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ICID News

2023 – 3rd & 4th Quarter

Message from the President

Dear Colleagues and Friends,

It is indeed an honour and a pleasure for me to reach out through this inaugural message, in my new role as President of ICID. I can feel, by all means, the weight and the burden of responsibility I have been called to following the successful election held last November in Visakhapatnam, India, during the 74th IEC Meeting. And for this purpose, please allow me to take this opportunity to sincerely thank all National Committees (NCs) who decided to support me and for the trust they have shown in me. But even more, allow me to thank all the NCs, no one excluded, who participated in the election in Visakhapatnam, India. I would especially like to thank my standing competitor, VPH Dr. Mochammad Amron from Indonesia, for allowing the establishment of a calm and correct atmosphere of competition a world where personalism and harshness are currently quite prevalent, I think this is an outstanding outcome for our community. Hence, I wish to ensure you all that I will do my best to enhance ICID visibility and recognition working with all NCs, Office Bearers and members of various Workbodies, to achieve the various goals of the Commission. But having said this, I can say to you that I equally feel a strong enthusiasm in taking the lead in this new role, hoping to be able to do at least as much as I have done while serving the Organization in my capacity as Vice President.

Of course, the challenges standing in front of us are such that can easily make our veins and our wrists tremble.

As we all know, world agriculture faces an enormous challenge over the next years: produce almost 50% more food by 2030 and double agricultural production by 2050. By that time, there will be almost 10 billion people living on our planet. But with 20% less arable land per person to grow enough food. At the same time, water availability and water security are severely at risk. Although there are several important components to this extraordinary situation, each and every one plays a part: increasing levels of urbanization, land consumption, nutritional changes, and the environmental effects of climate change.

Throughout the 20th century, water use has increased globally in the agricultural, domestic, and industrial sectors, and most recent projections indicate that both global water use and evaporation will continue to increase. And whilst in the years around 2000, about 57% of the world's freshwater withdrawal and 70% of its consumption were occurring in Asia, where the world's major irrigated lands are located, in the coming decades the most intensive rate of water withdrawal is expected to befall in Sub Saharan Africa and South America, increasing by 1.5 to 1.6 times, while the least will take place in Europe and North America (1.2 times). As of today, agriculture represents more than 2/3 of all water use worldwide (with 80% to 95% taking place in Developing Countries) being its largest consumer. But there is no doubt that in the near future, the importance of secondary and tertiary activities will be rising in the economy. This will reduce the share of the agricultural sector and increase the weight of the industrial and domestic sectors in the consumption of water resources. Now, these figures clearly show that today global water demand exceeds reliable and exploitable water resources. Thus, we need to reach an appropriate balance between the limited supply and the increasing demand which, at the moment, is heavily uneven. On the other hand, irrigation has become increasingly indispensable to increase yields of crops and agricultural production. And that food security must necessarily be achieved by modernizing techniques, introducing available innovation, and improving irrigation efficiency. That is exactly where modern irrigation fits in. Changing the economics of global agriculture and allowing farmers to produce more crops per hectare of land and per cubic meter of water used.

So, we need to ask ourselves which are the options available and what are the alternatives that could provide a sustainable solution to avoid water conflicts and meet the increasing water demand in agriculture?

There is no doubt that irrigation development, along with proper mapping of potentially "to be irrigated" areas can increase the resilience of agriculture to climate change, fostering a more efficient and sustainable use of water resources, enhancing productivity per unit of land and increasing the annual amount of crop production, significantly. And this is why there is a renewed emphasis on irrigation development, especially for certain areas of the world. Nevertheless, its proper achievement needs to be based upon sound approaches, built on a rigorous assessment of its needs, as irrigation potential assessment requires the evaluation of both land and environmental suitability, socio-economic conditions and the availability of adequate water resources, both for the cultivation of the major crops grown in the area and/or the introduction of new ones. But where can this be achieved? If we look at recent data produced by the FAO regarding currently irrigated areas and their potential development, it is quite clearly recognizable how the potential for expanding irrigated agricultural areas worldwide is relatively greater in Latin

America and Sub-Saharan Africa. At the same time, looking at the same data regarding the current and future withdrawal of water resources, the use of water resources at a global level remains low for Latin America, Sub-Saharan Africa and for East and South-East Asia, while South Asia and the MENA region (Middle East-North Africa) are already in conditions of water scarcity. According to the UN, water scarcity already affects more than 40% of the world's population, with 1.1 billion people around the world who do not have access to fresh water and around 2.7 billion who suffer scarcity at least one month a year. A statistic that raises alarm bells and drives the search for solutions. This is why we need to look other ways and other directions to improve water availability.

In the agricultural sector, the use of non-conventional or poor-quality water resources as an additional source for irrigation is one of the possible solutions to exploit. One of these, and one that is not entirely new, as it has been practiced since the dawn of civilization, is desalination.

In recent years, the use of Desalinated Sea Water seems to be consolidating as an alternative solution for irrigation of cash crops, for instance in countries such as Spain and Israel. Hence, large-scale supply with DSW has emerged as a substitute water resource for agricultural production, especially in coastal regions facing recurrent water scarcity, as well as in islands lacking freshwater resources. Areas where strong and sometimes harsh competition between domestic (tourism), industrial and agricultural uses usually occur, most dramatically during the crops' growing season. And, most importantly, areas where anthropic pressure on ecosystems is greater, because of often uncontrolled and/or unregulated groundwater extraction, with subsequent seawater intrusion into the aquifers.

Now, as all demographic data show that almost 40 percent of the world's population is presently living within 100 km of an ocean, and having population growth dynamics have been particularly significant along the coasts over the last decades, paradoxically enough many of the areas affected by freshwater scarcity are close to the sea.

Consequently, the adoption of DSW can be nowadays considered as a possible, technically feasible solution in order to guarantee adequate water supply for irrigation of high-income or cash crops. This trend is expected to intensify in the near future, with only two major constraints to its further development: energy cost and disposal of brine.

As desalination technologies have developed and improved, the cost of building desalination plants has progressively declined. This decrease in cost has been one of the primary factors for the acceptance, growth, and success of desalination. Since the 1960s, the cost of Multi-Stage Flash Distillation (MSF) to desalinate water has decreased approximately by a factor of 10, with approximate unit costs of US$ 10 per m3 to less than US$ 1 per m3 in 2020. Thus, because of the improved technical and innovative solutions recently introduced (new membranes adopted, innovation of desalination processes), DSW can indeed represent a possible solution to guarantee new sources of fresh water for irrigation. This is especially significant in the present scenario of climate change, where we are all withstanding the dramatic awareness of increasing water scarcity. Moreover, as successfully demonstrated in several countries (i.e. Saudi Arabia) water can be piped towards inland cities, even up to 100 km far away from the sea. Hence, desalination is not solely limited to coastal cities but can be implemented in many ocean bordering regions. Relying more and more on SWD means that for many people struggling every day to survive or to maintain a decent level of living, there would be a chance, at least. As technology continues to produce new processing methods and better solutions, there can be a whole new frontier of irrigation for more and more countries currently dealing with water scarcity.

I believe that ICID, using the strong International network and initiatives, is currently involved in any part of, and given the existence of its current operational plans such as the Technical Support Program (TSP) and the International Research Program for Irrigation and Drainage (IRPID) can offer many opportunities for research and collaboration in the field on these issues, effectively contributing to an improved capacity building, the better development of advanced training programs and allowing more wide-ranging knowledge sharing. There is no doubt that physical participation in our international events, after the difficult times of the Covid-19 pandemic, can greatly contribute to the achievement of ground-breaking technical discussions, facilitating policy advocacy and creating favourable conditions for multi-disciplinary approaches, besides enabling geographical cooperation among different countries. Greater opportunities will also be offered by our well-organized on-line workshops, especially for Young Professionals who often do not have financial support to physically attend Conferences and meetings, thus permitting access to all and making the best use of technology today available. And talking about Young Professionals, I believe we really need to shift our paradigm, moving from the classic "business as usual" to a rather more "Stay hungry, stay foolish..." approach, if I may say so, with a particular attention to the enhancement of youngsters and young women's role especially, guaranteeing an improved gender balance, starting from our working bodies and Office Bearers positions.

