celebrations of the M.S. Swaminathan Research Foundation (MSSRF) in Taramani, he said waterbodies were being desilted through Kudimaramathu scheme.

Read more at:

How to resolve Karnataka water crisis

Down to Earth, 9 August 2019.

At the peak of Karnataka's water crisis, the state's deputy chief minister, G Parameshwara, made a desperate suggestion. He said the government was mulling over a moratorium on the construction of new residential complexes in Bengaluru for five years to tide over the water crisis. Experts debate on whether restrictions on construction or population are an effective way to resolve the problem, or are there simpler ways to strengthen water conservation.

Read more at:

What Does the Article 370 Decision Mean For J&K's Already Troubled Ties With Water?

The Wire, 9 August, 2019

Moving a proposal to abrogate the special status of Jammu and Kashmir, which was guaranteed under Article 370, the Union home minister Amit Shah argued that the move will strengthen democracy and lead to developments in the state.

Read more at:

Pilot project for water conservation inaugurated

The Pioneer, 10 August 2019

In order to make the national Capital self-sufficient in water, Delhi Chief Minister Arvind Kejriwal, along with Union Jal Shakti Minister Gajendra Singh Shekhawat, on Friday inaugurated an underground natural water reservoir to conserve rainwater on the Yamuna floodplain.

Read more at:

Maharashtra reservoirs 70% full, more than last year

Consistent rainfall in Maharashtra resulted into filling the drinking water supplying major reservoirs speedily. These reservoirs has got almost 70% of rainwater storage against 60% last year. It is 10% more than the last year.

Read More

Floods in Kerala, Karnataka: Relief for flood-hit parts of southern India as water level recedes in many areas

In major relief for flood-hit areas of Karnataka and Kerala, rains have eased out as water levels reside in some parts of both these states. According to ANI, in Kerala, the weather is holding even though an orange alert in force till tomorrow (Tuesday) as Integrated Defence Staff keep a close watch and review the situation in the state.

Read more

To check floods, government plans law to manage 13 river basins

In the backdrop of recurring problem of floods and drought in one or the other part of the country, the Centre has planned to manage rivers by adopting basin approach under a law which may help all interstate and central agencies work in a coordinated manner.

Read more

Academic news: scholarships

ADB-Japan Scholarship Program for Developing Countries in Asia and Pacific

ADB/Japan Government
Masters Degree

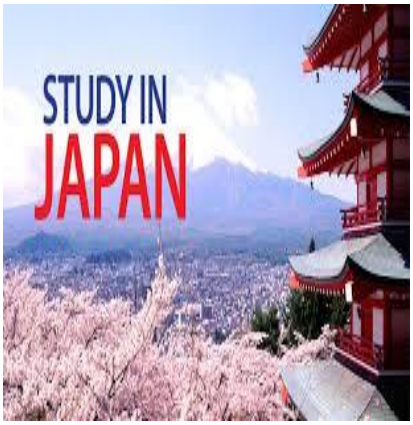
Deadline: varies
Study in: Asia, Australia, NZ

Read More:

Japanese Government Scholarships for International Undergraduate Students

Japanese Government
Bachelor's Degree

Deadline: varies per country
Study in: Japan



Read more:

Inlaks Scholarships

Inlaks Scholarships provide the opportunity to young Indian people with exceptional talent in any field to broaden their vision abroad and improve their skills to operate in society, thus making them a future vehicle of change in their environment.

INLAKS SHIVDASANI FOUNDATION
Scholarships

Read more:

Conference/call for papers:

Everything About Water Expo

August, Thursday 29- Saturday 31

India Exposition Mart Limited, Plot No. 25, 27, 28, 29 Knowledge Park-II
Greater Noida, Uttar Pradesh

15th EverythingAboutWater EXPO
SOUTH ASIA'S LARGEST WATER EVENT

Read more:

International Groundwater Conference on Sustainable Management of Soil-Water Resources

October Monday 21 – Thursday 24
Indian Institute of Technology Roorkee
Haridwar Highway
Uttarakhand

Read more:

World Aqua Congress - International Conference

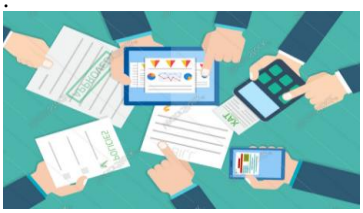
October Wednesday 30 – Thursday 31
India Habitat Centre, Lodhi Road Near Airforce Bal Bharati School
New Delhi

Read more:

Course/ Training Seminar Workshop/Contest:

One-day Pre-Conference Workshop Introduction to Water Ethics

.

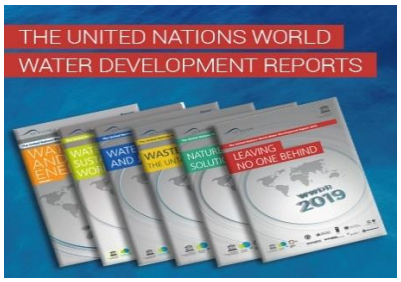


Organised by
Forum for Policy Dialogue on Water Conflicts in India (Pune)
Water-Culture Institute (New Mexico)
Ashoka Trust for Research in Ecology and Environment (Bengaluru)

Where? Bengaluru

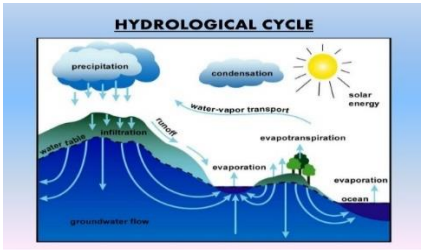
When? 23 September 2019
Read more:

UN World Water Report 2018



Water is an essential element of life as well as the ecosystem we live in. Without water, life cannot be imagined on Earth. Freshwater comprises only 2-3% of total amount of water found on Earth. Thus, this resource has to be used judiciously. According to UN World Water Report 2018, the global demand for water is increasing at the rate of 1% per year and it will continue to grow in future.
Read more:

Hydrology & Water Management degrees



Hydrology and water management deals with global water-related issues such as water quality and water distribution. Hydrology degrees are strongly connected to environmental engineering, but they can also include topics related to policy making and administration of resources. Graduates can become scientific resources managers, hydrogeologists or lecturers.
Read more:

Student Highlights

WSP MSc (2019-2021) students are visiting local wetlands of Surajpur and Dadri

For any comments or queries please contact:

Dr. Kaynat Qazi, Water Programme, C-PACT (Email id: Kaynat.qazi@snu.edu.in Office phone: +91-120 2663 846)

#0007 | January 2020

C-PACT WATER BULLETIN

CPACT & WSP (Water Science Program) presents a monthly news bulletin of latest news from India and abroad on debates, concerns, and events related to water.

Weaving the groundwater and surface water integration into a policy: The Karnataka State Water Policy for the 21st Century

Himanshu Kulkarni
Executive Director, ACWADAM, Pune
Adjunct Faculty, C-PACT, SNU

The drafting of the Karnataka State Water Policy for the 21st Century (2018) was perhaps the first effort of its kind wherein multiple discussions on key aspects of the water crises in the state, water management challenges and the possible solutions to the crises were held. The drafting of the water policy was also quite participatory with many experts contributing different sections of the draft. In many ways, the policy has evolved through a participatory process that led to a policy that not only states the crises around water in the State of Karnataka but also goes on to develop an approach to water resources management in the state, recommending key strategies that would be relevant to the conditions and situations prevailing in different geographies of one of the largest states in India today.

The policy is divided into ten chapters. The first chapter provides the overview of the State's water crisis leading to the second which states the foundation, goals and operations principles on which the approaches and strategies of water management in Karnataka should be based. Chapters 3, 4 and 5 describe the context of water in various sectors in the form of agricultural water use, rural domestic water needs, urban and industrial water needs and also highlights the need for specific strategies on water management that will be potentially relevant to the 21st century. Chapter 6 makes a special reference to the fact that the water crisis is not just about quantities and depletion but also about deterioration in water quality leading to contamination; depletion and contamination of water also lead to serious impacts on ecosystem health. Understanding the problem and developing strategies for improving water quality and ecosystem health form the core aspects of this chapter. Chapters 7 and 8 are on water governance, which must include reforms in operational aspects in water management in the state through a shift in how water-related organisations must operate on one hand and how legal aspects of water management must be improved to protect, manage and conserve water resources in the State. Chapter 9 is on data and knowledge generation while chapter 10 provides steps on the way forward in effective implementation of the new policy.

Water is unitary in nature and flows seamlessly from one sphere of the environment into another and especially from the surface of the earth into the sub-surface and then back to the surface. Integrating the surface water and groundwater aspects into the Karnataka water policy formed one of the highlights of the policy. This was done by first understanding the status of the water sector with regard to groundwater and its integration with surface water. Certain normative principles were used to develop such an understanding and included concepts such as water security for the entire population, integrated approach to managing water resources, improving productivity (especially in irrigation), improving health of watersheds and water bodies and improving water governance.

One of the major highlights of the water policy is the suggestion to understand how seven river basins across ten agroclimatic zones – that show variable rainfall patterns - in the State of Karnataka give rise to a typology of nearly 30000 micro-watersheds and nine principal aquifer systems. Clearly, Karnataka is a state that has enormous

diversity in its hydrology and hydrogeology, with the importance of locally existing natural sources of water such as springs in the head reaches of many of its rivers. As in many parts of India, groundwater depletion, groundwater contamination and depletion in river flows along with the deterioration in natural water bodies such as lakes and ponds constitute the different components of the crisis. These have led to serious cases of water shortages, vulnerabilities and distress.

While identifying the current gaps in the policy and practice responses to various problems and the limitations in certain established approaches to water management in the state, key policy level shifts are suggested, such as replacing dominantly supply-side approaches with integrated supply and demand management ones. However, the main feature of the policy emerges in the form of how strategic points of action have been woven into the document to compliment policy reform. In conclusion, a few of these are listed below:

- Science and data are useful instruments in overcoming uncertainty. Collaboration between scientists and policy makers will help bring in accuracy in estimation and prediction. Accuracy and prediction are especially important because the water environment in the State of Karnataka is not only variable but is rapidly changing.
- Knowledge and skill development on aquifers and groundwater management (PGWM) and irrigation management under PIM must be promoted in such a way that last-mile decisions and actions (by communities) are in line with the principle of Aquifers as Common Pool Resources. Building a cadre of professionals and strengthening capacities of existing cadres will need to be undertaken at various levels to achieve the fruits of PGWM and PIM.
- Data on various aspects of water can be used in catalysing decisions and actions, especially around community – level water security planning.
- Many community-led water management initiatives will require partnerships and collaboration between multiple actors. Facilitation of such partnerships and collaboration must be encouraged through policy and built into the design of various programmes, keeping in mind also that surface water and groundwater will need to be considered together even in local level interventions.
- Experiences from across the country on PIM and PGWM would be useful to draw upon in designing a variety of initiatives in improving efficiency of irrigation systems in Karnataka, while also bringing in a sense of equity, fairness and justice to the water management paradigm of the State.
- Fostering groundwater management in urban areas is important for the State's Water Security. Integrating citizen efforts with government policies and programmes could be the cornerstone for such efforts that could also include systematic groundwater recharge, conservation of wetlands and lakes (seen through the groundwater lens) and demand-management through improved water usage efficiency, equity and social norms.
- Resources for studies and programmes on the revival of springs through restoration of springsheds must be undertaken on a large scale in all the districts that have hill ranges and that play host to spring-water systems. An inventory of springs in Karnataka could be a good way to begin the process.
- State Government Regulation, like the Karnataka Groundwater Act can also be reformed in line with the new policy. It is encouraging to note that the State has taken up a review of the Act in light of provisions made in the Draft Groundwater Model Bill (2016) and is already considering amendments to some sections of the Act while also making addition to the rules. In particular, the Karnataka Groundwater Act must make reference to the principles as articulated in the Draft Model Groundwater Bill, particularly in the context of a strong statement that groundwater is a common pool resource. Moreover, like in the draft model bill, it may be interesting to link water budget to the regulation and nature of management, while also alluding to other policies, programmes and legislation that have a direct bearing on the management and governance of groundwater resources.
- The management of waste water through systematic recycling, reuse and recharge must be considered, particularly in Urban Areas of the state. There is already a lot of traction in the reuse of urban waste water, whether for irrigation or as recharge. Developing tools for the various dimension of waste water RRR is important. Treating waste water as a resource could be a starting point towards bringing about reforms in Waste Water Use. Entitlement, allocation, ownership of waste water generated in urban sources must be clearly specified in the Waste Water Policy.

