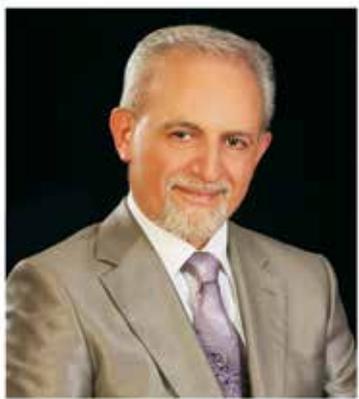


ICID NEWS

MANAGING WATER FOR SUSTAINABLE AGRICULTURE



MESSAGE FROM THE PRESIDENT

Dear Colleagues,

I take this opportunity to wish ICID fraternity a new year filled with prosperity of thoughts, joy of actions, and contentment of achieving the goals. I look forward to seeing our fraternity help acquire the development objectives in a holistic manner worldwide through agricultural water management.

We have had a very fruitful year 2016, representing ICID in a number of international events as well as organizing regional conferences and workshops. However, the most satisfying event was the Second World Irrigation Forum (WIF2), with true multi-stakeholder flavor, that was successfully organized by THAICID in Chiang Mai, Thailand in November 2016. My sincere thanks go to the Royal Irrigation Department for their excellent organization and management of the Forum with full professionalism and the highest standards of any scientific gathering.

The Forum was adorned by a fruitful Ministerial and an intense high level officials Roundtable meetings. The outcome of the meetings in the form of a statement rejuvenated the cooperation among ICID member

countries and laid the foundation for active collaboration under the guidance of high level officials. On the other end of the spectrum, farmers and Young Professionals (YPs) from different parts of the world enjoyed the opportunity to interact with various stakeholders. Apart from the roundtable meetings, the Young Professionals availed the opportunity of the presence of world's top experts and participated in the training workshops related to various aspects of irrigation planning and practices to achieve the Forum objectives.

I would also like to acknowledge ICID appreciation to all the stakeholders for their commitment to partner in various programs during the course of WIF2 and also planning for future associations towards realization of ICID Vision 2030 and bilateral interests.

The year 2017 begins with great hopes and expectations for ICID to pursue its mission. This year, we will consolidate our activities undertaken in the three year cycle during the 23rd ICID Congress, taking decisions to incorporate the outcomes from the multi-stakeholder discussions at WIF2. Indeed ICID Vision 2030 including the action plan for strengthening the National Committees (NCs) will be amongst our priorities this year and we very much count on our NCs contribution.

We continue to face the challenge that the changing attitudes towards irrigation development and management. Irrigation practices consume lions share of natural resources, some of which are under severe constraints. Agriculture water management (AWM) within the hydrological and socio-economic dynamics has to be conceptualized and perform within such constraints. For

AWM to play its role in addressing the diminishing natural resources and increasing expectations, it is deemed necessary to revisit the old concepts of irrigation development such as crops water requirement, irrigation water losses and indeed irrigation sagacity as a whole.

ICID through collaborative efforts of its effective NC network and the extended partnership works through a number of new initiatives including the Technical Support Unit (TSU) and International Research Program on Irrigation and Drainage (IRPID) has to continue to contribute profoundly in the global efforts to make this world a better place to live through sustainable development.

The 23rd ICID Congress to be held in Mexico City from 8-14 October 2017, will address a couple of major questions that will focus on **"Modernizing Irrigation and Drainage for a New Green Revolution"**. I am sure you would now be preparing yourselves for actively participating in this endeavor. At the 68th IEC meetings planned to be held in parallel with 23rd ICID Congress, we would have to launch the Action Plan that would help us in achieving goals envisaged in ICID Vision 2030. I strongly believe that moving along a well-defined action plan will prove a turning point in the way the ICID network collaborate to achieve its objectives.

Happy New Year 2017!

Dr. Saeed Nairizi
President, ICID



Five years after the Bonn Nexus Conference – Implications for irrigation and drainage

Jeremy Bird*

The water–food–energy nexus offers an unprecedented opportunity for change in agricultural water management. Mr. Jeremy Bird delivered a keynote address on this topic at the 2nd World Irrigation Forum, held at Chiang Mai, Thailand, November 2016. This is an extract of the keynote presentation.



It is increasingly clear that if the world is going to reduce hunger and eradicate poverty in the face of climate change, then not only is achieving security for water, energy and food for people critical, but in doing so a far more integrated and cross-sector planning framework will be needed. The water, energy and food sectors are intimately connected in important ways: actions in one sector inevitably affect the others and each interacts with the natural environment. The way water is sourced, treated, priced and distributed influences energy requirements; dietary choices affect water and energy demands; production of biofuels can displace food production. Focusing on food production automatically puts an emphasis on water use, but also on how energy is utilized in these systems.