Last, but not least, we all need to strive for the long-term financial sustainability of our organization. Covid-19 has changed the world and has brought along significant economic changes and dire financial consequences, also for our organization. For this purpose, I believe we need to further improve our visibility at the international level by enforcing our participation in major network activities, at all levels, strengthening our collaboration with the most important International Organizations, and thus raising our recognition. This is a very significant issue, as I firmly believe that by augmenting our "political" influence", we might also be stimulating interest or curiosity at least, possibly attracting more countries to join our Organization. As well as players of the private sector in the water business, as a consequence, might be encouraged to use our dialogue platforms to stimulate awareness about most recently developed technologies and innovations, as well as about the feasibility of Public-Private-Partnerships for AWM.

With all this in mind, I would like to say that we will leave no stone unturned...

I will be looking forward to your support, and continued participation in future ICID activities and I will be more than happy to receive your valuable suggestions to take forward our goals.

Wishing You All a Very Happy New Year 2024!

Dr. Marco Arcieri
President, ICID

25th International Congress on Irrigation and Drainage & 74th IEC Meeting, 1-8 November 2023, Visakhapatnam, India

The ICID with its Indian counterpart, Indian National Committee on Irrigation and Drainage (INCID) in association with Central Water Commission, Ministry of Water Resources and Government of Andhra Pradesh organized the 25th ICID Congress and 74th International Executive Council meeting and exhibition from 1-8, November 2023, at the Radisson Blu Resort, Vishakhapatnam, India. The 25th ICID Congress centred around the theme "Tackling Water Scarcity in Agriculture." The event brought together irrigation and drainage professionals and a broad range of other stakeholders to share their knowledge and experience in sustainable agriculture water management focusing on irrigation management.

This ICID Congress being organised in India after 57 years which brought together a global congregation of around 1,300 experts, researchers, and professionals which include 350 foreign delegates from 40 countries to address the challenges of water resource management, irrigation and drainage. The event was inaugurated on 2 November 2023 by the Hon'ble Minister Mr. Gajendra Singh Shekhawat, Ministry of Jal Shakti, Government of India, and Hon'ble Chief Minister of Andhra Pradesh Mr. Y.S. Jagan Mohan Reddy. The grand opening ceremony was attended by distinguished dignitaries Hon'ble Minister Mr. Gajendra Singh Shekhawat, Ministry of Jal Shakti, Government of India, and Hon'ble Chief Minister of Andhra Pradesh Mr. Y.S. Jagan Mohan Reddy; Mr. Ambati Rambabu, Hon'ble Minister for Water Resources Development; Mr. Gudivada Amarnath, Hon'ble Minister for Industries, Infrastructure, Investment & Commerce, Information Technology; Mrs. Vidadala Rajini, Hon'ble Minister for Health, Family Welfare & Medical Education; Government of Andhra Pradesh; Prof. Dr. Ragab Ragab, President ICID; Mr. Kushvinder Vohra, Chairman, Central Water Commission (CWC) & Indian National Committee on Irrigation and Drainage (INCID); and Mr. Shashi Bhushan Kumar, Principal Secretary, Water Resources, Government of Andhra Pradesh, Mr. The inaugural function began with a welcome address by Mr. Kushvinder Vohra, INCID Chairman. He emphasised the importance of sustainable water management in the context of food and ecosystem security. Hon'ble Minister of Jal Shakti Mr. Gajendra Singh Shekhawat highlighted the crucial role of international collaboration for the redressal of the issues and challenges of the water sector in the wake of climate change. Hon'ble Chief Minister of Andhra Pradesh, Mr. Y.S. Jagan Mohan Reddy shared his vision for various interventions required for water resources development and management in the State of Andhra Pradesh Mr. He urged the International Commission on Irrigation and Drainage (ICID) to work on a solution to transfer water from one basin to another in drought-prone conditioned, which is economically viable, socially acceptable, technically feasible and environmentally friendly especially in Andhra Pradesh Mr. Andhra Pradesh is one of the States which is dependent on rain-fed irrigation system and faces problem in water supply to agricultural crops during lean monsoons, he said. He also highlighted the key interventions being undertaken in the field of water resources in the State.

The opening plenary session was delivered by President Prof. Dr Ragab Ragab. He highlighted the vision and activities of ICID, including Webinars,

Awards, ICID Membership Networks, ICID Publications, Memorandums of Understanding (MoU) Signed by ICID to strengthen partnerships and cooperation with partner organizations and working groups on Climate Change Impact and mitigation. Prof. Dr. Ragab Ragab also presented a couple of presentations: (i) Misunderstanding and Misconceptions in Irrigation Water Management; and, (ii) Climate Change as a Challenge to Water and Food Security. The presentation covers diverse issues, which include (i) By 2050, the world population is expected to increase to 9.8 billion; (ii) The food demand is expected to increase by 70% to 100%; (iii) Water & energy consumption is expected to increase by 50%; and (iv) Climate change predicted to increase vulnerability of agricultural sector.

Secretary General Mr. A B Pandya delivered the vote of thanks to all the delegates for accepting the invitation of the Congress and making it a successful opening session. He also shows a gesture to all the international organizations including FAO Land and Water Division, ADB; IWMI; IGS; ICARDA; World Bank; INCID; Ministry of Water Resources, Andhra Pradesh; CWC, Minister of Jal Shakti, Govt of India and all the Direct Members of ICID for their participation.

To express gratitude and to pay tribute to the late N.D. Gulhati, the father of ICID, a visionary, who dedicated his entire professional life to the development of irrigation and drainage, a memorial lecture is organized in every ICID Congress. The aforesaid lecture was delivered by Hon'ble Minister of Jal Shakti, Mr. Gajendra Singh Shekhawat on the topic 'Ensuring Water and Food Security through Climate Resilient Infrastructure'. He presented a brief overview of country's progress in water resources development, vital role of storage and increasing water use efficiency to meet burgeoning irrigation demand with growing population. He flagged various issues, challenges, way forward and the government's commitment to water resource management and particularly in attaining sustainable development goals.

During the Congress Plenary the keynote addresses were delivered by (i) Ms. Yasmin Siddiqui, Director, Agriculture, Food, Nature, and Rural Development (AFNRD), Asian Development Bank; (ii) Dr. Qu Dongyu, Director General, FAO; (iii) Dr Mark Smith, DG, IWMI; (iv) Ms. Amal Talbi Jordan, Global Lead Water in Agriculture, World Bank; and (v) Mr. Kushvinder Vohra, Chairman, CWC/ INCID.

The 74th IEC Meeting was organized in three sessions. The Opening Plenary aimed at addressing all stakeholders, experts, representatives, partners, and observers with the objective to communicate issues of general concern and also presenting ICID annual awards and recognitions. The plenary session was attended by about more than 400 delegates from 40 countries. They participated in the various Working Group Meetings, Task Teams and Committees in the following two days. The main session of IEC was conducted in two sessions on 4 November, 2023 took all decisions based on the outcomes and recommendations of the work bodies and permanent committees.

There were 18 sessions encompassing the Congress Questions 64 & 65 primarily addressing the supply side augmentation of irrigation water and demand management. Besides, 6 International Workshops on various working groups of ICID, 12 side events by leading International Organizations such as FAO, IWMI, India EU Water Partnership (IEWP), GIZ, Japan International Cooperation Agency, International Center for

Agricultural Research in the Dry Areas (ICARDA), M.S. Swaminathan Research Foundation (MSSRF), Chinese National Committee on Irrigation and Drainage (CNCID), INCID and ICID on special topics, 2 International Symposia and 2 Plenary Sessions.

A Special Session on 'Farmers Empowerment through technology innovations and capacity building' was organized during the 25th ICID Congress. Indian Network on Participatory Irrigation Management (IndiaNPIM) organized this special session in partnership with Ministry of Jal Shakti Government of India, ICID, INCID and National Committee on Precision Agriculture and Horticulture (NCPAH), Ministry of Agriculture and Farmers Welfare, .Government of India. This session was sponsored by Jain Irrigation, Sai Sanket, ITC, NETAFIM, MiDigitek and WWF-India. During the session, over 150 participanted including members of Water Users Associations from over 10 states of the country (including – Andhra Pradesh, Telangana, Karnataka, Maharashtra, Gujarat, Rajasthan, Uttar Pradesh, Madhya Pradesh, Chhattisgarh etc.), senior specialist from the World Bank; officials from state irrigation and water resources departments; senior officials from Ministry of Jal Shakti, Government of India and other delegates.