Latest News

IIT Kharagpur study reveals how drying of Saraswati-like river caused decline of Harappan city Dholavira

A recent study by IIT Kharagpur has for the first time connected the decline of Harappan city Dholavira to a disappearance of a Saraswati-like river that once flowed through the Rann of Kutch.
Read more:

Demarcation of Saraswati on to identify encroachments

To increase the water carrying capacity of Saraswati river and to identify encroachments, the demarcation of the river is being done in Thanesar city.
Read More:

PCMC readies action plan to contain pollution of rivers

Maharashtra Pollution Control Board (MPCB) in December 2019 served a show cause notice to Pimpri Chinchwad Municipal Corporation (PCMC) regarding heavy pollution in Pavana and Indrayani rivers. The board had asked the civic body to submit a time-bound programme to contain river pollution or face action.
Read more:

J&K admin to fell 21 lakh trees to 'reclaim' Wular Lake

The Jammu and Kashmir administration has embarked on a project to cut over 20 lakh trees to "reclaim" the shrinking Wular Lake spread across north Kashmir's Bandipore and Baramulla districts. With the cutting of 2 lakh trees already underway in the first phase, experts advise caution.Read more:

IIT Madras Designed Check Dam Aids Palar River To Store Surplus Rainwater

Funded under CSR by Madras Atomic Power Station (MAPS) at Kalpakkam, the Project Design of IIT Madras Researchers helped save Rs. 49.5 crore.
Read more:

Central Water Commission Panel Inspects Jayakwadi Dam

A committee of experts of the Central Water Commission (CWC) on Thursday conducted an inspection of the Jayakwadi dam in Aurangabad district of Maharashtra. The panel comprising state and central government officials visited the dam and inspected the dam in terms of its security and management, an official said.
Read more:

Academic news: scholarships

Integrated Water Centre (IWC) Scholarships 2019/2020 for International Students to Study in Australia

Read more:

ARES Scholarships in Belgium for Developing Countries

Each year, the ARES offers the chance to pursue a one-year specialised master's degree programme or a 4-to-6-month advanced training course within a higher education institution of the Wallonia-Brussels Federation, Belgium.Read more:

International Water Center Scholarship (IWC) 2020

Masters in Integrated Water Management (MIWM)

Program Period:1 to 2 Years.
Read more:

Conference/call for papers:

LET2020 – The 17th IWA Leading Edge Conference on Water and Wastewater Technologies

The IWA Leading Edge Conference on Water and Wastewater Technologies is designed to be the place where new ideas are introduced and the opportunity is provided to interact with the "best of the best". This is the global conference where new insights into how pioneering science, technological innovation and leading practices shape the major transformation in water management that is underway.
Read more:

The Global Summit on Waste Water Treatment & Reuse

The Annual Global Summit on Water & Wastewater Treatment & Reuse (GSWWTR), scheduled for 30th- 31st January 2020 at Hotel Le Meridien, New Delhi, India, brings together Industrial and Municipal wastewater professionals, providers of water and wastewater treatment technology & consultants to discuss challenges, efficient solutions and presents the latest thinking and technology to help solve our country's Waste Water challenges.Read more:

13th Annual Global Water Alliance Conference 2020

The Global Water Alliance (GWA), an international NGO, is organising the GWA conference 2020 with an aim to achieve WASH sustainability goals for developing countries.
Read more:

Course/ Training Seminar Workshop/Contest:

Water Heroes - Share Your Stories Contest

The "Water Heroes – Share Your Stories" Contest is being launched by Department of Water Resources, River Development & Ganga Rejuvenation; Ministry of Jal Shakti, Government of India with the objective of promoting value of water in general and for supporting country-wide efforts on water conservation and sustainable development of water resources.Read more:

International Seminar on Sustainability Issues in Water and Energy - Nanotechnology Solutions

The International Seminar on Sustainability Issues in Water and Energy - Nanotechnology Solutions aims to Discriminate information on the latest trend in research in the areas of air, water and energy, Identify research areas relevant to sustainability of air, water and energy, form the group of researchers to collaboratively work on the above areas and Contributing to making the world better. Read more:

5th Edition of India Industry Water Conclave

The Conclave provides a platform to showcase best practices, deliberate on policy issues and highlight sustainable water management practices.
Read more:

Student Highlight

Field work Semester 3: Training in watershed management

Samaj Pragati Sahayog (SPS), Dewas, Madhya Pradesh (August 2019)

The module is prepared with the objective that the students become fully capable of implementing and managing integrated watershed development projects on their own. Students get a first-hand exposure to field experiences of watershed management. They get to understand the need for watershed management, the ridge-to-valley approach and participatory planning methods used, the details of watershed structures constructed as well as the social issues that arise during implementation. The students will get to understand both the supply-side (water conservation and storage) and the demand-side (water use in agriculture) aspects of watersheds, the rationale of watershed structures, their location, design, construction and maintenance aspects. They will get hand-on experience in developing watershed treatment plans, integrating demand-side and supply- side aspects, with costing and physical and financial planning.

For any comments or queries please contact:

Dr. Kaynat Qazi, Water Programme, C-PACT (Email id: Kaynat.qazi@snu.edu.in Office phone: +91-120 2663 846)

****

#0008 | February- 2020

C-PACT WATER BULLETIN

CPACT's WSP (Water Science and Policy) program presents a monthly news bulletin of latest news from India and abroad on debates, concerns and events related to water.

Do we understand our ecosystems?

Moumita Karmakar, Assistant Professor, C-PACT, SNU

For the past two years, students of WSP have undertaken field trips to a bird sanctuary at Surajpur (28°31.425´N, 77°29.714´E) in Tehsil Dadri, District Gautam Buddha Nagar, not so far from SNU. The purpose was to understand the challenges involved in protecting aquatic ecosystems from multiple stressors, such as changes in land-use through rapid urbanisation and the effects of climate change. The Surajpur bird sanctuary is part of a reserve forest. It is home to many species of flora and fauna and comprises a rainfed water body of approximately 60 hectares in area, which provides a good example of a freshwater natural wetland within an urban setting. Such natural urban wetlands are complex aquatic ecosystems, and of enormous ecological importance in India.

The water body receives water from the Tilapta irrigation canal, which is part of the Ganga canal. The Ganga canal was closed for cleaning between September and October in 2019, because of which the flow of water into the Tilapta canal, and into the wetland, decreased sharply. When we visited the Surajpur bird sanctuary on 2 November 2019 we found the water level low and algal production rather high (Fig. 1).

Fig. 1. The water level at a spot in the Surajpur wetland had fallen in 2019

This, however, is no ecological surprise. Closing canal systems even for very short durations alters the hydrological settings of the entire wetland ecosystem and its physical, chemical and biological properties. Figure 2 explains the reasons.

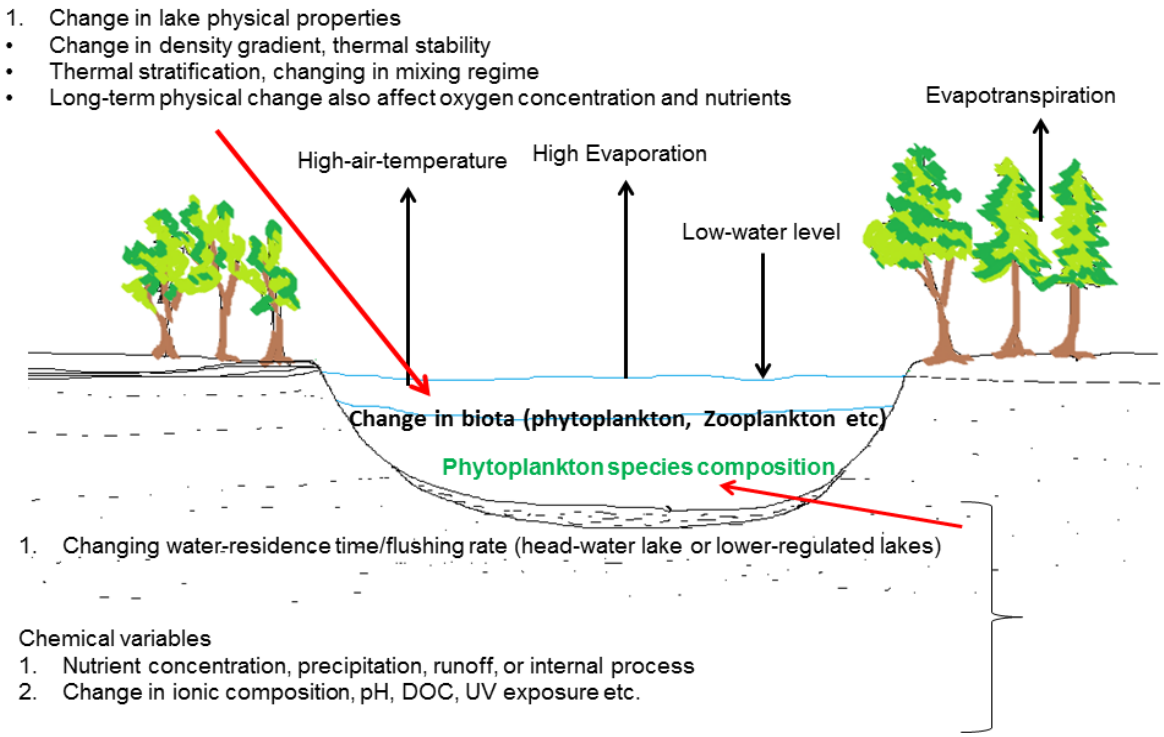


Fig. 2. Interactions among different physical and chemical properties in aquatic systems can raise the primary production of phytoplankton

A fall in the water flow or precipitation raises the ion concentration in an ecosystem to cause such a limnological change. The algal communities are extremely sensitive to changes in their environment, as changes in the physical conditions of a lake or aquatic system strongly affect phytoplankton communities. The mixing of water columns influence nutrient availability and, consequently, phytoplankton production. The enrichment of nutrients (phosphorus and nitrogen) within a wetland enhances the primary production of phytoplankton, and water transparency and light penetration increases (because less dissolved organic carbon is transported from the catchment). An ecosystem is thus highly complex: it has many components and their interactions are nonlinear, and its dynamics can be unprecedented. Moreover, anthropogenic activities shape an ecosystem and modify its structure and function, and self-reinforcing processes can shift and lead to temporary or permanent 'regime shifts'. Anthropogenic activity and climate change have accelerated eutrophication in an aquatic system, and we can know the effects better through enquiries into the responses of aquatic systems to changes in their environment.