In November 2011 the German government hosted the innovative Bonn Nexus Conference to highlight the inter-dependencies amongst water, food and energy within a broader development context. The Nexus conference goals sought to demonstrate the value in adopting a new approach to planning and management that takes into account the inter-connectivity between sectors, not only to benefit from more cost effective approaches, but also to avoid the consequences of unintended negative impacts. The Bonn 2011 policy recommendations have implications for irrigation, namely increasing policy coherence, accelerating access, creating more with less, valuing

natural infrastructure and mobilizing consumer influence. As we have so often seen though, the mere presence of policy frameworks alone is unlikely to bring needed benefits unless accompanied by incentive mechanisms that bring about change. That is what this presentation at the WIF2 set out to examine.

The catalyst for change will come from two recent global agreements. Although following a relatively sectoral approach, there is broad recognition that the individual Sustainable Development Goals are heavily interconnected. Add to that the funding opportunities associated with the Paris climate agenda, there is a tremendous opportunity to bring about change. The fact that both these international commitments have been agreed at the highest level provides hope that societies will embrace a more coordinated and integrated approach. It will however require pragmatism to focus on the most critical points of inter-dependency - and the water–food–energy nexus provides a good starting point.

Irrigation is a classic nexus case, as much of the water used to supplement rainfall is pumped using energy sources of multiple types, including in India using electricity at highly subsidized rates. As climate variability increases, there will be even more demand for energy. The new revolution in solar irrigation pumping is one example of the interconnectivity between climate and sustainability

policy, leading to both mutual benefits and potential pitfalls. Major programs to introduce subsidized solar irrigation pumps in India as a climate mitigation measure through renewable energy technology, may bring other unintended risks. The low operating costs can lead to inefficient water management and over-pumping of aquifers. Dr. Tushaar Shah and the IWMI-Tata Program are piloting an innovative cooperative arrangement of solar farmers that embraces incentives for water saving by allowing solar farmers to feed in surplus electricity into the grid system. Feed-in-tariffs are set to both encourage irrigated agriculture through efficient water management while providing an additional and diversified source of income to farmers – an income which itself a climate resilience benefit. Initial results are encouraging and demonstrate how incentive pricing can be used to change behavior.

Groundwater will also come under increasing stress as drought periods become more frequent, even within wet seasons. There will be a need to adapt irrigation systems to operate under conditions of uncertainty, while conjunctively managing surface and groundwater resources. This will require a far more proactive approach from policymakers to meet the demands of their stakeholders, for example with new approaches to managing aquifer recharge such as those being piloted in Uttar Pradesh State, India.

Africa lags behind the rest of the world in the use of irrigation, with only 5% of arable land irrigated, that figure could be increased to 25% with sufficient investment and better technology. Much of the early benefit in terms of livelihoods and resilience will come from supplementary irrigation, providing a 'first step on the irrigation ladder' for rainfed farmers. Examples of some policy reforms and support mechanisms to achieve this were highlighted in the Agriculture Water Solutions Program.

Africa also has an opportunity to learn from and avoid the problems of over-abstraction and aquifer contamination already faced in many parts of Asia, but to do so will need more proactive policy and incentive

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frameworks. The IWMI-coordinated Groundwater Solutions Initiative for Policy and Practice (GRIPP) is a global partnership that aims to raise awareness of groundwater to provide examples of evidence-based policies and approaches that will sustain the benefits of groundwater.

Wastewater re-use for irrigation is another dimension that is increasing, particularly in peri-urban areas, but the water is often unsafe for both the consumer and the irrigator. In reality it will be years before many less developed and emerging economies that will be able to finance and sustain wastewater treatment plants; and so ways are needed now to more safely manage the existing situation. Simple and safe approaches like retention ponds and watering systems that reduce transmission of pathogens to the crop are available and can be an interim measure to reduce risk

through a multi-barrier approach 'from farm to fork'.

Beyond technical aspects, demographic trends are having a major influence on the way irrigated farming is conducted that also requires relevant policy responses. Male migration to urban areas and overseas has led to the feminization of agriculture and yet women's access to resources, credit and support mechanisms are often not recognized, thus further constraining their opportunities to improve livelihoods.

Many irrigation systems continue to face challenges in performance and delivery at a time when pressures on resources and competition between sectors are increasing. And yet sustainable irrigation practices offer considerable potential for improving communities' resilience to climate variability. The SDG agenda

together with Paris climate agreement provide an opportunity to generate political support to scaling up innovative solutions and for attracting the necessary finance for their implementation.