The objective of the session was to have a knowledge exchange session across the farmers and WUAs, who came from different parts of the country and to expose them to the cutting-edge technology and means on efficient irrigation. Whilst the farmers from each of the state talked about the state of their respective WUAs and the challenges that they face; on the other hand, few success stories of participatory farmers' approaches were also discussed and appreciated.

The sideline events were organised by FAO, IWMI, INCID and MSSRF, Norway, on special topics of Global Mapping of Irrigation Potential and Needs.

A side event organized by FAO with the objective to introduce the progress on the development of a new framework for mapping irrigation potential and needs. The side event contributed to the reviewing the existing methods, stocktaking of information requirement to conduct irrigation potential mapping and setting a roadmap for the development and piloting.

Side event organized by IWRS with the objective to highlight the smart agriculture technologies for managing irrigation water and improving irrigation water use efficiency on-farm and at the regional level. Specifically, the session will focus on the applications of the Internet of Things (IoT), crop modeling, satellite and UAV remote sensing in irrigation water management.

The side event by INCID showcased the promotion of gender-responsive water management (SDG 5 and SDG 6), particularly irrigation management. The side event covered the role played by women in agriculture water management, irrigation development, governance and management. This side event also facilitated a comprehensive discussion and shared the mechanism for effective involvement of women in making strategic decision.

Secretary General Er. Ashwin B. Pandya introduced the agenda for the 74th IEC meeting and provided an overview of the important issues before the Council such as the review of the action plans identified under Road Map to ICID Vision 2030, International Research Program on Irrigation and Drainage, Knowledge Management Strategy and the procedural aspects regarding the conduct of IEC and Meetings of workbodies, including permanent committees. VP Prof. Dr. Tsugihiro Watanabe, Chairman, PCTA acquainted the members with the four thematic groups of Basin, Knowledge, Schemes and On-Farm under which the workbodies reporting to PCTA are organized and the review of these thematic groups. VPH Dr. Mochammad Amron, Chairman, PCSO made a short presentation on the important aspects that need attention of various Working Groups and how to make the meetings of workbodies reporting to their respective permanent committees, more vibrant and productive.

Dr. Mohammad ALomair, Chief Data Officer the representative of Saudi Arabian National Committee of ICID (SACID) made a presentation and shared about the Saudi Irrigation Organization (SIO), which manages and develops the irrigation sector in the Kingdom by achieving sustainability and

enhancing efficiency. Mr. Kushvinder Vohra, Chairman, Central Water Commission & ex-officio Secretary to Government of India and Chairman, INCID & Vice President, ICID, presented the activities of INCID and also briefed about the background and objectives of INCID.

During the opening ceremony of the 25th ICID Congress and 74th IEC Meeting released two publications: Historical Water Sustainability, and Compendium: World Heritage Irrigation Structures (2014-2022).

The session also announced the winners of the WatSave Award, WHIS, Best Performing National Committee and Best Paper Award and election for the new President and Vice Presidents. Several study tours and excursion visits are also being organized to Araku valley, Kambalakonda Eco Park, Indira Gandhi Zoological Park, Simhachalam temple, Rishikonda beach etc. for showcasing and promoting the touristic destinations, cultural & architectural heritage.

Besides knowledge enriching technical discussion, the rich cultural heritage of India was also showcased in the form of melodies of Indian classical music, captivating folk dances from various provinces and Bollywood extravaga.

For more details, please visit: **<https://icid-ciid.org/inner_page/241>.**

The Visakhapatnam Congress Statement 2023

The 25th International Congress on Irrigation and Drainage with the main theme "Tackling water scarcity in agriculture" was held from 1-8 November 2023 at Radisson Blu Hotel, Visakhapatnam, India, organized and hosted by the Indian National Committee of ICID (INCID). The Congress was attended by more than 1289 delegates from 40 countries.

Based on 147 papers from 33 countries submitted, the participants discussed the two Questions i.e. Q 64. "What alternative water resources could be tapped for irrigated agriculture?" and Q 65. "Which on-farm techniques can increase water productivity?". During the Congress, in addition to addressing these two questions, an international symposium on "Pathways and technologies for modern irrigation services" and a number of side events addressing various aspects of agricultural water management were also held. Notable amongst the side events are "New approaches in agricultural water management capacity building" organized by IWMI. Workshop on "Water, Energy and Food Nexus" organized by Working Group on Water, Energy Food nexus of ICID coupled with IWMI side event on Realizing Nexus gains for sustainable and resilient agri-food systems. Side Event on "Improving water productivity in dry areas" by ICARDA, "Modernization of Irrigation systems" by CNCID-ICID were also organized. Side events on "India Irrigation Forum-Integration of Farmers' Knowledge and Technology" by INCID; "Women & Water and Smart Agriculture Technologies for Irrigation Water Management" by Indian Water Resources Society (IWRS) were organized by the respective organizations. A young professionals training programme was organized with the active support from GIZ and India-EU partnership programme.

Major outcomes identified for various Congress questions / sub questions and side events are as follows.

Question 64: What Alternative Water Resources could be tapped for Irrigated Agriculture?

The question was subdivided into three sub-questions as Developing and Reinforcing Conventional Sources of Irrigation Water, Tapping non-conventional sources of water, and empowerment of farmers. A total of 67 papers were received for the question. The major outcomes from the deliberations are:

- The fluidity of precipitation patterns and the inherent variability in water availability underscore the need for bringing irrigation systems up to performing to their full potential thereby offering substantial opportunities for enhancing productivity and resource utilization.
- Waste water is a pivotal alternative water resource especially in peri-urban areas for mitigating water shortages in agriculture.
- Conventional sources development for irrigation water requires meeting challenges of over-extraction, unsustainable solutions and implementation of IWRM strategies in developing societies.
- Precipitation variability is a major challenge for maintaining sustainable irrigation needing adaptive water management strategies.
- Deployment of non-conventional sources of water involves setting up of waste water reuse strategies, harnessing saline water irrigation techniques and addressing relevant problems in their use.
- Utilizing non-conventional water resources for irrigation aligns with the Roadmap 2030 vision of ICID for a water secure world.
- Reclaimed and saline water represent stable alternatives for irrigation but they need challenges of handling contaminants and increased salt loads and ameliorating their effects on consumer health risks and reduction in agricultural yields if the treatment processes are not managed continuously.
- There are needs for guidelines for non-conventional water irrigation

projects with systematic technical solutions.

- Insufficient understanding of salt and contaminant movement in diverse irrigation scenarios necessitates coordinated drainage systems to control the movement and maintenance of salt balance.
- While encouraging empowerment of farmers the challenges of underutilization coupled with resistance to change, complexity of new micro irrigation and other systems need to be addressed.
- Capacity development of the communities coupled with Participatory Irrigation Management is an essential ingredient of empowerment strategies
- Empowerment policies have to be customized for local contexts with extension services, tailored guidance for facilitating the uptake of the new approaches
- As the global population rise, the empowerment of farmers becomes imperative for resilience and sustainability of agriculture in face of water scarcity and increasing demands from other competing sectors.
- Deployment of alternative sources and adaptation of the new sources by the community will need provision of finances from global funds like climate funds and other supporting multilateral institutions for achieving sustainability of the alternative sources.

Question 65: What On-farm Techniques can Increase Water Productivity?