Climate change affects terrestrial and aquatic ecosystems worldwide, and shallow lakes and ponds have proved to be especially vulnerable. The Surajpur wetland has experienced urbanization, land-use change and low water levels for certain periods. These may have destroyed the habitats of many floral or faunal species despite the several conservation initiatives. The fieldwork to the bird sanctuary has shown that we need a much better understanding of how aquatic systems function, if we hope to create informed decision-making processes, and develop and implement effective conservation strategies and environmental policies.

References:

https://www.thehindubusinessline.com/news/national/ganga-canal-closed-for-cleaning-to-affect water-supply-in-15-up-districts/article29602841.ece
https://www.dailypioneer.com/2019/state-editions/ganga-canal-closed-till-diwali-for-cleaning.html

Latest News

Piped Water Scheme to get Rs 11,500 Crore in 2020-21

Presenting the 2020 Union Budget, Finance Minister Nirmala Sitharaman said that the Jal Jeevan mission to provide piped water supply to rural households would get a budget of Rs 11,500 crore in the year 2020-21. This allocation will be part of the Rs 3.6 lakh crore mission, which aims to achieve its goal by the year 2024. Read More:

Budget 2020: ₹4,400 crore for clean air, ₹11,500 crore for clean water - and warnings to polluters

The government also allocated a total of ₹11,500 crore for clean water.

Read more:

Andhra Pradesh State Govt Planning To Implement Water Drome Facility In Krishna River

"State government of AP and Ministry of Civil Aviation are planning to implement water drome facility near the Krishna river. Read More:

1,000s of fish 'poisoned' to death in Chennai's Tiruneermalai lake

Thousands of Catla fish, varying from two to four feet, were found floating dead in the Tiruneermalai lake on Saturday morning. The deaths are due to rampant pollution, allegedly caused by industries in the vicinity. Read More:

Budget 2020: Extra earnings for farmers through solar pumps

In a bid to replicate the Gujarat experience of solar pumps on national scale, the Union Finance Minister Nirmala Sitharaman has announced a major initiative towards creating an additional income source for the farmers through solar power generation. Read More:

National Institute of Oceanography launches study on changing monsoon trends

KOCHI: With climate change triggering extreme weather events and changes to the monsoon pattern, the National Institute of Oceanography (NIO) at Goa has launched a study into the causal factors and impact. Read More:

Academic news: scholarships

Monash University Microbiology in Water Engineering Scholarship 2020

Monash University, Australia, invites applications for scholarships in Microbiology in Water Engineering for 2020 from undergraduate and postgraduate students. The scholarships are for environmental engineering (especially water engineering) and public health protection (in particular microbiology/ epidemiology), and is of AUD 5,000.
Read more:

Environment Water scholarships 2020 – 2021

NEW ZEALAND
MINISTRY OF FOREIGN AFFAIRS & TRADE

New Zealand Scholarships for international students. Fully Funded to study at University of Auckland, Auckland University of Technology, Lincoln University New Zealand, Massey University, University of Canterbury, University of Otago +2 More

Undergraduate, PhD, Bachelor, Masters, Postgraduate courses
Read more:

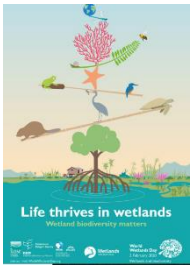
ACWA scholarships 2020-21

ACWA awards several different scholarships each year to qualified graduate and undergraduate students majoring in water resource-related fields. Online applications for the upcoming 2020-21 academic year are now available.

Read more:

Conference/call for papers:

Life thrives in wetlands: An Event



To mark the World Wetlands Day, Wetlands International South Asia is organizing a half-day event on 2 February 2020 at India International Centre, New Delhi. Read More:

Conference: Approaches to Shaping Climate Resilient Agriculture

To be held on 28 February 2020 at The Lalit Ashok, Bengaluru.

Read more:

One Day National Conference: Water Resources: Remediation & Rejuvenation

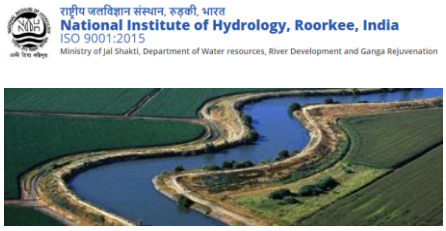
On 26 February 2020 at University of Mumbai. The Conference shall address the current state of challenges, future pathways, different technologies and institutional solutions to accelerate the implementation of water-related Sustainable Development Goal and the 2030 Agenda targets at 'leaving no one behind". Read more:

Course/ Training Seminar Workshop/Contest:

Training School: Hydrogeological Tools and Methods to Decipher Aquifer Characteristics

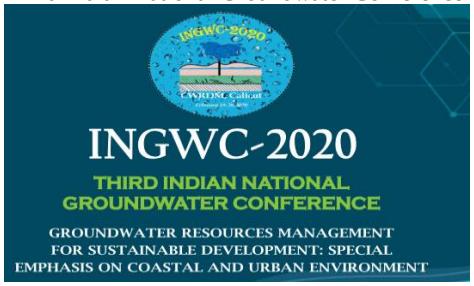
The Watershed Organisation Trust is organizing the training school from February 25—29, 2020.
Read more:

Training Course: Hydrology For Water And Sanitation (11-14 February 2020).



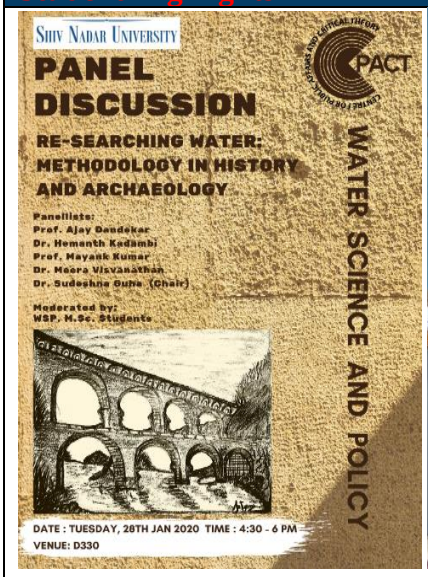
Offered by the National Institute of Hydrology, Roorkee, February 11—14, 2020
Read more:

Third Indian National Groundwater Conference



February 17—20, 2020, Kozhikode, Kerala.
Read more:

Student Highlights



28 January 2020, *Panel Discussion on Re-searching Water: Methodology in History and Archaeology* organised by the M.Sc. students of WSP

For any comments or queries please contact:

Dr. Kaynat Qazi, Water Programme, C-PACT (Email id: Kaynat.qazi@snu.edu.in Office phone: +91-120 2663 846)

#009 | June - 2020

C-PACT WATER BULLETIN

CPACT & WSP (Water Science Program) presents a monthly news bulletin of latest news from India and abroad on debates, concerns, and events related to water.

Traditional Water Harvesting Systems of India

Tenzing Saldon, Research Associate, C-PACT

Traditional water harvesting systems are back in fashion! India, after having gone through an extended 50-year phase of constructing big dams and canals, is once again being forced to look at its traditional, small scale water harvesting and management systems; especially amongst grassroots organizations which are working with people to develop cheap water management systems that can be managed by the communities locally (Dying Wisdom Review, 2018). Indian history provides several examples of traditional water harvesting techniques that incorporate not only rainwater and groundwater but also surface water harvesting, such as streams, rivers and even floods (Shanmugam, 2020). For example, the *Arthasastra* provides evidence of the knowledge of rainfall regimes, soil types and appropriate irrigation techniques in different micro-ecologies (Nair, Singh, & Gupta, 2020). The examples show the existence of traditional water harvesting systems as part of well-organized hydraulic systems and well-planned water circulation systems. Of the various traditional water management systems a few core principles stand out as common and critical.

Pic 1: Sangani tank, Sivagangai District, Tamil Nadu (courtesy, Bhavani Seenivasan)

Firstly, they were locally relevant and not based upon the understanding that a 'one size fits all' solution could be applicable. Evidence also suggests that developments of harvesting structures were different for different ecological regions, showing an in-depth knowledge of India's ecological diversity (Dying Wisdom, 1997).

Secondly, local communities maintained the traditional structures. Traditional water-harvesting systems used in rural India played a very important role in empowering local communities, creating economic wealth in poor villages, promoting integrated village ecosystem management – a form of sustainable development which had the potential to alleviate rural poverty and unemployment, and in the overall improvement of the nation's environment (Review Dying Wisdom: Rise, Fall and Potential of India's Traditional Water-harvesting Systems, 2020).

Thirdly, traditionally systems were made to align with the flows in nature – with a fair share for the environment which today we call the e-flows. Whereas, modern systems are yet to find a balance with the way nature works, ancient structures such as these were not built randomly. In fact, behind these water harvesting structures genius engineering was at play. For example, tanks in Karnataka built during colonial times did not allow any water to overflow (Iyengar, 2007).

Another example of such structure is the Dabbehalla tank at Sirsi which is 125 feet in length and eight feet in height and was built by the Shiliga tribe of Uttara Kannada District about 40 years ago. The structure still stands today ensuring water availability throughout the year. This structure was born out of a traditional experience called *Jarukattu*, or allowing free flow of floodwater during the rainy season so that water collected in pits, and could be used during the summers. They offer instances of "success stories" as opposed to instances where modern dams of concrete and iron have been reduced to rubble during heavy rainfall (Kalav, 2007). Apart from this there are other examples where acute water crises due to droughts, floods, rapid urbanization etc. have been tackled through the revival of traditional systems. For example, in Bhap, Rajasthan, a structure called *nadi* built in the 1960s, is a traditional and ancient practice of creating water-harvesting structures. Restored after the region was in a drinking water crisis in 2014, it has proved important for live stocks as well. The restoration project was undertaken by the local Gram Panchayat in collaboration with CAIRN CSR representative of Barmer Unnati (Kumar, 2017).

The revival of traditional water harvesting systems have provided opportunities for solving the ongoing water crisis. Sometimes these methods have fulfilled the requirements of the people in a more effective way, more so as they are simple and easy to carry out by the community. Being highly cost-

effective and sustainable, they also ensure an adequate supply of availability for all which helps us form the basis of development and prosperity. Learning and applying the knowledge from traditional water harvesting systems will eventually lead us to better water security.

Bibliography

Dying Wisdom. (1997). In A. Agarwal & S. Narain, *State of India's Environment (Volume 4).* CSE. Retrieved March 2020

Dying Wisdom Review. (2018, March). *Down to Earth*. Retrieved March 2020

Iyengar, S. (2007). *Waternama - A collection of traditional practices for water conservation and management in Karnataka.* Bangalore: Communication for Development and Learning. Retrieved January 2020

Kalav, S. (2007). Water Traditions. In S. Iyengar, *Waternama.* Communication for Development and learning. Retrieved January 2020

Kumar, R. (2017). *Revival of traditional water harvesting structure by Vedanta Cairn.* India CSR Network. Retrieved January 2020

Nair, S. S., Singh, S., & Gupta, D. A. (n.d.). Traditional water management systems for drought mitigation in India. *The Water Digest*. Retrieved January 2020

Review Dying Wisdom: Rise, Fall and Potential of India's Traditional Water-harvesting Systems. (n.d.). *Environment & Urbanization*. Retrieved January 2020, https://www.environmentandurbanization.org/dying-wisdom-rise-fall-and-potential-indias-traditional-water-harvesting-systems

Shanmugam, C. R. (n.d.). *Revival and Management of Traditional Water Harvesting Systems.* Retrieved January 2020

Pic 2: Traditional pond in Madurai district (courtesy, Bhavani Seenivasan)

Latest News

Covid Derails Rejuvenation of Chennai lakes

The ongoing Covid-19 pandemic has delayed rejuvenation of four important lakes and the Buckingham Canal in Chennai.