Together the agriculture water management community have a role to play in providing evidence-based solutions to the challenge of irrigation and to water management more broadly. In doing so, we need to take account of and benefit from the inter-relationship of water, food and energy. IWMI has joined a broad range of partners under the CGIAR Research Program on Water, Land and Ecosystems to support that aim.

The presentation can be accessed at <http://www.icid.org/wif2_bird_iwmi.pdf>.



Role of Women in Irrigation and Drainage Sector

Kathleen Heuvel*

As a run up to the 2nd World Irrigation Forum, an e-Forum was organized for the Young Professionals to discuss the role of women in the irrigation and drainage sector. The discussion focused on the unique challenges they face and some possible solutions to address those challenges. The group was able to draw on a wide range of backgrounds with participants from Zimbabwe, Ethiopia, Vietnam, Iraq, Faso, Bangladesh, North Sudan, Morocco, Somalia, United Kingdom and Australia. Below is a summary of outcomes of the discussion.

The challenges have been grouped into social challenges, legal restrictions and institutional enablement within the sector. The status and role of women was explored in terms of women's involvement in Water Users' Associations (WUAs), capacity development (trainers and community organisers), irrigation management and lastly training and extension.

The role women play in the development and management of water resources

The importance of involving both men and women in the management of water and sanitation has been recognised at a global level since the 1977 United Nations Water Conference. From the discussion a general consensus was made that women

have a crucial role in the irrigation and drainage sector too. Women around the world contribute through a diverse range of skills from maintaining household food production, water and food preparation, supporting the family workforce, field labour, post harvest processing, education, training and professional roles in water resource management. An example from Somalia, a developing country shows



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that women are increasingly involved in the sector and that there is rise in female entrepreneurs breaking into sectors traditionally dominated by men.

Perhaps the importance of the role women can play is best summarised by the comment that women's empowerment in agriculture has a direct positive relation to calorie availability and dietary diversity at the household level and is also associated with household wealth. However, one recurring issue raised was the socio-cultural beliefs in some regions that dictate women cannot hold positions of responsibility and must remain in the household activities. In these cases women remain an untapped resource and such societal barriers prevent women from holding decision making positions or participating at high levels in the market.

Restrictions, inequalities and challenges women face in the sector

Women face many social challenges and in some cases legal restrictions that limit or prevent their involvement in the irrigation and drainage sector. The general consensus was that the challenges and restrictions women face are exacerbated in developing countries. Another notion that was echoed by several of the participants is that women often carry the social responsibility of running a household, often in addition to their work in the field. These tasks often are not assigned any economic value, which combined with unequal pay puts women at a considerable economic disadvantage and increased workload. While it is widely agreed that equal pay is imperative, the group opined that shared household responsibility should be addressed through education, support and cultural change. Providing support networks that develop the skills of women and encourage empowerment are a step towards influencing cultural change in this area. Gender inclusive social meetings, agricultural training and education opportunities also incentivise women and give young women the aspiration to strive for success in the industry. This is one of

the areas where many participants have reported observing positive changes. For example, there is evidence to show that there is an increase in female farmland owner's registration with water users' associations and they have the right to vote in these associations as per Iraqi law.

Policy provisions in place in the sector, are they enough and how could they be improved

For the most part, there are sufficient policy provisions in place with respect to gender participation in agriculture and consequently in the irrigation and drainage sector. However, the industry remains largely male dominated and it is believed that lack of women empowerment is the main cause for this imbalance. It was highlighted that there is lack of policy provisions in place in Morocco, for instance, to encourage gender participation. It is thought the lack of access to resources (land, markets, and credit), services and information along with cultural constraints and legal framework all contribute to a lack of female participation. This issue is certainly more prevalent in the developing world. Education in this area should highlight the opportunity for a community to increase production of food and fibre in an attempt to drive a change in legal and policy provisions that restrict women's participation in the sector. At the heart of this issue is the need for women to be active in all levels of the sector but perhaps most importantly at a policy and decision making level.

Provisions to support women's involvement in Participatory Irrigation Management

There was mixed opinions on the level to which Participatory Irrigation Management acts make provisions to protect the rights of women and encourage their participation and fair treatment. This is largely driven by the level of development and degree of gender equality in the society. Some great examples have been shared that show women being empowered to participate in water resource management, from

the Vietnamese Water Resource Ministry to the Australian water trading market. More can certainly be done in this area, whether through gender inclusive meetings or promoting women's representation on boards and in decision making roles.