The question was subdivided into three sub-questions as Improving management of existing facilities, Improved agronomic practices and research/ innovation, and efficient application of irrigation water. A total of 80 papers were received for the question. The major outcomes from the deliberations are:

- Increasing water productivity is a logical strategy to help achieve food security under growing water scarcity in agriculture.
- Various agronomic practices with seasonal and stage wise water production function, conservation agriculture and improved soil nutrient contents demonstrate increase in production
- Extended Hydrological forecasting with sub-seasonal approach provides valuable help in integrated water management and optimization of emerging situations.
- Soil moisture forecasts also helps in limiting water supply and optimizing the outputs. IoT technologies can provide accurate and dynamic information of water consumption and rainfall in real time and has the potential of adapting to the climate change scenarios.
- Controlled drainage can optimize agricultural water use, nutrient losses reduction, improve crop production and has potential to address several SDGs.
- New technologies such as UAV, software based models, and IoT among others, have been validated in specific cases for improving/ strengthening the existing management facilities in agriculture sector for increase in water productivity.
- Undertaking research for evolving new innovative inputs in agriculture is a required strategy for sustaining food security under growing water scarcity for agriculture.
- Use of bio-degradable materials for mulching presents a superior alternative to traditional plastic films with increased yields and increased water use efficiency.
- Improved communication systems and a semi-automated remote sensing approach is promising in the European environment and field trials in India can yield interesting results.
- Conservation of water through controlled evaporation, cost effective design of micro irrigations systems demonstrate benefits of applications due to reduced operating costs.
- Developed optimized techniques contribute to the minimization of the use of chemical reagents and acids during the operation of drip irrigation systems, which provide ecological benefits.
- Making prediction of crop production under climate change using ANN model plays a crucial role in future demands and decision making in water allocation and distribution.
- Water scarcity in agriculture will be better understood and recommendations better adopted in case the role of each agency is well covered and discussed at various platforms.
- Adoption and sustainability of the proposed techniques including incentives for using water productivity enhancing techniques, require quick dissemination by R&D organisations because farmers/ irrigators issues are crucial issues and are greatly influenced by their perceived gains and adaptation capacity.
- Understanding the nexus of Water-Energy-Food-carbon-water quality is important. It is a multi-parametric trade-off which might provide various insights for different cropping and geographical conditions. Accordingly policies could be prepared for different agro-climatic regions.
- Crop cultivation activity index can be developed for different scenarios in a study area using a nexus-based index and used effectively by the policy makers.
- Conservational agriculture aims at more efficient usage of water and other resources and accordingly the strategies for different regions could be modelled. The subject includes sustainable and environment friendly practices like minimum mechanical soil disturbance, species diversification and permanent soil organic cover and it helps in improved water storage and better resilience to climate change.
- Conservation Agriculture and system irrigation can be compared using Anova test using different parameters like Leaf Area Index, Grain Yield, Bulk density.

The Recommendations from the Symposium and Other Significant Special Events - JICA FAO JNCID Session Recommendations

Summary

Several concerns arise with the increase in rice consumption and production driven by population growth. These include issues in rice paddy fields, such as the production and release of methane, contributions to greenhouse gas emissions, and added strain on water resources, particularly in areas where water is scarce.

Addressing the challenges faced by rice paddy agriculture, which stem from factors like climate change and population growth, requires a multifaceted approach. One key aspect involves implementing efficient water management practices, encompassing water-saving technologies, improved irrigation techniques, and water recycling.

The objective of this side event is to highlight the challenges confronting paddy agriculture due to climate change and population growth. It aims to share insights gained from implemented initiatives, draw lessons learned, and articulate key messages to promote climate change measures in paddy agriculture.

Outcome

We, JICA, FAO and JNCID, organized a special session on the promotion of climate change measures in paddy agriculture and discussed sub-question 65.1; improving management of existing systems, and came to three conclusions.

First, we share the view that the continuation of paddy agriculture is crucial for the food security and that more efficient water use measures need to be considered for securing water resources under pressure due to climate change.

Second, we agreed on the importance of further promoted investments to utilize existing irrigation systems for tackling the global food crisis under climate change.

Third, we reached a consensus that greenhouse gas reduction in paddy agriculture can be achieved by improving water management technology and that research and studies should be promoted to further advance the application technology and dissemination of this approach.

SIDE Event by NIBIO, NRRI, MSSRF, OUAT, AAU and IWMI on Climate Action: Technology Intervention and Technology Interventions and Capacity Building of Smallholders in Irrigated Rice-Based Cropping Systems of India

Significant Outcomes

- The system water productivity of Rice-Sunflower, Rice-Maize was found to be 12.6% and 20.9% higher than that of Rice-Rice cropping system in Odisha. Poly mulching with drip irrigation in vegetables decreases water requirement by 30%. This adoption of climate smart water management practices led to significant water savings of 30 to 40% and a reduction in irrigation costs.
- Diversifying cropping systems (Rice-oilseed & Rice-pulses) can mitigate Greenhouse gas (GHGs) emission by 44.3 to 50.2%, reduced system input energy consumption by 38.8 to 45.9% & enhanced benefit cost ratio by 9.5 -12.3% over Rice-Rice system.
- Green manuring with drought tolerant rice varieties in medium land decreases water requirement by 25%.
- Smart Seed Production System was introduced under the RESILIENCE Project at Chawdang Pathar, Merapani, Golaghat districts in Assam. This system shortens the seed production cycle. Newly notified varieties are made available for cultivation to farmers within a 1-2 years.
- First high yielding, aromatic, non-glutinous purple rice variety, Labanya, developed from AAU, Assam. It has high antioxidants, phenolic compounds, high iron, high fibre and is therefore diabetic friendly. Less cooking time. Can be made into several value added products like cookies, bread, cake, kheer, pulao/biriyani and wine.
- Built the capacities of farmers on suitable on farm water saving technologies through mobile based learning, whatsapp groups and audio conferences coupled with field demonstrations. Weather based water management was promoted through site specific agro advisories based on medium range weather forecasts. AS a result, over 3000 farmers have become aware of this technology with more than 570 farmers successfully adopting it in their rice and vegetable field.

Outcomes of Side Events by ICARDA on Improving Water Productivity in Dry Areas

ICARDA side event was tailored to maximize water productivity and sustainability and to provide a holistic paradigm of actions for maximizing water productivity under dry conditions. The side event has the following specific outcomes:

- Enable and support the knowledge dissemination of the Water Scarcity Initiative (WSI) as an impactful regional partnership platform for strengthening and enhancing water resource planning and management in the context of climate change and building productive, resilient, and sustainable agricultural landscapes and food systems.
- Contribute to showcasing the valuable practices for enhancement of agricultural water productivity including solar-powered irrigation with improved irrigation systems, crop diversification, rainwater harvesting for supplemental irrigation, low-cost and scalable raised bed machinery.
- Provide various methods pursuing precision irrigation scheduling either field measurements of actual evapotranspiration including standardized energy balance and micro-meteorological methodologies, lysimeter, and soil moisture depletion methods or other digital techniques including the remote-sensing based estimations of actual evapotranspiration and numerical modelling for estimation of irrigation depth.

Side Events by IEWP-GIZ on Good Practices in Water Management: Learnings from the EU and India

This side-event was organized to showcase the key activities, success stories and valuable insights gained from the IEWP Action Phase 1 and 2. These lessons learned contribute to

the shared vision of India and the EU for a more sustainable management of water resources and to tackling the challenges facing water management in the context of growing population, competing water demands and climate change.

- The session offers key learnings from the IEWP as supported by GIZ, balancing inputs from Indian and EU water sector experts. The session includes the following presentations:
- River Basin Management (RBM): Blending EU and Indian Approach, using the case of Tapi RBM Plan (Dr. Jyoti NALE, Project Advisor, SGR-IEWP, GIZ)
- Technology Innovations & Interventions for RBM Solution Forum: a B2G interface, showing the practicalities of moving from plan to action in the Tapi River basin (Mr. John THOMAS, Senior Expert (Business Interventions for Tapi RBM) IEWP, GIZ)
- Introducing a remote sensing-based protocol for determining irrigation efficiency (Ms. Charlotte de Fraiture, EU Expert, IHE Delft
- Experience from the EU MS regarding water balances, water allocation, drought management, and adaptation to climate change (Mr. Carlos BENITEZ SANZ, EU Expert, Water Planning and Management)

Side Events by IWMI, Water Research Commission of South Africa and University of KwaZulu-Natal on "New approaches in agricultural water management capacity building"

Agricultural water management (AWM) continues to attract science, policy, and donor interest because water consumed in irrigation provides food and fibre security yet intersects with water allocation for other sectors such as cities and freshwater ecology. The balancing act between improving the performance of irrigation systems whilst not raising levels of water consumption requires careful and tailored approaches underpinned by good science working at all scales. However, the lack of high-degree-level training for water scientists to help achieve this balancing act and to work with irrigation systems and irrigators facing rapidly changing conditions is beginning to show.