Read more at:

Telangana Government Set to Challenge Godavari River Management Board's Objections to Projects at Apex Council

Telangana government is reportedly set to challenge the Godavari River Management Board (GRMB) direction to stop construction of all projects on Godavari river in the Apex Council meeting to be held in June.

Read more:

Bhakra Beas Management Board Generates 43% Surplus Power during April-May

The Bhakra Beas Management Board (BBMB) has surpassed its power generation target for the first two months of this fiscal by about 43 per cent.

Read more:

Nature, Not Man, Has Greater Impact on Monsoon, says Study

Work by a team of researchers from China, UK may help unravel mystery over the fluctuating pattern of monsoon

Read more:

Mumbai gets 50% Rainfall for June in First Fortnight, Shower Expected until Thursday

In the first fortnight of June itself, the Meteorological department at Santacruz observatory recorded 50% of the required rainfall for the month.

Read more:

PepsiCo Foundation Commits $3 million for Safe Water in Bengal and Maharashtra

The PepsiCo Foundation has committed to invest $3 million with the NGO "WaterAid" to provide safe water access to agricultural communities and help women in high water-risk areas in West Bengal and Maharashtra.

Read more:

Academic news: scholarships

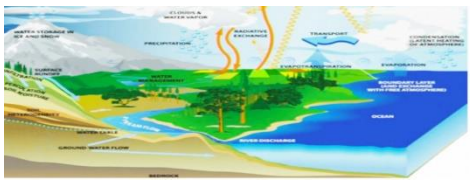
Rotary Scholarship for Water and Sanitation Professionals

The strategic partnership between The Rotary Foundation (TRF) and IHE Delft Institute for Water Education aims to tackle the world's water and sanitation crisis by increasing the number of trained professionals to devise, plan, and

Fully-Funded International PhD Scholarship in Water Chemistry and Microbiology, Australia

Candidates from all over the world are invited to apply for the Fully-Funded International PhD Scholarship at Curtin University in Australia.

WMO Fellowships



WMO is partnering with IHE Delft to jointly support two to three fellowships a year from developing and least developed countries to

implement solutions in developing and emerging countries. For MSc programmes starting in October 2021, the application deadline of the Rotary scholarship is 15 April 2021. Read more:	Studentship available for pursuing a PhD in Water Chemistry and Microbiology for the academic year 2020-2021 Read More:	undertake an MSc in one of the agreed IHE Delft programmes. Read more:

Conference/ Course/ Training Seminar Workshop/Contest:

Online webinar: Women and Resilience in the Water Sector

The panel included presentations focusing on the importance of women in taking control of discussions and debates regarding their role in the water sector. This included not only their strong voices, but for them to take a more active role in measuring and monitoring.
Read more:

Online Training on the Basics of Decentralized Wastewater Treatment and Local Reuse

Course Dates: 01 June – 26 June, 2020

Total Study Hours: 24 hours

Commitment: 6 hours a week

Read more:

ACWADAM's Online Foundation Course on Groundwater Management

Given the COVID-19 crisis and travel restrictions, ACWADAM will continue in its conduct of the foundation course on groundwater through an adapted online version.
Read more:

Graduating batch of WSP MSc. 2020

For any comments or queries please contact:
Dr. Kaynat Qazi, Water Programme, C-PACT (Email id: Kaynat.qazi@snu.edu.in Office phone: +91-120 2663 846)

****

#0010 | August - 2020

C-PACT WATER BULLETIN

CPACT & WSP (Water Science Program) presents a monthly news bulletin of latest news from India and abroad on debates, concerns, and events related to water.

Water-Tourism-Consumption-Waste (Ladhak)

Sreedeep Bhattacharya, Associate Professor, CPACT

The carbon footprint of popular culture has rarely left such footmarks on an entire landscape like it has in Pangong in the last few years. The impact of the movie *3 Idiots* (2009) is so widely felt and visible that it does not really call for a before-after analysis of one of the most spectacular lakes in the world. Jaw dropping records from Leh Tourism reception center reveals that numbers went up from 77,800 in 2010 to 1,48,588 in 2011, which apparently is more than half of the entire population of the entire region of Ladakh. Between 2014-17, five and a half lakh tourists visited Ladakh out of which 2016 alone recorded close to two lakhs. There are close to 7000 taxis functional during the peak season between May-August and the number of tents along Pangong has significantly gone up. Popular imageries have encouraged tourism through simulated images that project the space as a site of fantasy and pleasure waiting to be collectively gazed upon. Construction and consolidation of such a gaze is often mediated through signage, which in this case is the massive commodification of areas surrounding the shooting-points of *3 Idiots*' climax scene, near Spangmik village. A range of eating, staying and selfie-points are named after the fictional figure – Rancho. The plantation of the replica of a yellow scooter (used by Kareena in the last scene) aims to take the simulated experience closer to the staged-authenticity, offering an easily identifiable signpost for visual consumption.

Tourism has flourished in Ladakh in the last decade also because of massive improvement in road conditions after the war in Kargil – making the road trip way more pleasurable. Frequent flights from Delhi make it possible to fly over the rouge terrain in no time these days. But, one must realize that it needs a lot of commodities transported from elsewhere to counter the challenge and restrictions imposed by a high altitude desert devoid of vegetation and to serve the ever-desiring tourists wanting to carry homely comforts no matter where they go.

Pleasure seeking requires delivery of facilities such as running hot water, western commode, well-cushioned beds, tasty food, clean water and many such amenities. In the absence of an exhaustive list of typical visiting and shopping sites selling a vast array of predictable tourist experiences, the restless tourist can often get bored here and seek all the comfort in the tent after reconciling with the absence of specific and predetermined sites of simulation. Hence more and more home stays give away to luxury tents. Most tourists are eager to perform the familiar even in a space that is so unusual. Such a scenario is apt for the entry of everything that is a part of a 'package' – packaged trip, packaged food, packaged water, packaged comfort of luxury tents. As the mercury touches subzero temperatures in October, the rush of organized mass tourists wanting all the domestic comforts and a possible duplication of their household facilities finally come to an end. Seeking familiarity of food, comfort, connectivity in one of the most environmentally sensitive zones lead to visually predominant abundance of trash and tremendous tampering of the local eco-systems. Along with the leftovers of one-time-use commodities, they leave being traces of their horrendous comfort-seeking desires in an otherwise inhospitable geographical locale.

Makeshift arrangements of superior self-indulgent materials lay barren – stripped off its flesh with bones exposed – often leading to the worst form of visual pollution against such a breathtaking backdrop. A sensational backdrop that otherwise deserves an immersive pause has been converted into consumerist rubble to cater to mass tourism.

While the upsurge of tourism in recent years may have provided livelihood to several families across Ladakh – increasing their consumerist aspirations – the increased tourist flow has lead to the betterment of services desired by the packaged-tourists and creation of pockets of seasonal spectacles to be abandoned soon after the tourists depart. The material excess consumed during the season lay abandoned waiting for yet another onslaught in the next season. Even though Government of India has declared Pnagong as a cold desert sanctuary and The High Court has issued all illegal business establishments to be removed from the vicinity, pictures prove otherwise. Most of these tentareas are leased out by locals for a sum of one lakh rupees per season to people mostly from Leh. Those who take it up on lease make that much in a week's time during the peak of a season. In my last five visits in the last eight years, I have observed additional makeovers on the shore of Pangong. Thousands of tourists visit Pangong everyday and the numbers are bound to increase in the coming years. The covered-up basins, commodes and pipes gaze at the uninvited tourist strolling in the off season as fragments of its former self and the lake-view is absolutely damaged by the chaotic assemble of these ruinlike materials.

To read full paper, click: https://journal.equinoxpub.com/JCA/article/view/18842

Latest News

Government Trying To Undertake Ganga-like Rejuvenation Of 5 More Rivers: Official

A scientific study on the lines of the Ganga river cleaning project will be done for Periyar, Cauvery, Godavari, Narmada and Mahanadi, another official added.
Read More:

NGT Directs Delhi, Haryana To Prepare Environment Plan For Najafgarh Lake

The controversy over declaration of Najafgarh Jheel (lake) as a water body, falling both in Delhi and Gurgaon in Haryana, led the National Green Tribunal Friday to direct both the governments to prepare an environment plan to prevent encroachments and construction in the area.
Read more:

UP govt to install 8,000 solar borewells, 35 per cent in Purvanchal districts

The details emerged during Chief Secretary Rajendra Kumar Tiwari's assessment of action plans prepared by various departments for the overall development of Purvanchal districts of the state.
Read More:

Need to focus on agriculture, water resources, financial inclusion and skill development: Study

Government needs to focus on areas such as agriculture, water resources, financial inclusion and skill development under the aspirational district programme, a study assessing the impact of the aspirational district programme has suggested.

Read more:

WB govt to provide tap water supply to 55 lakh households by March next year: Official

The West Bengal government has set a target to provide 55 lakh households in the state with tap water supply by March next year, a senior official said on Monday.
He said the government has decided to provide tap water supply to at least 20,000 households daily under the "Jal Swapno" scheme and work for the same will start from October.
Read more:

Bihar man digs 5-km canal to bring water to his village

A man in Bihar's Gaya district has carved out a 5-km canal in over 20 years to bring irrigation water to the fields in his village.

The feat of Loungi Bhuiyan, a resident of Kolithwa village, makes one recall the toil of 'Mountain Man' Dashrath Manjhi, another native of Bihar who cut a road through a hill near his village in 22 years.
Read more:

Academic news: scholarships

Applications Invited for IWC Water Leadership Program Scholarship 2020/2021

For the 2020/21 round we are offering a total of 5 scholarships:

Two (2) scholarships funded by IWC (1 x full scholarship*, 1 x half scholarship*)
Two (2) scholarships funded by Clearwater (2 x full scholarships*)
One (1) scholarship funded by NSW Water Directorate (1 x full scholarship**)
Read more:

Queen Mary bursaries and scholarships

Worshipful Company of Water Conservators bursary
Level: Masters
Course: MSc Water and Environmental Management
Country: United Kingdom
Value: Up to £4,000
No. of awards: Various
Deadline: Thursday 5th August 2021, 5pm
Read more:

International Water Centre Scholarships for International Students

nternational Water Centre
Masters (MS) Degree

Deadline: 1 Aug 2020 (annual)
Study in: Australia
Next course starts Feb 2021
Read more:

Conference/ Course/ Training Seminar Workshop/Contest:

Training-cum-Workshop on "Overview of Water Resources Sector in India" through Distance Learning for Media Professionals

Government of India
Ministry of Jal Shakti
Department of Water Resources, River Development & Ganga Rejuvenation

Department of Water Resources, RD & GR, Ministry of Jal Shakti is functioning as "Centre of Excellence" in the field of training and capacity building to water sector professionals in the planning, development and management of water resources.
Read more:

5th International Conference Water resources and wetlands

9 September 2020 09:00 - 13 September 2020 18:00, Tulcea, Romania

Read more:

The 2nd International conference on Water Resources in Arid Areas (WRAA2020) in Oman

21-24 Sep 2020 – Sultan Qaboos University, Oman
Read more:

Students News

ORIENTATION PROGRAMME: 17th August 2020
M.Sc. WATER SCIENCE AND POLICY

For any comments or queries please contact: Dr. Kaynat Qazi, Water Programme, C-PACT (Email id: Kaynat.qazi@snu.edu.in Office phone: +91-120 2663 846)

****

#0011 | October - 2020

C-PACT WATER BULLETIN

CPACT & WSP (Water Science Program) presents a news bulletin of latest news from India and abroad on debates, concerns, and events related to water.