Capacity development needs for better involvement and performance of women and the methodology to be adopted to fill these needs

There are a wide range of capacity development needs that must be addressed for better involvement and performance of women in agriculture and irrigation management. These include training and education in practical water management skills as well as in finance, agribusiness and value chain management. Women must be encouraged to participate in decision making roles in the public and private sector in order to promote gender equality to fully utilise women's potential. It is also important to acknowledge the work and special competencies that women currently have the potential to bring to the industry. Women already have such an active role in the agricultural industry, the irrigation and drainage sector must prioritise gender empowerment at all levels; including field, community, professional and decision making roles.

In summary, lack of female empowerment is a key driver in the issue of inequality and is at the heart of this discussion on the role of women in the irrigation and drainage sector. Developing the skills of women, providing positive mentoring opportunities, acknowledging the success and allowing young professional women to be promoted into decision making roles, particularly in the area of policy, are all steps towards building a gender inclusive sector. World is working towards a sustainable increase in production of food and fibre, under constant pressure of an increasing population and changing climate. It is vital that both genders are given the chance to contribute skills, labour, expertise and knowledge to achieve this common goal.



The 67th IEC meeting held at Chiang Mai in November 2016 has witnessed a big support from ICID members to strengthening capacity building activities to professionals working in the agriculture water management sector. Secretary General welcomed the views of the members and took initiative to start a series of Webinars starting from February 2017.

Since 23rd ICID Congress theme is on 'Modernizing Irrigation and Drainage for a new Green Revolution', customized webinars are woven around the theme modernization for the benefit of professionals working in this area. Some of the webinars in pipeline are:

Professional series: (i) Concept of Efficiency (Vice President Hon.

Felix Reinders, South Africa); (ii) Water Accounting and Audit (Mr Jippe Hoogeveen/ Dr Robina Wahaj - FAO); (iii) Benchmarking (Mr. Sanjay Belsare (India)/ Mr. Milano (??)); (iv) MASSCOTE (Dr Robina Wahaj, FAO); (v) Modernisation Approach (Vice President Ian W Makin, UK); (vi) Sustainable Development Goals (Secretary General Avinash C Tyagi)

Young Professional series: (i) Modern Technologies for improved irrigation and drainage sector; (ii) Use of waste water in agriculture; (iii) Controlled drainage; (iv) ICID WatSave Awards; and (v) Environmental impact analysis of irrigation systems using life cycle analysis.

More details on this new initiative will be announced shortly on ICID media.

Declaration of Ministers' Meeting

Ministers from Bhutan, Cambodia, China, Ethiopia, Indonesia, Laos, Nepal, Pakistan, Sudan, and Thailand participated in the Ministerial Roundtable Meeting held during the 2nd World Irrigation Forum on 6 November 2016 deliberated on the mechanism to support countries in delivering on SDGs through Agriculture Water Management (AWM). They advocated for establishment of a multi-stakeholder partnership for the purpose.

RECOGNIZING that Agriculture Water Management (AWM) is key to enhancing water security, ensuring the sustainability of the surface and groundwater resource, achieving food security in a world confronted by limited natural resources while positively influencing the process of achieving almost all Sustainable Development Goals (SDG);

ACKNOWLEDGING the need for advocacy for enhanced investment, means of sharing experiences, exchange of best practices, and transfer of technologies with focussed attention on more effective and sustainable management of agricultural water, setting targets and evolving monitoring mechanism;

NOTING that the International Commission on Irrigation and Drainage (ICID), a professional, voluntary, not-for-profit International Organization, dedicated, inter alia, to enhance the world-wide supply of food and fibre for all people by improving water and land management, through application of irrigation, drainage and flood and drought management for achieving sustainable irrigated agriculture and disaster risk reduction, is supported by more than 60 member countries and serves as the required network;

ACKNOWLEDGING that ICID shares mutual goals of poverty alleviation through food and water security with UN entities Food and Agriculture Organization of the United Nations (FAO), International Fund for Agriculture Development (IFAD), World Meteorological Organization (WMO) as well as other International Organizations such as International Water Management Institute (IWMI), International Crop Research Institute for Semi-arid Tropics (ICRISAT) with participation of Asian Development Bank (ADB) and World Bank (WB), and has a mutual interest and commitment to work for better management of agriculture water and mitigation of water-related disasters caused by floods, droughts, etc., using the latest tools and information;

NOTING that the Paris Climate Conference (COP21) through article 7 of the Paris Agreement established the global goal on adaptation and called upon parties to strengthen their cooperation on enhancing action on adaptation by augmenting adaptive capacity, strengthening resilience and reducing vulnerability to climate change;