The side event presented a 2023 report developed by IWMI and partners for a new capacity-building programme in agricultural water management. The side event concluded that there is a need for an AWM Academy, which will be a partnership of various actors (research/academic, private and public sectors, multilateral funders, farmers, etc.) to train a new crop of agricultural water managers capable of responding to these challenges. The AWM Academy would focus on training junior and mid-career water scientists based in science, policy and funding organisations in Sub-Saharan Africa – although a global remit is also possible. Without this investment in AWM capacity building, we risk missing an opportunity for AWM to lead the transformation of food, water and ecosystems.

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Side Event on Smart Agriculture Technologies for Irrigation Water Management by Indian Water Resources Society (IWRS) INCID-IWRS

Smart Agriculture Technologies for Irrigation Water Management Organized by Indian Water Resources Society, Roorkee (IWRS) Department of Water Resources Development and Management (WRD&M), Indian Institute of Technology Roorkee & Indian National Committee on Irrigation and Drainage (INCID) The session on the topic "Smart Agriculture Technologies for Irrigation Water Management" was organized by the Indian Water Resources Society, in collaboration with the Department of Water Resources Development & Management, Indian Institute of Technology Roorkee, and the Indian National Committee on Irrigation and Drainage (INCID). This session was chaired by Mr. Kushvinder Vohra from the Central Water Commission, who is also the President of IWRS. The co-chairs of the session were Dr. Ashish Pandey, Executive Vice-President of IWRS, and Er. Ashok K. Kharya, Vice-President of the Executive Office of IWRS. The keynote speaker for the session was Prof. Yutaka Mat-suno, a Professor in Agricultural Technology and Innovation Research Institute at Kindai University, Japan. He discussed Agriculture Water management systems through smart technologies and the Robotics model in Japan. He explained the advanced irrigation system for crops and focused on various issues faced by farmers in the agricultural sector. Mr. Anuj Kanwal, Commissioner of Command Area Development & Water Management and Bureau of Water Use Efficiency, Ministry of Jal Shakti, Government of India, explained the Water Use Efficiency goals in India.

He talked about the irrigation water management problems faced by Indian farmers and how to overcome these types of problems. Another keynote speaker, Prof. Sri-nivaulu Ale from the Department of Biological and Agricultural Engineering at Texas A&M University, Texas, USA, highlighted the smart Android mobile application for smart irrigation in the Texas Rolling Plains region. He explained the workflow of the decision support tool in agriculture water management and focused on real-time crop information for cotton cultivation. During the session, students from IIT Roorkee presented posters related to IoT systems in farming, some field experiments, and satellite data for estimating soil moisture. The session included interactive Q&A segments where participants had the opportunity to engage with experts and clarify doubts on the presented topics. In conclusion, the Chairman of the session, Mr. Kushvinder Vohra, stated that as the agricultural sector faces the challenges of a growing global population and climate change, the adoption of smart technologies for irrigation water management is a promising step towards a more resilient and productive industry.

Visit to Tadipudi Reservoir

Thatipudi Reservoir was constructed on the River Gosthani in Andhra Pradesh State, India between 1963 and 1968 with a cost of Rs. 20.43 million. The main objectives of the project are to provide drinking water to Visakhapatnam city @ 11 Mgd and to irrigate 15366 Acres in Gantyada, S. Kota and Jami Mandals in the Vizianagaram District. The reservoir storage capacity is 3.325 TMC. The annual irrigation demand is 1817 Mcft and the annual drinking water demand is 643.00 Mcft.

The canal system under the Thatipudi Reservoir Project became old and has deteriorated with time, due to which water could not be conveyed to the contemplated ayacut at the tail end reaches. Due to this reason, the improvements and modernization of the canal system had to be taken up to stabilize the ayacut under the project with an estimated cost of Rs. 24.92 Crores (US$ 3 million) under the JICA programme and completed in 2016.

As part of the 25th ICID Congress & 74th IEC Meeting held from 1-8 November 2023 at Vizag, India, a technical tour to Thadipudi Reservoir

was arranged for the participants. President Prof. Dr. Ragab Ragab along with Vice President Hon. Dr. Yella Reddy, and Mr. Madhu Mohanan, Communication Officer, Assistant Program Officers - Mr. Prakash, Mr. Mukesh Kumar, ICID Central Office, visited the Reservoir on 10 November 2023 and interacted with the project officials. The following suggestions were made for the effective functioning of the project:

- Establishing Automated Water Level Recorders (AWLRs) and automatic Water Quality monitoring system at Thatipudi Reservoir Project for

SALIENT FEATURES

Longitude — 83°11′ 40″
Latitude — 18° 10′ 19″
Catchment area — 129 Sq. Miles
Maximum flood Discharge — 41,624 Cft/Sec.
Dependable Yield — 2.194 TMC
Spillway gates — 4 Nos (9.14 M x 6.10 M)
Gross capacity at FRL — 3.325 TMC
Live Storage — 3.175 TMC
Dead Storage — 0.150 TMC
Water supply to Visakhapatnam — 0.643 TMC
Irrigation Demand — 1.817 TMC
Max. height of Dam — 26.50 M
Free Board — 3 M
Top width of Dam — 4.88 M
Length of earthen Bund — 540 M

WATER SPREAD AREA

At Full Reservoir Level (FRL) — 2600 Ac.
Ayacut stabilized — 15366 Ac.
Crest level — +84.42 M
FRL — +90.52 M
M.W.D. — +90.52 M
T.B.L. — +93.57 M

DRINKING WATER DRAW

Off levels — +73.61 M; +76.65 M; +79.70 M
Irrigation sluice Draw-off levels — +76.50 M; +81.68 M
Irrigation sluice Vent size — 1.80 MX 1.20 M
Average bed level of river — +67.72 M
Deep bed level — +67.30 M

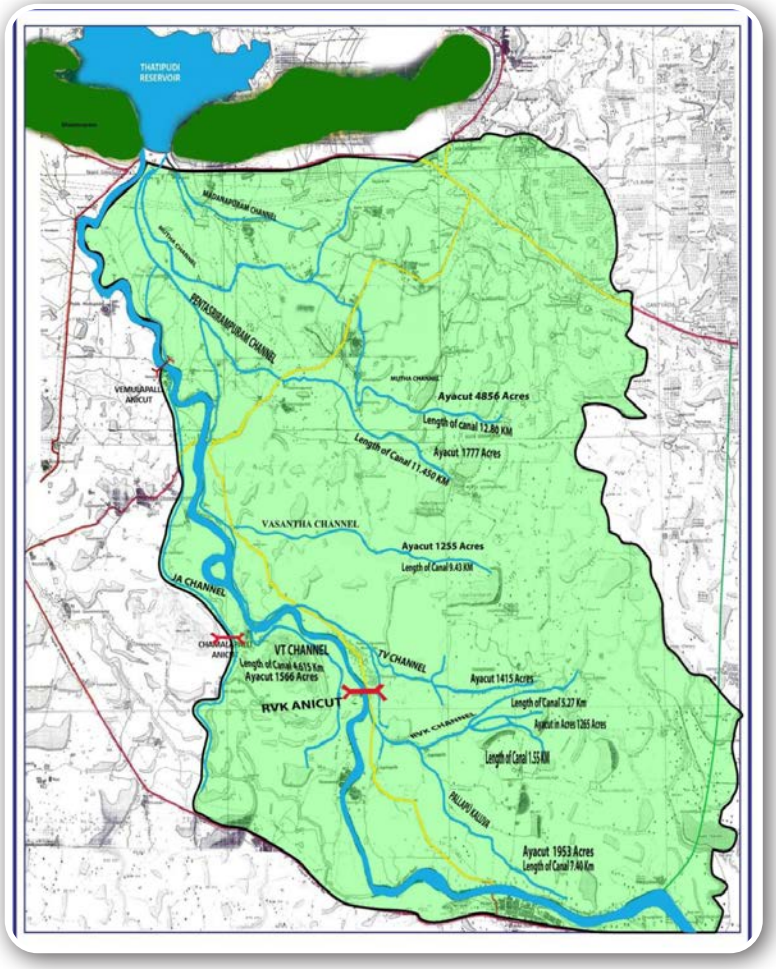


Figure: Ayacut map

real-time monitoring the Reservoir levels and water quality as water of the reservoir is used for domestic water supply.