Ken-Betwa: Exploring the Interlinking of Rivers

Shipra Singh

(M.Sc. student, Water Science and Policy, SNU)

Access to freshwater, to produce food for people, plants and animals, to operate industries and provide drinking water for cities, is a major challenge. Rivers have always been a source of freshwater. Many rivers have seen many civilizations settling and evolving on their banks. They have shaped our landscape, carried nutrients through their flows, silt and sediments. As habitats, homes and breeding grounds, for many plants and animal species they are significant components of the environment. The ecosystem services that rivers have provided human beings are a gift of nature; signifying an inalienable right to life that rivers have. With the advent of industrial revolution, mechanization and pollution, excessive water withdrawal and greed for maximizing growth have threatened these rivers and life in and around them.

The concept of "interlinking" is a colonial legacy from the British era where interlinking production terrains through railway routes was a means to expand trade. The Government of India is now determined on interlinking of rivers, as a means to address the present water scarcity in various parts of the country. The main objective behind this is to transfer the surplus waters from some river basins to deficit river basins (Goparaju et al, 2017). The massive "Garland Project" aims to link 14 Himalayan and 16 Peninsular rivers. The concept was initially proposed during British rule around 1839 by Arthur Cotton to link the rivers as a means of inland transportation. Later in 1982, the Government of India established National Water Development Agency (NWDA). The idea of river interlinking was then taken forward by the former President of India, A.P.J. Abdul Kalam (Islam, 2006). The stated benefits from this project include employment generation, poverty alleviation, hydropower generation (estimated to be approximately 34GW annually), increased irrigation potential, fishing and tourism, flood and drought mitigation and much more.

Ken-Betwa Interlink has been proposed to be the first and is expected to divert 659 million cubic metres from Ken river to the Betwa river and is expected to cost around 9000 crores. The basin areas covered by the two rivers include the Bundelkhand region. The project aims at working in two phases. Phase 1 constitutes of construction of an earthen and a concrete filled dam near Daudhan village along the Ken river with its height reaching up to 73.5m. The estimated cost is around Rs. 9000 crores and it has the capacity to irrigate around 6 lakh hectares of land in Panna, Chhattarpur, Tikamgarh districts (Madhya Pradesh), and Banda, Mahoba and Jhansi (Uttar Pradesh). As the region of Bundelkhand is drought prone, this project is aimed at mitigating droughts and reviving the dried-up water bodies in the region. The project has been considered to be a cost-effective solution for ensuring food and water security.

While the economic benefits have been considered, the associated environmental and ecological impacts have not been properly acknowledged. The concept of 'surplus' and 'deficit' itself is also not very clear. In nature there are no surpluses or deficits in the flow of a river; even a monsoonal flood or the

seasonal drying of the river bed are part of the natural cycle of a river. The objective of transferring water from full flowing rivers to rivers in drought prone regions without considering the consequences in terms of geological, hydrological and ecological parameters, is flawed. The area near Daudhan Dam passes through Panna National Park which is home to several keystone species, especially tigers. The national park has also been a part of Project Tiger1973 and is spread over 560 sq km of area that encompasses districts of Panna and Chhatarpur in Madhya Pradesh. In addition to that, both Ken and Betwa rivers are a habitat for various species such as ghariyals, crocodiles, snakes, fishes and aquatic fauna and more than 300 species of birds. The wildlife in these river basins comprises of leopards, sambhar, deer, antelope and trees such as teak, ebony, ash tree, mahua etc. which are revered and also form a part of the basic food chain. In addition, it is known that this project will affect the local geohydrology, cause the depletion of aquifers, change in river flow patterns, cause social and cultural disruption, and also increase river sharing disputes. These impacts along with the extreme impacts on habitat loss and biodiversity loss which affect the environment, make the current cost estimates of the project miniscule and highly under-estimated. The geography, hydrology, geology and ecology of Bundelkhand region need to be clearly understood and analyzed, with people's participation, before giving environmental clearance.

With the technological advancement and engineering approach, societies have always taken steps taken to control the rivers and their flows and taming them according to the society's own needs. The concept of interlinking is broadly focused on supply side management and changes are made on the basis of this concept in the policy realm. The examples of river interlink are not just limited to India, but also globally such as in China and Bangladesh. There is a need to abolish the concept of "dams;" despite being considered the "temples of modern India." They represent the logic of capital investments and huge infrastructure, proving that environmental problems can only be solved by technocratic approaches that subjugate and control nature. A project like the Ken-Betwa interlinking will bring numerous plant and animal species to the verge of extinction (Bandyopadhyay and Parveen, 2004). There is a desperate need for firm scrutiny of the policy and decision-making processes towards interlinking rivers. An environmental justification and action plan (and not a techno-fix) is crucial for successfully addressing water problems.

References:

1. Bandyopadhyay, J., Parveen, Shama. Interlinking of Rivers in India: Assessing the Justifications, (2004), pp. 5307-5316.

2. Goparaju, Laxmi. Ahmad, Firoz. Thakkar, Himanshu. Submergence analysis of the proposed Ken Betwa Dam (Madhya Pradesh) India, using geospatial technology in Environmental Impact Assessments, (2017), pp. 18-28.

3. Islam, Nazrul. (2007), IRLP or the Ecological Approach to Rivers, (2007), Vol.41, pp.1693-1702.

4. National Water Development Agency
(Website: http://nwda.gov.in/content/innerpage/about-us.php)

5. Jhala, Y.V., Qureshi, Q. and Nayak, A.K. (eds) 2020. Status of tigers, Copredators and prey in India, 2018. National Tiger Conservation Authority, Government of India, New Delhi, and Wildlife Institute of India, Dehradun.

Latest News

NABARD launches refinance scheme for WASH programme, earmarks Rs 800 cr for FY''21

In a bid to promote sustainable and healthy lifestyle in rural areas, National Bank for Agriculture and Rural Development (NABARD) on Thursday announced a special refinance facility to support the government''s Water, Sanitisation and Hygiene (WASH) programme.
An amount of Rs 800 crore has been earmarked for this purpose for the financial year 2020-21, NABARD said in a statement.
Read more:

J&K to complete Jal Jeevan Mission by 2022

The Administrative Council (AC), which met here under the chairmanship of Lieutenant Governor, Manoj Sinha, approved the proposal of the Jal Shakti Department to modify the roadmap for ensuring 100% piped water supply in rural areas under Jal Jeevan Mission by December, 2022 owing to the COVID- 19 pandemic induced delays.
Read More:

Centre notifies revised guidelines for ground water use; prohibits new industries, mining projects in 'over exploited zones'

Centre notifies revised guidelines for ground water use; prohibits new industries, mining projects in 'over exploited zones'

Read more:

2.25 lakh people affected due to fresh wave of floods in 9 Assam districts

The flood situation in Assam remains grim as more than 2.25 lakh people have been affected across the state.
The water levels of the Brahmaputra river and its tributaries have been rising following incessant rains in the last few days.
Read More:

Govt. scraps 2014 order on inter-State water disputes

The Water Resources Department has scrapped a 2014 order which sought to prevent the release of information regarding inter-State water disputes under the Right to Information Act.
Read more:

Goa becomes first 'Har Ghar Jal' state by providing tap water connections in rural areas

Goa has become the first 'Har Ghar Jal' state in the country by providing 100% tap water connections in rural areas covering 2.30 lakh households, the Jal Shakti Ministry said on Friday.
Read more:

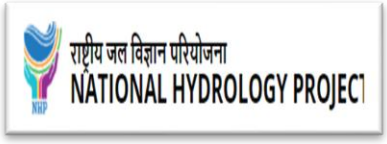
Academic news: scholarships

IIT Kharagpur School of Water Resources Junior/Senior Research Fellowship 2020

Read More:

Webniar Learning:2 weeks GIS & RS application to water resources

(07/12/2020 - 18/12/2020)



A Geographic Information System (GIS) is designed to capture, manipulate, store, analyze, and manage data.
Read more:

Online Course
Water Resources Management and Policy

University of Geneva

Read more:

Conference/ Course/ Training Seminar Workshop/Contest:

E-Conference

GLOBAL WATER CONGRESS 2020

2nd, 3rd & 4th October 2020, Digital Conference & E-Competition. GLOBAL WATER CONGRESS 2020.

Read more:

National E-Competitions

NWater Conservation

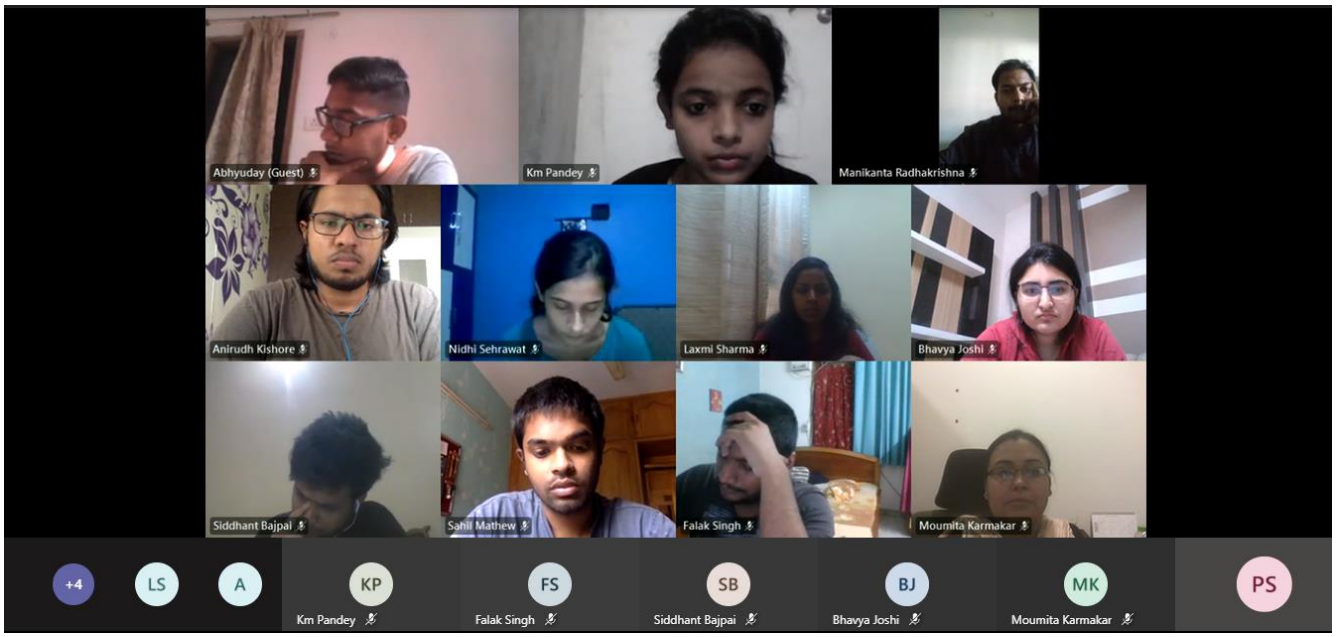
Sustainable uses of water: domestic, agriculture and industrial
River conservation
Ponds and Lakes restoration
Rain water harvesting
Global water key issues: pollution, scarcity, conflict & wastageational E-Essay Writing Competition
Read more:

Call Of Abstracts For Oral And Poster Presentation:

the participants are invited to submit their abstracts and full length papers on the theme and sub themes of the Conference. The abstracts will be released in 'Souvenir and Abstract Book' during the Conference, while selected full length papers will be published freely in 'International Journal' or Proceedings of the Conference or Edited Book. The participants may send their abstracts by 30th August, 2020
Read More:

Student Highlight

WSP M.Sc. (batch of 2020-22): Enjoying online classes since August 2020



For any comments or queries please contact:

Dr. Kaynat Qazi, Water Programme, C-PACT (Email id: Kaynat.qazi@snu.edu.in Office phone: +91-120 2663 846)

****

#0012 | December - 2020

C-PACT WATER BULLETIN

CPACT & WSP (Water Science Program) presents a news bulletin of latest news from India and abroad on debates, concerns, and events related to water.