- Encouraging farmers to adopt water-saving practices by implementing Drip Irrigation and Sprinkler Irrigation.
- To involve universities/ engineering colleges to encourage students for field trips to the Reservoir. Many PhD and MSc research projects could be conducted using the reservoir's data. One of these studies could be on climate change impact, water saving on rice cultivation, and more.
- The existing Project site location is suitable for tourism and hence necessary steps have to be taken to develop the same as a tourist spot which in turn will generate resources for additional maintenance for the project.
- Necessary measures have to be taken up periodically to ensure that the project is in a healthy condition.

The competent authorities of the project are:

1. Mr. S. Sugunakar Rao, Chief Engineer, North Coast, Visakhapatnam
2. Mr. K. Suryakumar, Superintending Engineer, Irrigation Circle, Visakhapatnam
3. Mr. M.A. Seetharama Naidu, Executive Engineer, Irrigation Division, Vizianagaram
4. Mr. S. Pandu, Deputy Executive Engineer, A.R. Sub Division, Gajapathinagaram
5. Mr. V. Tamminaidu, Assistant Executive Engineer, Thatipudi Section, Thatipudi

The following points are derived from the ICID President's technical briefing:

- The location of the Tadipudi reservoir is picturesque and the large water body with clean water gives a very pleasant look and begs for more development to make full use of such a unique location with an extraordinary landscape.
- The reservoir project could be a good study material for students and research scholars in terms of hydrology, reservoir design, operation and maintenance and management, water quality, climate change impact and flood routing studies.
- Suggested to establish automatic and continuous Stage Level Recorder and water quality (as part of this water is used for drinking) at the dam site. This will also require building an office on site equipped with high performance computers to receive the automatically recorded data and produce real-time observation series.
- Water quality parameters must be observed very closely as the surrounding agricultural activity and use of agro-chemical (e.g., Nitrogen, Phosphorus, Potassium, etc.) could affect the suitability of water for drinking.

- As most of the irrigation water was delivered to paddy fields, the President suggested rethinking the way the Rice is cultivated and adopting more water saving practices such as dry rice cultivation and drip irrigated rice which proved to save a significant amount of water, produced more yield, and prevent mosquitos and Malaria disease. Mrs. Reddy who is specialized in plant breeding and biotechnology and took part in the visit confirmed the possibility of using different rice varieties for non-paddy cultivation.
- The President appreciated that the original design of the reservoir considered a possible 20% extra storage to accommodate above-average runoff flow to the reservoir due to extreme events and possible climate change impact. This was a smart thinking ahead of time.
- The president also investigated the location and operation of the spillway. He appreciated the location as it is far away from any downstream community housing who are usually the victim of the sudden release of spillway due to extreme events.
- Given the reservoir is a "beauty spot", the President suggested the site be developed further to allow, water sports, tourism (boat site seeing), swimming training, school and university visits and promote the region including the site nationally and internationally as a holiday destination. The development will of course be accompanied by establishing facilities for food, drinks, waste disposal/collection and sanitation which will attract investors to pay for the construction and will at the same time be a "job creation" process for the locals.
- The president was highly impressed by the work of the three members of staff who oversee supervision, operation, and maintenance. The authorities must be proud of them, and they should be proud of themselves for keeping this huge reservoir in such immaculate condition. However, with the suggestions above in relation to continuous monitoring and redevelopment of the site, more staff will be needed.

At the end, the ICID delegations including the President, thanked the staff for their hospitality and their explanation of all aspects of the reservoir from design to spillway operation to stage measurement to water source and use and more. We cannot thank them enough for their efforts, friendly discussions, and professionalism.

12th N.D. Gulhati Memorial Lecture, 2023

Hon'ble Minister Mr. Gajendra Singh Shekhawat, Ministry of Jal Shakti, Government of India delivered the 12th N.D. Gulhati Memorial lecture for International Cooperation in Irrigation and Drainage on the theme **"Ensuring Water and Food Security through Climate Resilient Infrastructure"**. To express gratitude and to pay tribute to the late N.D. Gulhati, the father of ICID, a visionary, who dedicated his entire professional life to the development of irrigation and drainage, a memorial lecture is organized in every ICID Congress. The memorial lecture aims to encourage the exchange of significant global developments relevant to irrigation and drainage engineering, including all allied aspects like the environment, sociology and economics, as well as fostering and enhancing international cooperation to meet the ICID objectives.

Brief extract of the lecture:

It is a well-established fact that irrigation can enhance agricultural productivity by increasing crop yields, improving crop quality, extending the growing season, reducing the risk of drought, and enabling crop diversification. However, unplanned irrigation also poses some inherent threats to agriculture such as increasing waterlogging, soil salinization, soil erosion, nutrient leaching, etc. Therefore, proper planning, design, implementation and monitoring of irrigation infrastructure along with adopting best agricultural practices is essential to optimize its benefits.

As we reflect on India's progress since independence, it is evident that we have come a long way in the water sector. As a founding member of ICID, India has actively participated in Shaping the Global Discourse on Irrigation and Drainage Engineering.

Hon'ble Minister Mr. Gajendra Singh Shekhawat presented a brief overview of country's progress in water resources development, vital role of storage and

increasing water use efficiency to meet burgeoning irrigation demand with growing population. He flagged various issues, challenges, way forward and the government's commitment to water resource management and particularly in attaining sustainable development goals. He also emphasised on crucial role of international collaboration for redressal of the inextricable linkage of climate change and food security.

Hon'ble Minister Mr. Gajendra Singh Shekhawat called for proper planning and designing and implementation of irrigation infrastructure along with practising best agricultural practices to optimise benefits. He further mentioned that Jal Shakti Ministry had given a great synergy and coherence in water management and committed an investment of $140 billion by 2024 in water and sanitation sectors. "India is striding forward in terms of economy. However, when it comes to fresh water, there is only 4% available in the country and there is a need to focus more on water management."

Since independence in 1947, India has achieved monumental agricultural progress from being net importer and barely sufficient to one of the largest exporters of all kind of agriculture and horticulture produce today. Irrigation plays a crucial role in India's journey ensuring water availability and boosting crop yields.

Stressing on following a comprehensive approach towards the water sector as a whole rather than focusing on irrigation alone, Mr. Gajendra Singh Shekhawat informed that in India, the total irrigation potential created so far reached 114 million hectares from various sources of surface and groundwater which is over three-fold increase in the past 75 years.

Storage plays a vital role in irrigation, as it effectively bridges the gap between the fixed duration supply of water and the ever-present demand throughout the year. Additionally, storage facilities play a pivotal role in mitigating the risks associated with droughts and floods, which have the potential to significantly impact the agricultural productivity and livelihoods of countless farmers. India's total live storage capacity now stands around 250 billion cubic meters, which is significant increase from 111.47 cubic meter in 1971. However due to the requirement for a high capital investment and rehabilitation & resettlement cost, it's becoming more and more challenging to create new storage reservoirs. In this context, its essential that we manage our storage in more prudent and efficient manner. The government under the leadership of Prime Minister Mr. Narender Modi has adopted the approach of efficient management and utilisation of existing water storage with the active involvement of all stakeholders and integrated reservoir operations.

Climate change is posing serious threats to the entire world. Indian sub-continent is already facing huge temporal and spatial variability in respect of availability of water, and climate change further worsens the situation. Climate change will make hydrologic events more unpredictable and lead to more frequent occurrence of hydrological extremities like floods and droughts. Various studies indicate greater expected loss in the Rabi crop and every 1°C rise in temperature reduces wheat production by 4-5 Million Tonnes. Collectively the impact of climate change, continuous rise in population and deterioration in water quality due to various anthropogenic factors could affect the Indian irrigation sector. India being the second most populous country, seventh largest country by area and the fifth largest economy but having only 4% of freshwater resources of planet is acutely aware of our role in addressing the issue. Considering these potential threats, Prime Minister's National Action Plan on Climate Change (NAPCC) has been continuously making various mitigative and adaptive climate resilient interventions. National Water Mission and National Mission for Sustainable Agriculture are at the core of NAPCC. engineering.

Through various global initiatives and recently through G-20 engagement, India have demonstrated our dedication to sustainable water management practices. Mr. Gajendra Singh Shekhawat mentioned that 25th International Congress on Irrigation and Drainage provide unique platform for us to share significant developments in irrigation and drainage engineering. He urged all the participants and delegates that let us work towards tackling water scarcity in agriculture and ensuring a sustainable future for generations to come. He further extended his heartfelt gratitude to all the participants, organizers, and partners for their contributions in making this congress a resounding success.

WatSave Award, 2023

WatSave Awards are annual awards that were instituted by ICID in 1997 to recognize and encourage the development of innovative ideas to facilitate robust and result-oriented technologies that could be implemented to save the usage of water for agricultural purposes. This year's WatSave Award goes only in the Category of Technology.

IRRISAT – A satellite Based Irrigation Advisory Service (Technology) Prof. Guido D'URSO and Mr. CARLO DE MICHELE (Italy)

IRRISAT is a satellite-based irrigation advisory service developed in Italy and operational since 2007 in the

Campania region (Southern Italy); nowadays it has been used in Australia (with name COALA). The service aims at providing farms and managers of water resources with real time information on crop water needs. Irrigation needs are estimated using high resolution data from Earth observation satellites and meteorological gridded data (including 5-days forecast) by using the FAO 56 "direct" calculation method. Data are aggregated at various spatial scales (from field or irrigation unit to district or river basin scale) and temporal scales (real time, historical series). Information is distributed in near-real time to the users (farmers and/or water agencies) by using ICTs, namely web- mapping applications. Several water user associations in Italy are using IRRISAT for supporting their everyday management of irrigation distribution, as well as for detecting non-authorized water withdrawals. For details, please visit <**https://icid-ciid.org/award/watsave/43>.**

7th Best Performing National Committee Award, 2023

The Best Performing National Committee Award (BPNCA) is presented triennially at every ICID Congress, with the main objective to recognize the contributions made by a National Committee to fulfil ICID's mission and objectives. It is presented at every triennial Congress starting from the 18th ICID Congress (Montreal) in 2002. The performance of the award-winning National Committee is judged by a Panel of Judges based on the performance of the `Candidate National Committee' during the 3-year period between the immediate past two consecutive Congresses. Iranian National Committee on Irrigation and Drainage (IRNCID) has won the 7th BPNC Award. The award was received by Dr. Sahar Norouz from President Prof. Dr. Ragab Ragab on the occasion of the 74th IEC Meeting and 25th ICID Congress held in Visakhapatnam (Vizag), India November 2023.

Best Paper Award 2023

The ICID Journal 'Irrigation and Drainage' is the flagship publication of ICID. The journal is a prestigious, peer-reviewed publication, publishing original papers on scientific, engineering, environmental and socio-economic issues associated with irrigation and drainage. It is a rich resource of reference to professionals, engineers, researchers, university professors, and students of irrigation, drainage, and agriculture disciplines. Its management is governed by an International Editorial Board (EB). 'Best Paper Award ' was started in 2006 to recognize the outstanding papers contributed to 'Irrigation and Drainage', annually. During the 74th IEC Meeting, the Best Paper Award 2023 was presented to Wenpeng Xie, Masaomi Kimura, Yohei Asada, Toshiaki Iida, Naritaka Kubo from Japan for their outstanding paper titled '**The development of a hybrid model to forecast paddy water temperature as an alert system for high-temperature damage'**. <**https://onlinelibrary.wiley.com/doi/10.1002/ird.2692>.**

Climate change has led to increasing global air temperatures. In the field of crop cultivation, long-term high temperatures (heatwaves) during the rice-growing season might increase the risk of high-temperature damage to rice, which might result in reductions to the yield and quality of rice. In this study, a hybrid forecast model consisting of a combined paddy field heat balance model and a meteorological forecast model is proposed for predicting 1-day-ahead water temperatures as an alert system for high-temperature damage to paddy fields, with resolution in terms of hours. The results show close agreement between the measured and predicted water temperatures, and the high-temperature alert accuracy was 88.5%. Additionally, the climate resilience of paddy fields was investigated by using the rising annual temperatures due to climate change. The observations indicate that while paddy fields are sensitive to the climate, their climate resilience can be improved through artificial measures. Farmers and managers of paddy fields can thus be made aware of the water temperatures of the paddy fields in advance to enable reasonable management of water resources and avoid high-temperature damages caused by extreme weather conditions.

World Heritage Irrigation Structures (WHIS), 2023

ICID identifies, recognizes and maintains a record of World Heritage Irrigation Structures of archival value that are more than a century old and help understand the evolution of irrigation systems among civilizations across the world. This concept was mooted at the 63rd International Executive Council (IEC) Meeting held in Adelaide, Australia in 2012. The idea is to conserve these heritage structures for posterity on the lines of the world heritage sites recognized by UNESCO. During the 74th International Executive Council Meeting held at Vizag, Vishakhapatnam, India in November 2023, a total of 19 World Heritage Irrigation Structures were recognized for inclusion in the ICID Register of World Heritage Irrigation Structures (WHIS). With this addition, the WHIS Register now comprises 159 structures from 19 countries. For more information on the Register, please visit: <**https://icid-ciid.org/award/his/44**>.

Newly recognized structures are:

- Baini Weirs, Hongze Lake Irrigation System, Huoquan SpringIrrigation System, and Qimenyan Irrigation System, **China (Four).**
- Balidiha Irrigation Project, Jayamangal Anicut, Prakasam Barrage (Old Krishna Anicut), and Srivaikuntam Anicut**, India (Four).**
- Notog Weir, The Kepajaran Main Intake, and The Talang Barrage / Dam, **Indonesia (Three).**
- The old regulator Al-Hussainya, **Iraq (One).**
- Takebe Weir, Yamagata-goseki Irrigation System, Honjukuyousui Irrigation Canal, and Kitayama Irrigation System (Canal), **Japan (Four).**
- Damnoen Saduak Canal, and Bang Nok Khwaek Lock, **Thailand (Two.)**
- Şamran Canal, **Turkey (One).**









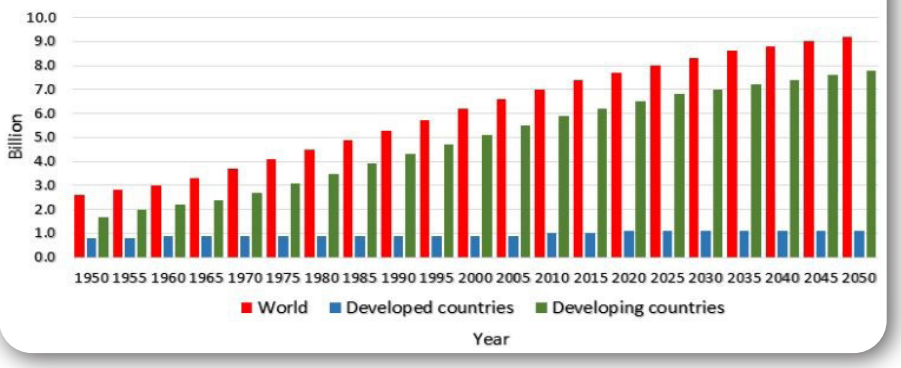
Harnessing Water Use Efficiency through Transversality Systemic Approach

Dr. Arvind Kumar, President, India Water Foundation (IWP)

In the past, the main force behind the demand for food has been the growth of the population. However, with a slowdown in global population growth rates, other factors like increasing per capita income and individual food consumption are now gaining more importance in influencing the global demand for food. As of the first quarter of 2023, the world's population has reached 8 billion, and projections indicate that it is expected to further increase to 9.2 billion by the year 2050. This marks a progression from the global population of 7.6 billion in 2018, which grew to 8 billion by the closing part of the first quarter of (Figure) 2023.