Water Management in Indian Agriculture: Emerging Priorities

P.S. Vijayshankar
(Research Director and Founder Member, Samaj Pragati Sahyog, Madhya Pradesh,
and Adjunct Faculty, C-PACT, SNU)

Annual replenishable water resources of India are estimated at about 3880 billion cubic metres (BCM). Studies by Central Water Commission (CWC) over a period of 30 years (1985-2015) showed that the average annual water resource available is 1999.20 BCM, out of which only 1122 BCM can actually be utilised[1]. Several of the Indian basins like the Indus, Sabarmati, Pennar and Krishna are already becoming "closed" basin, with little opportunity for further development.[2] As the supply augmentation of water is increasingly getting difficult, we need to focus our attention more on demand management of water to for finding sustainable solutions to our water problem. Agriculture is the largest user of water. A recent study by NABARD and ICRIER estimated that about 78% of India's annual freshwater withdrawals is for agricultural purposes.[3] If the water demand is not managed in agriculture, ensuring drinking water availability will prove to be difficult. The NABARD-ICRIER study further identified three "water guzzler" crops, rice, wheat and sugarcane, which occupy about 41% of the gross cropped area and consume more than 80% of the freshwater withdrawals for irrigation. This has meant grave inequity in the distribution of irrigation across crops and farmers and also a strong mismatch between existing water endowments and the water demanded by these water-guzzling crops.

The main reason why farmers grow such crops even in areas of patent water shortage is the structure of incentives, as they find that these crops have steady markets. Public procurement of foodgrains at Minimum Support Prices (MSPs) has played a big role in entrenching such water-intensive cropping patterns even in water-scarce environments. Even a small reduction in the area under these crops, in a region-specific manner would go a long way in addressing India's water problem. The most important

[1] Central Water Commission. 2019. *Water and Related Statistics*, New Delhi: Ministry of Jal Shakti, Government of India

[2] Gulati, A., Sharma, B., Banerjee, P and Mohan, G. .2019. *Getting More from Less: Story of India's Shrinking Water Resources*, NABARD-ICRIER report, Indian Council for Research on International Economic Relations (ICRIER), New Delhi.

[3] Sharma,. B. , Gulati, A., Mohan, G. Manchanda, S., Ray, I. and Amarasinghe, U. 2018. *Water Productivity Mapping of Major Indian Crops,* NABARD-ICRIER report, Indian Council for Research on International Economic Relations (ICRIER), New Delhi

step in this direction is for the government to diversify its crop procurement operations to align with local agro-ecology and natural resource endowments.

The best way of doing this is to start procurement of crops that were prominently grown in each region before the monocultures associated with the Green Revolution set in. India's cropping pattern before the Green Revolution included a much higher share of millets, pulses and oilseeds. These must urgently find a place in public procurement operations. As this picks up pace, farmers will also gradually diversify their cropping patterns in alignment with this new structure of incentives.

If we were to make such a switch in cropping patterns, to reflect the agro-ecological diversity of India, what volume of water would we save? We have made an attempt to quantify the water that could be saved by 2030 in 11 major agricultural states: Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Telangana and Tamil Nadu. These states together accounted for about 66% of the total irrigated area of the country in 2015-16. We explored water use in the production of crops under two different scenarios of crop replacements, what we have termed as "Low Change" and "High Change", and compared it with a Business-as-Usual (BAU) scenario[4]. In these 11 states, we take the area under three most water-intensive crops, namely rice, wheat and sugarcane, and redistribute the area to the replacement crops. The replacement crops are largely pulses and nutri-cereals. The choice of the replacement crops is governed by an analysis of the cropping pattern of the concerned state in the period before the monoculture of the Green Revolution takes firm roots there. While working out crop replacement scenarios, we have kept in mind that such substitution has to be between crops grown in the same season and it must also be mindful of the specific agronomic and soil conditions of each region. The water savings were calculated as the difference between the water-use in the BAU scenario, as compared to the two crop replacement scenarios.

Our results show that through seasonally appropriate agro-ecologically suitable crop replacements, we can save about 18-36% of water applied in agriculture. Given that water-intensive crops currently occupy over 30% of the gross irrigated area in these states, the amount of water saved annually would be considerable. In our estimate, water saving could be high in states like Maharashtra (48%), Punjab (42%) and Telangana (43%). This would enable access to supplementary irrigation for millions of small and marginal farmers and also considerably reduce the pressure on rural drinking water sources. It can be argued that these crop replacements will result in a reduction in total foodgrain output because of differentials in yields across crops. We agree this is a possibility. However, it must be borne in mind that the rapidly deteriorating water situation poses a very serious constraint to maintaining the productivity levels of water-intensive crops, especially in states like Punjab and Haryana. At the same time, our proposal for aligning cropping patterns with regional agro-ecology includes raising the share of Eastern India in national output of water-intensive crops like rice. Such a change is urgently required to correct the basic anomaly in water use in agriculture in India.

---

[4] The details of the methodology of calculating water use and water saving is discussed in Mihir Shah and PS Vijayshankar "Transforming Water and Agriculture in India", paper presented at the National Dialogue on Indian Agriculture Towards 2030, organised by FAO-MoA-NITI Ayog , 21st January 2021.

Latest News

Bihar may introduce licenses for bore wells

The state Minor Water Resources Department (MWRD) has prepared a draft manual on the instruction of the state government. “Chief Minister Nitish Kumar directed the department to prepare a fresh manual to restrict overexploitation of groundwater in the state in view of reports of water crisis during the summer,” an official said. Read More:

Challenges to India’s urban water security and future growth patterns

The Sustainable Development Goal (SDG) 11 calls for inclusive, safe, resilient, and sustainable cities. This cannot be achieved without innovation in the water sector with in-depth broad thinking, research and analysis on the links between economic growth and the future of our urban spaces. Read More:

UN-Water Joint Statement: 31st Special Session of the General Assembly in response to the COVID-19 pandemic

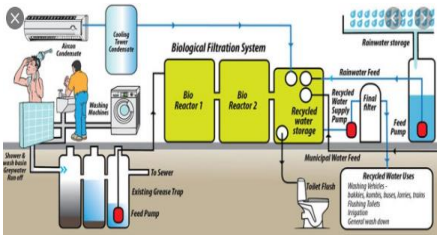
Water and sanitation: the first line of defense, but unavailable for billions of people

Poor people tend to get hit harder by the health and socio-economic consequences of COVID-19. This crisis has clearly revealed the dire inequalities that result from chronic underinvestment in a basic public health measure: water and sanitation services. Read More:

India plans dam on Brahmaputra to offset Chinese construction upstream

India is considering a plan to build a 10 gigawatts (GW) hydropower project in a remote eastern state, an Indian official said on Tuesday, following reports that China could construct dams on a section of the Brahmaputra river. Read More:

IISc researchers devise new wastewater recycling system



A decentralised wastewater treatment and recycling system developed by the Centre for Sustainable Technologies (CST), Indian Institute of Science (IISc), helped 180,000 litres water in a year in Berambadi, a village in Karnataka. Read More:

World's largest lakes reveal climate change trends

NASA-funded research on the 11 largest freshwater lakes in the world coupled field and satellite observations to provide a new understanding of how large bodies of water fix carbon, as well as how a changing climate and lakes interact. Read More:

Academic news: scholarships

Climate change and COP26 - Open call for creative commissions

British Council is the UK’s international organisation for cultural relations and educational opportunities. The British Council is inviting applications for creative commissions that bring together art, science and digital technology and offer innovative responses to climate change. Read More:

Title: Water & Energy for Food Grand Challenge - Call for Innovations & Prizes 2020

WE4F is a joint international initiative which is focused on environmentally sustainable innovations aiming to improve energy and water efficiency in the agricultural sector. Read More:

PhD Scholarship, Water for Change 2020

CEPT University, India invites applications for PhD Scholarship: Water for Change 2020 from outstanding PhD researchers interested in sustainability transitions and resilience in general and in urban water systems and governance in particular. Read More:

Conference/ Course/ Training Seminar Workshop/Contest:

UNESCO International Conference on "Water, Megacities and Global Change"

1st December 2020 - 4th December 2020 Bringing together scientists, operators, policy makers and civil society to address water security and global challenges in Megacities. Read More:

EauMega Online Pre-Conference 7-11 December 2020

Following the postponement of the Second International Conference "Water, Megacities and Global Change" to December 2021. The Steering and Programme Committees have decided to hold an online pre-conference event from 7 to 11 December 2020. Read More:

Virtual workshop on financing transboundary water cooperation

A Virtual workshop on financing transboundary water cooperation and basin development took place online on 16 and 17 December 2020.

Read More:

Student Highlight

Lecture on "Wetland Restoration and Management-Case of Vembanad Wetland" by Mr. Jojo T. D. (Ashoka Trust for Research in Ecology and the Environment (ATREE), November 17th 2020. Organized by the M.Sc. Water Science and Policy (class of 2020-2022).

For any comments or queries please contact:
Dr. Kaynat Qazi, Water Programme, C-PACT (Email id: Kaynat.qazi@snu.edu.in Office phone: +91-120 2663 846)**********

#0013 | February - 2021

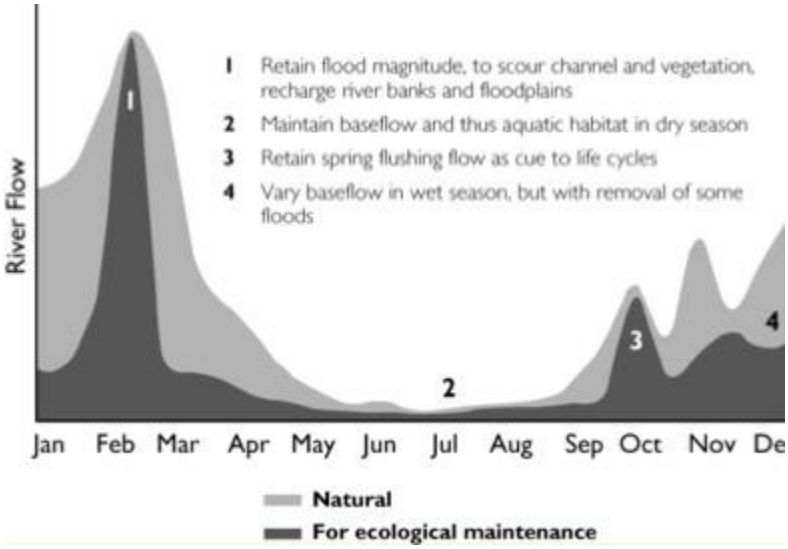
C-PACT WATER BULLETIN

CPACT & WSP (Water Science Program) presents a news bulletin of latest news from India and abroad on debates, concerns, and events related to water.

E-flows for a Paradigm Shift in Water Management in India: A Commentary

Sahil Regi Mathew
(M.Sc. student, Water Science and Policy, Shiv Nadar University)

The Brisbane Declaration (2007) defines environmental flows (e-flows) as "the quantity, timing, and quality of water flows required to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend on these ecosystems" (Arthington et al, 2018). The concept arises from the acknowledgment that anthropocentric activities have degraded rivers and have reduced or stopped their flow to a point where they cannot exhibit their original ecosystem functions. While e-flows do provide a metric that takes into consideration many ecological and social variables, it should only be used as one of many methods to reverse the dominant paradigm of water management in the country, especially with regard to surface water. This commentary is an outcome of a class discussion as part of the fifth module of the Water Science and Policy M.Sc. program[1].



Hydrograph depicting e-flows in comparison to natural flows
Source: FRC Environmental, 2017

[1] I thank my teachers, Rajeswari Raina and P. S. Vijayshankar for the class discussion and editing this commentary.

The fundamental ideology behind the study of e-flows is that it is an anthropocentric *choice*. How much water we want flowing in a river is finally a *choice* that we humans make. Let us take the example of the Ganga River Basin Management Plan (GRBMP) and assume that the consortium of Indian Institute of Technology (IIT) have consulted with all the stakeholders along the Ganges (although this itself should be questioned), accounted for their ecological and social needs and have arrived at a regime that is about 50% of the peak flow[2]. Where is this 50% going to be implemented? The Ganges river is about 2500 km in length, does an e-flow regime necessarily imply that the flow will be captured throughout the length of the river? Especially in the case of the Ganges, where the report (GRB EMP, 2011) explicitly mentions that one of the main drivers for restoring flows in the river is for its spiritual integrity, it is doubtful that policy makers will be serious about an e-flow except in sites of spiritual significance. Secondly, all the knowledge disciplines used to inform e-flow policy are constantly evolving. Methods to identify new species, determine habitats, assess demographic changes and river morphology will continuously evolve. Since e-flow policies will in most cases demand a paradigm shift in government policies on water, one can imagine the bureaucratic hurdles to be overcome to get a flow percentage approved. Policy makers might get the impression that this is a static percentage, however, it should be noted that e-flows in themselves have to keep evolving with other disciplines. Thirdly, the e-flow concept allows you to determine what species *you* deem to be important for the region. Of course, if the report mentions that Gangetic dolphins will be protected with a 50% flow, it does not mean that all other species will not be protected. Certainly, species that can adapt to this flow will continue to live. However, we can grossly underestimate our evaluation of the importance of some species as many of the disciplines used for these evaluations are continuously evolving. We have to understand that all life is interconnected and choosing to protect one (or many) species will have cascading impacts on the ecological web, leading to the disappearance or appearance of several other species.

Finally, we have to really understand where we place e-flows within our prevalent paradigm of water resource management in India. The concept is definitely refreshing and is juxtaposed against the dominant paradigm of heavy extraction of natural resources. To that end, e-flows definitely attempts to reverse some of these thought patterns. But it is still speaking the language of policy makers. It serves knowledge, a scientific estimate of 50 percent of peak flow as one truth, to policy makers. It denies the river its natural dynamism and relationships with ecosystems all along its length and depth, flows and undercurrents.

However, we must *know* our place as a species that shares an ecosystem with other living beings that have a right to river water. For a fairly large portion of our time as a species on this planet, we had lived *with* rivers, intimately *knowing* its trajectory and pulse, *behaving* as the river nudged us. Rivers had their own agency to perform their ecosystem functions, only one of which was to be a carrier of

[2] The actual goal of the IIT's is to almost completely mimic the natural flow regime of the river.

water. We are clearly in a different phase of our existence today, and it is imperative that our knowledge and our policies point towards a direction that restores the river's full natural agency.

Ganges River Dolphin
Source: Down to Earth, 2019

This commentary is meant to applaud the inclusion of e-flows in our water knowledge-policy regime. But it is also to remind us that e-flows should be used as one of the many tools to steer policy towards a larger Dharma[3] perspective. A Dharma perspective fully acknowledges our place as humans as just one species that (i) shares fairly and equitably in the resources that a river provides to all life in an ecosystem and (ii) lives within the agency that the river has, as it performs its ecosystem functions and roles in the larger global water cycle.

References:

Arthington, A. H. (2018). Environmental flows: Ecological limits of Hydrologic alteration (eloha). *The Wetland Book*, 1843-1847. doi:10.1007/978-90-481-9659-3_348

Environmental Flows: State of the Art with special reference to Rivers in the Ganga River Basin (Rep. No. 022_GBP_IIT_EFL_SOA_01_Ver1_Dec 2011). (2011). Indian Institute Technology.

Iyer, R.R. 2015 "Water Policy and Science: Disciplines, Perspectives, Values," in Raina, R. S. (Ed.) Science Technology and Development in India: Encountering Values, Orient BlackSwan: Hyderabad. pp. 87-103.

Example of an environmental flow recommendation. Light grey shows the natural (pre-disturbance) flow pattern, and the dark grey shows the allocated environmental flow to sustain key ecosystem processes at different times of the year. [Digital image]. (2017, May 23). Retrieved February 18, 2021, from https://frcenv.com.au/4110-2/

Sinha, R. K. (2019). A Ganges River Dolphin [Digital image]. Retrieved February 18, 2021, from https://www.downtoearth.org.in/news/wildlife-biodiversity/thriving-gangetic-dolphin-presence-in-bihar-reveals-census-63285

[3] Responsibility towards the poor and underprivileged, other humans that share resources with us irrespective of state/national boundaries, other species and Planet Earth itself (Iyer, 2015).

Latest News

SC takes suo moto cognizance of pollution in Yamuna

The Supreme Court on Wednesday took suo moto cognizance of pollution in the Yamuna river and also issued a notice to the Haryana government on a plea by Delhi Jal Board (DJB). Read More:

MoU Signed Between IITG, Brahmaputra Board & CWC to understand the fury of Brahmaputra River

On December 9, 2020, the Brahmaputra Board, CWC and IIT-Guwahati signed the MoU (Memorandum of Understanding). IIT-Guwahati has been roped in for the mission to analyse the quality of water, sand and sediment of the river to seek solution to erosion. Read More:

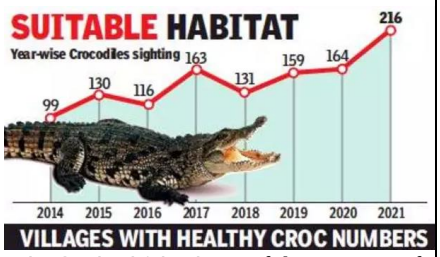
Stop "crime of pollution", NGT tells UP govt over discharge of sewage in rivers joining Ganga

The National Green Tribunal has come down heavily on the Uttar Pradesh government over discharge of untreated sewage in rivers joining the Ganga and said there was no indication how "crime of pollution" is to be prevented by the State. Read More:

Study finds metal pollution in aquaculture farms

A study of aquaculture farms across 10 States, which account for the bulk of India's production, has found "hazardous" levels of metals such as lead and cadmium in all of them. Read More:

Crocodiles flourish in Gujarat's Charotar wetlands



VADODARA/ ANAND: If the prospect of spotting the large, ponderous, lizard-like amphibious reptile with carnivorous habits stirs the inner Steven Irwin in you, then head to the wetland Read More:

Jal Shakti Ministry reviews water-resources projects across nation

The Union Minister of State for Jal Shakti, Rattan Lal Kataria, took a review meeting of the Central Soil and Material Research Station (CSMRS) on Monday and urged its functionaries to further step up efforts towards making India self-reliant. Read More:

Academic news: scholarships

Fully Funded PhD Scholarships 2021-2023 on Clean Water Technologies

We're offering a competitive tax-free PhD stipend of $27,500 per year for three years. Funding also covers tuition fees, research project consumable costs and related research funding for conferences/workshops. You can also earn additional income for teaching assistance opportunities. Read More:

Rotary Scholarship for Water and Sanitation Professionals

The strategic partnership between The Rotary Foundation (TRF) and IHE Delft Institute for Water Education aims to tackle the world's water and sanitation crisis by increasing the number of trained professionals to devise, plan, and implement solutions in developing and emerging countries. Read More:

Joint Japan World Bank Graduate Scholarship Programme (JJ/WBGSP)

The Joint Japan/World Bank Graduate Scholarship Program
Fully Funded Master Degree in Japan

The Joint Japan/World Bank Graduate Scholarship Program is open to women and men from developing countries with relevant professional experience and a history of supporting their countries' development efforts. JJWBGSP is envisaging opening the 2021 application period late March 2021 with a deadline for applying around mid-May 2021. Read More:

Conference/ Course/ Training Seminar Workshop/Contest:

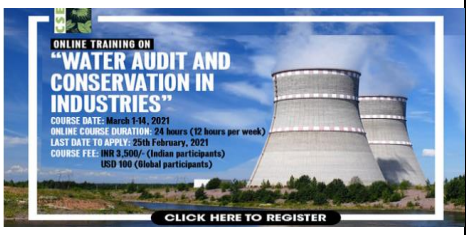
Webinar: Transboundary Water Agreements - 19 January 2021

This is the first of six webinars in 2021 that are linked to the Massive Open Online Course (MOOC) on "Governance for Transboundary Freshwater Security." The webinar series is called the "transboundary freshwater security governance train" and is carried out January-June 2021. Read More:

Rainwater Harvesting for Home Landscapes Online Workshop

Kat Sawyer will teach you how to capture rainwater for reuse in your landscape, and sink it into the soil instead of sending it down the drain. Join us for this online workshop that explores rainwater harvesting and water reclamation strategies. **Read more:**

Online Training on Water Audit and Conservation in Industries



The online course is self-paced wherein recorded sessions from experts, presentations and other reading material will be uploaded on the training platform on daily basis. Additionally, 2-3 live online sessions will be organized with all the experts for taking up queries over weekend. **Read More:**

Student Highlight

WSP M.Sc. (batch of 2019-21) field training at Samaj Pragati Sahayog in Dewas, Madhya Pradesh.

For any comments or queries please contact:
Dr. Kaynat Qazi, Water Programme, C-PACT (Email id: Kaynat.qazi@snu.edu.in Office phone: +91-120 2663 846)

****

#0014 | April - 2021

C-PACT WATER BULLETIN

CPACT & the WSP (Water Science and Policy) Program present a bulletin with latest news from India and abroad on debates, concerns, and events related to water.

Sumerian Civilization: The use and abuse of water

Manikanta Radhakrishna
(M.Sc. student, Water Science and Policy, Shiv Nadar University)

Lessons about the management of water resources are available aplenty in history. Evidence from the Sumerian Civilization is explored here. Here, we analyze the Iraq water crisis in the socio-ecological feedback framework from the historical perspective of the Sumerian Civilization. This provides a strong narrative on the role of water in socio-ecological systems, and understandings of the use and abuse of water.

Water is a life support system on earth, in its multiple forms and myriad functions. These life-supporting functions are generated by water as a controller of the stability and resilience of the earth's ecosystem. Further, water is also a victim of change due to human impacts and thereby a driver of change of the ecosystem, often leading to ecosystem regime shifts or collapse (Rockström et al., 2014).

Let us look at one of the earliest civilizations to thrive, the Sumerian civilization, in the land between two rivers Tigris and Euphrates, known best today as Ancient Mesopotamia. The Bronze Age Sumerian Civilization flourished on the lower alluvial plains of the rivers, in southern Iraq, for a thousand years or more, ca. 3500 BCE-1800 BCE (mid-4th to the beginning of 2nd millennium BCE). Its grandeur, however, was no match for the Ubaid Period (of the 5th and 6th century BCE) which preceded it, with small farming villages growing wheat and barley, and keeping domesticates of sheep, pigs and cattle emerged. Such settlements, largely of the Neolithic type proliferated in the south and north.