By 2050, around 8 billion people will reside in developing nations, with 1.2 billion in developed nations. Notably, population growth in Europe and Japan will be offset by U.S. growth. To meet increased food demand, global agricultural production must rise significantly. Developing countries, particularly in Asia (41%) and Africa (47%), will drive population growth. Annual global food consumption is expected to increase by 1.4% between 2022 and 2031, mainly due to population growth in low- and middle-income nations. Technological advances in developed nations contrast with the prevalence of small farms worldwide (84%, producing one-third of crops).

Figure: Population Growth 1950 – 2050



(**Data Source:** Food and Agriculture Organization (FAO) and World Bank; **Figure Source:** George Silva (2018). Feeding the world in 2030 and beyond – Part 1 Productivity challenges. Michigan State University Extension. Available online at: https://www.canr.msu.edu/news/feeding-the-world-in-2050-and-beyond-part-1)

Increasing arable land is crucial for food production, but in 2020, global arable land was at 10.6%, down from 10.8% in 2019. Bangladesh, Denmark, Ukraine, Moldova, and India had the highest percentages. In 2016, global arable land was 1.4 billion hectares, with Asia, Africa, Europe, North America, and South America having the most. Developed countries had more arable land in 1961, but by 2007, developing nations surpassed them. Over 40 years, pollutants and erosion have endangered one-third of arable land, limiting expansion. About 200 million more arable hectares may be available by 2050, mainly in Sub-Saharan Africa and Latin America. However, deforestation poses ecological risks. Per capita, arable land globally will decrease from 0.42 hectares in 1960 to 0.19 hectares in 2050. Developing countries face a reduction from 0.33 to 0.14 hectares, necessitating more intensive land use. Soil salinity in India is a concern, affecting around 6.74 million hectares, with estimates suggesting 50% of arable land could be salt-affected by 2050.

Role of Water in Agriculture

Global agriculture accounts for 70% of freshwater withdrawals, and by 2050, a 50% increase in agricultural production and 15% rise in water withdrawals are needed to feed 9 billion people. Climate change, population growth, urbanization, and economic development are straining water resources, causing scarcity and competition. Traditional freshwater sources are polluted and depleted. Glaciers, vital for climate, biodiversity, and water resources, are melting rapidly due to human activities. Recent studies show alarming rates of glacier loss, contributing to sea level rise. Water scarcity and stress, driven by physical and economic factors, pose threats to sustainability, food security, and human health. Wastewater reuse is gaining traction to address rising water demand in agriculture amid depleting water resources and increasing pollution levels.

Wastewater Reuse in Agriculture

Farmers, responding to increased agricultural demand, are exploring non-conventional water sources, particularly domestic and municipal wastewater with high nutrient content. Improper use poses health risks, but treated and safely applied wastewater can enhance food security. Agriculture can employ wastewater directly (e.g., for livestock or irrigation) or indirectly (through managed aquifer recharge). Approximately 44% of the 3,928 km^3 of water withdrawn annually is consumed, with 56% discharged as wastewater, including agricultural drainage. Municipal water demand contributes 11% to global water withdrawal, with 8% discharged as wastewater (330 km^3 annually), a potential resource for irrigation. Regions like MENA, Australia, and China regularly use municipal wastewater. Globally, around 2.75 million km^2 of land are irrigated, and the annual 330 km^3 of municipal wastewater could potentially irrigate 40 million hectares. Despite challenges, there is significant potential to improve and expand the planned use of wastewater

to meet global food production water demands.

Benefits and Risks of Reusing Wastewater in Agriculture

Reusing wastewater in agriculture offers multifaceted advantages, addressing critical issues such as water scarcity, soil fertility, and environmental sustainability. The practice contributes to increased water availability, particularly in areas with limited conventional water resources, offering an alternative to costly freshwater irrigation. Wastewater contains valuable nutrients like nitrogen, phosphorus, and potassium, along with organic matter, enhancing soil fertility and structure. This not only improves agricultural productivity but also presents a viable solution to reduce reliance on chemical fertilizers, subsequently saving costs and mitigating environmental pollution.

Beyond the agricultural realm, wastewater reuse holds the potential to transform livelihoods and address broader societal challenges. By allowing farmers to diversify crops and increase production, the practice can bolster income and food security. Job opportunities arise along the entire value chain, from wastewater collection and treatment to distribution and marketing. Moreover, wastewater reuse helps minimize food waste and eases pressure on water and soil resources by reducing the need for freshwater and chemical inputs. Despite these benefits, careful consideration and adherence to quality standards are essential due to potential health risks and environmental impacts associated with the use of untreated or partially treated wastewater. Striking a balance between maximizing the advantages of wastewater reuse and minimizing its potential drawbacks is crucial for ensuring a sustainable and safe approach to agricultural water management.

Transversality Systemic Approach

In projects focused on reusing wastewater, it is crucial to embrace the principles of Integrated Water Resources Management (IWRM), necessitating a participatory approach that engages all stakeholders. A broad basin-wide perspective, taking into account interconnections and trade-offs, becomes paramount, emphasizing adaptive management grounded in continuous monitoring and evaluation. Additionally, a demand-driven approach is pivotal, promoting water conservation, efficiency, and productivity. Emphasizing a precautionary approach to minimize adverse effects on human health and the environment is essential, coupled with the imperative to ensure equity and social justice in water allocation and access.

The transversality systemic approach, characterized by interdisciplinary and holistic perspectives, seeks to comprehend and tackle intricate issues by integrating diverse knowledge from various fields. This approach emerged in response to reductionist methods that fragment knowledge and disregard interdependencies. In the context of wastewater reuse, a transversality systemic approach involves considering technical, environmental, social, and economic aspects. Collaborative efforts among stakeholders play a vital role in crafting comprehensive and sustainable solutions. However, challenges encompass institutional, social, technical, and environmental limitations, including concerns about health risks, aesthetic considerations, and the sustainability of wastewater treatment technologies. Despite these challenges, the approach yields advantages by enhancing water use efficiency, supporting the circular economy, and contributing to sustainable development and climate change adaptation.

Way Forward

For global development, sustainable water management is essential. Concerns about the widening gap between the supply of water and the growing demand for water are being addressed by policymakers and the scientific community more frequently. With increased water stress and shortage predicted, there is an increasing focus on efficient water use, which calls for more innovative and out-of-the-box approaches. However, they fail to take into account the proper closing of the loop in the operational water cycle, which is necessary for identifying pathways to circularity. Freshwater sustainability and water-use efficiency approaches have a tendency to reconcile the consumption of freshwater with economic growth and societal development. Currently, agriculture is the sector using the most freshwater and wastewater globally. It should go without saying that using and supplying wastewater for irrigation can reduce the pressure of on-site demand on agro-industrial activities and ensure the continuity of the supply chain, maintaining food security, as such, a circular economy approach that uses wastewater for agriculture presents another opportunity to improve water sustainability and water-use efficiency in economic systems in conjunction with the application of a transversality systemic approach that disallows ecosystem-based adaptation, integrated water resource management, and the water-energy-food (W-E-F) nexus approach.

However, the effective implementation of water-use efficiency for controlling the reuse of wastewater/treated water in agriculture relies on several factors. These include harnessing technological capabilities, adapting existing systems to incorporate wastewater systems, and garnering support from policymakers and the general public. The successful application of the transversality systemic approach, along with its allied approaches, in ensuring water-use efficiency for managing the reuse of wastewater/treated water in agriculture presents an opportunity to develop a framework that can facilitate the scaling up of such practices for replication in other contexts. To implement such a framework, it is essential to identify and address barriers related to economic, environmental, and technological feasibility, as well as societal and political considerations. By aligning the circular economy as a political goal achievable through actionable measures, the transversality systemic approach, along with allied approaches like EbA, IWRM, and the water-energy-food nexus approach to managing wastewater reuse, can be positioned as a conceptual solution to address the water crisis.

Captured Moments from Vizag Event











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International Commission on Irrigation and Drainage (ICID) established in 1950 as a scientific, technical and voluntary not-for-profit professional international organization.

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