They reaped the benefits of rich nutrients that the two rivers carried. However, the climatic conditions were not as favourable to those in the south as to those living up north: insufficient rainfall with less than 200 millimetres of rain and long hot dry summers were conditions that were less propitious for agriculture. It was in these conditions that the first civilization occurred. People adapted to conditions and developed farming by managing the water. Settlements grew into towns and then into the cities in greater numbers during the Uruk period (3rd to 2nd millennium BCE, ca. 3200-2400 BCE). When settlements in Southern Mesopotamia grew into towns, the largest was Warka. City-states emerged in this region by 3200 BCE, and we note the presence of powerful elites, rich burial practices, and royal temples owning vast swathes of land. At this time, rainfed agriculture gave way to irrigated agriculture and the majority of towns and cities were all interconnected with canals and irrigation networks.

However, it is to be noted that water management in the region existed well before the city-states. Irrigation ditches were constructed by early settlers and canals by villagers independent of imperial states and rulers. This tells us that water management existed as enabled by multiple decentralized actors and their purposes; states and rulers facilitated large-scale irrigation. The evidence, therefore, contradicts the Wittfogel (1957) theory that the states empires of the ancient world represent the ability to control irrigation practices.

Given the topographic advantage of the elevated river, irrigation channels and gravity-led canal constructions could be built with minimum alteration to the water flow. Furthermore, extensive water management could only be carried out by the community coming together and constructing barrages and canals from bricks or reeds. The contemporary texts in cuneiform, suggests that the decentralized model

was further governed with equitable distribution and management from canal inspectors' known as 'Gugallum' (Postgate, 2017).

Water as a control variable from irrigation and a network of canals created an entire agro-ecological system of intensive farming and a social system of food security and trade. The intricate network of a vast topography of irrigation channels enriched the alluvial soils and thereby increased crop yield multifold times. Further, the rich sediment deposits enriched harvests, of many kinds of vegetables, herbs and fruits. Water intensive crops such as flax which can be only grown in the river and irrigation canals were cultivated (McCorriston, 1997; Mithen, 2012). Further, the network of waterways both natural and manmade helped inhabitants in southern Mesopotamia to trade in agricultural produces, and other items for building materials and exotic items. Contemporary inscriptions inform us of the maritime trade of vast surplus of grains. The annual yield, despite the occasional floods and droughts, represented great skills at water storage systems, and creations of flood mitigation structures such as earthen dykes.

As the uses of water played a crucial role in the 'rise' of the Sumerian Civilization it also played a detrimental role, gradually converting the Fertile Crescent into a desert. With the extensive irrigation to meet the growing settlement needs and the use of water as a weapon in the power struggle between kings, the soil became saline and infertile over the years. For instance, when Entemenak of Girsu diverted the river Tigris following a dispute with Umma, this newly irrigated land saw the salts of the rocky mountains of the north being settled down as sediments, as the water evaporated the sodium ions of the sediments settled down in the root zone causing crops loss. Historical texts found after this incident point to the presence of salinity in the soil, wheat being replaced by salinity resistant barley in this region. Evidence also shows that eventually, all the crop yields had declined by 1700 BC (Jacobsen and Adams, 1958). The codes of Ur-Nammu (2115–2085 BC) also indicate the empire-state actions to control the extensive irrigation practices by penalties. This process of salinization that occurred across southern Mesopotamia over centuries eventually lead to shifts in the ecosystem from fertile land to desert. The decline in the habitat manifested in the social systems, with the Third dynasty of Ur coming to an end, and people moving up north. Perhaps the issue of salinization was taken into cognizance by Hammurapi (1792–1750 BC, Fig. 1), who framed a law, no 53 in his Code, imposing a heavy penalty for the breaching of dams. The salinization of soil altered the ecosystem forever; the ability to adapt to the new desert environment was capable only to the tribes who revived the traditional knowledge of alternative fallowing. But in the 19th century, the innate greed of the British rule destroyed the traditional systems through new canals from irrigation projects, leading to more salinization of soil.

Humans for centuries have changed the landscapes and ecosystems around them. But in the Anthropocene, the ability of the system to recover has been hampered. The socio-ecological feedbacks that occur with the use and abuse of water are to be recognized as crucial for stability and resilience. Short term gains fashion long term ecological regime collapses; hence we need to take cognizance of the various manifestations, and use and abuse of water within our contemporary ecosystem.

References

1. Rockström, Johan, Malin Falkenmark, Carl Folke, Mats Lannerstad, Jennie Barron, Elin Enfors, Line Gordon, Jens Heinke, Holger Hoff, and Claudia Pahl-Wostl. *Water resilience for human prosperity*. Cambridge University Press, 2014.
2. Jacobsen, Thorkild, and Robert M. Adams. "Salt and silt in ancient Mesopotamian agriculture." *Science* 128, no. 3334 (1958): 1251-1258.
3. McCorriston, Joy. "Textile extensification, alienation, and social stratification in ancient mesopotamia." *Current anthropology* 38, no. 4 (1997): 517-535.
4. Mithen, Steven. *Thirst: For Water and Power in the Ancient World*. Harvard University Press (2012).
5. Postgate, John Nicholas. *Early Mesopotamia: society and economy at the dawn of history*. Routledge (2017).
6. Wittfogel, Karl August. Oriental despotism: A comparative study of total power. Yale University Press (1957).

Fig. 1. Votive slab, limestone, Showing Hammurabi with his right arm raised in worship, Old Babylonian, 1792-1750 BCE, Abu Habba (Sippar), Iraq, The British Museum, BM 22454

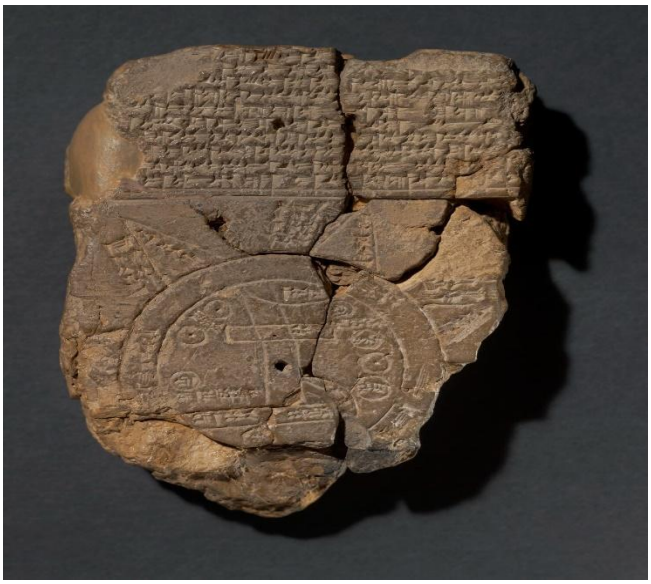


Fig. 2. Map of the World, Clay Tablet, 9th century BCE, Late Babylonian, Akkadian, Abu Habba (Sippar) Iraq, The British Museum, BM 92687

Fig. 2. Shows the world as a disc, surrounded by a ring of water called the "Bitter River"; "Babylon" is marked as a rectangle at the right end of the Euphrates which flows south to a horizontal band, of which the right end is marked "marsh" and the left end is marked "outflow". The text at the beginning of the obverse of the tablet declares:

... ruined cities ...
... whom Marduk watches ...
... the ruined gods who ... in the midst of the sea
... serpent, great dragon, between Anzu, scorpion-man
... mountain-goat, gazelle, zebu, leopard, bison
... lion, wolf, stag and hyaena
... the animal which Marduk created upon the rolling sea
... Ut-Napishtim, Sargon and Nur-Dagan king of
... their interior no-one knows"

Thanking Dr. Sudeshna Guha for the edits and the pictures.

Latest News

Students Reinventing Cities

the Students Reinventing Cities initiative is progressing very well. Across the world, we are seeing a lot of enthusiasm from cities, academia and students to collaborate and to imagine together a more green and just future. Read more:

Odisha has most contaminated sites in India: CPCB data

Of the 112 sites in India contaminated by toxic and hazardous substances, 23 were in Odisha followed by Uttar Pradesh (21) and Delhi (11) Read More:

World's freshwater fisheries are under threat of extinction, finds wwf report

A new report lists all the ways freshwater biodiversity is facing extinction and also comprises a list of solutions that can help bring it back from the brink. The report, titled World's Forgotten Fishes, has been published after a combined effort from 16 global conservation organisations including the World Wildlife Fund (WWF). Read More:

Work Underway In Projects Worth Rs. 1.91 Lakh Crore Under Jal Jeevan Mission: Jal Shakti Minister In Rajya Sabha

According to Jal Shakti Minister Gajendra Singh Shekhawat, Telangana government has provide tap water to each and every household in the state,, in Gujarat, 83 per cent and in Himachal Pradesh 76 per cent of the people had tap water connections Read More:

Rahiman Paani Rakhiye: 130 stepwells in rejuvenation mode in HP's Dharamshala

Block development officer Abhineet Katyayan sys his office in collaboration with Centre for Urban and Regional Excellence has conducted a water assessment study in Dharamshala block covering nearly 200 stepwells Read More:

IIT Madras releases a music video on river conservation

A video launched on Earth Day by IIT Madras alumni combines ragas, eminent singers and a message. Read More:

Academic news: scholarships

IGCS Summer School 2021 on "Sustainable Water Management at the Saltwater – Freshwater Interface"

The IGCS invites young and interested students to apply for the upcoming IGCS Summer School! Kiel University (CAU), Germany in collaboration with The Indian Institute of Technology Madras (IITM) in India, will host it and look forward to welcome 30 PhD and Graduate students studying at Indian or German universities. Read More:

Hemendra Kothari Fellowship

teri school of advanced studies
Knowledge for Sustainable Development
(Deemed to be University under Section 3 of the UGC Act)
Accredited by NAAC

TERI SAS with support from Hemendra Kothari Foundation, Wildlife Conservation Trust, Mumbai provides merit fellowship to MSc students of Environmental Studies and Resource Management (ESRM), Climate Science and Policy (CSP), Geo-informatics(GEO), Plant Biotechnology (PBT) and Water Science & Governance for initiating projects /research ideas that synergizes with the work areas of Hemendra Kothari Foundation and TERI SAS.Read More:

Water conservation course- 400 hours of free online courses

ConservationTraining is an open and free learning community that offers conservation-based training materials from The Nature Conservancy and our partner organizations.

With over 20,000 users from over 200 countries enrolled, our mission is to share training with our conservation colleagues across the world. Read More:

Conference/ Course/ Training Seminar

Call for abstracts for the 15th World Aqua Congress

15 th World Aqua Congress (XV WAC), an annual international conference in water organised by Aqua Foundation, is scheduled on September 14 th - 17 th , 2021 - a virtual event. The theme of the conference is Valuing Water (Beyond Pricing, Environmental, Social and Cultural Value).Read More:

Online training: Evaluating recharge potential of borewells in rural and urban areas

This training programs aims to equip the participants with the necessary knowledge and

skills for executing effective bore well recharge interventions in rural and urban areas. Read More:

National Recreational Water Quality Workshop: the week of April 6-8, 2021

CTIC Conservation Technology Information Center

This virtual format, 3-day workshop will be a forum for recreational water quality managers, stakeholders, researchers and public health officials at all levels to share information and ideas about implementing a successful recreational water program. Read More:

Student Highlights

Beating the pandemic, the graduating batch (WSP class of 2021) doing fieldwork in March-April 2021.

For any comments or queries please contact:

Dr. Kaynat Qazi, Water Programme, C-PACT (Email id: Kaynat.qazi@snu.edu.in Office phone: +91-120 2663 846)

****