NOTING also that the Addis Ababa Action Agenda on Financing for Development calls



for investing in sustainable and resilient infrastructure, including for energy, water and sanitation for all, as a pre-requisite for achieving many of our goals, and recognizes South-South cooperation as an important element of international cooperation for development as a complement, not a substitute, to North-South cooperation;

NOTING that Agenda 2030 for Sustainable Development recognizes Partnership as a means of implementing the agenda and encourages the establishment of voluntary partnerships for the achievement of these Goals;

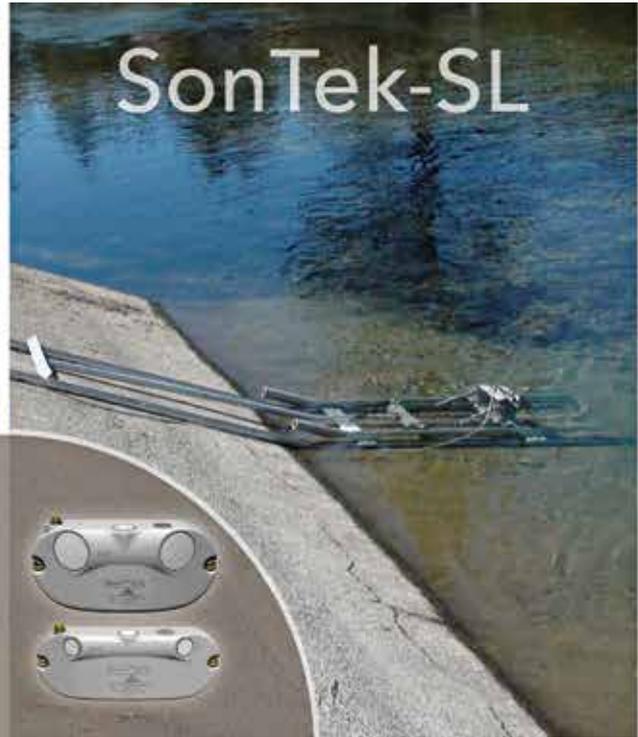
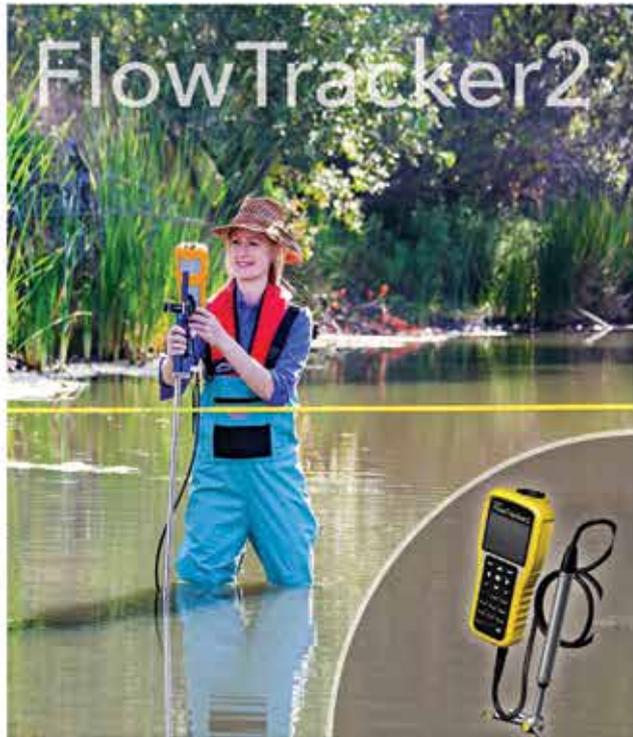
NOTING with appreciation the efforts by FAO to bring sustainable agriculture and food systems to the forefront of the global Climate Change Agenda and the 2030 Sustainable Development Agenda and the partnership initiative on "Coping with water scarcity in agriculture: a global framework for action in a changing climate";

Ministers, participating in the Second World Irrigation Forum, hosted by the Kingdom of Thailand, based on their deliberations on 6th November 2016 decided to:

- (a) **Establish** a High Level Advisory Group on "Partnerships for Agriculture Water Management" as an action-oriented multi-stakeholder partnership to:
 - i. Facilitate improving agricultural water productivity, especially in irrigated areas where the competition for water is intensifying and/or water supplies are becoming less reliable;
 - ii. Support member countries in achieving the SDG targets related to AWM by enabling existing partnerships as well as promoting new partnerships, where required;
 - iii. Support the UN System efforts in monitoring the progress on related SDGs;

- iv. Strengthen the World Irrigation Forum, which provides opportunities for reviewing progress made by existing partnerships with inputs from regional and national partnership dialogues;
 - v. Advocate strong policy support for higher investments in AWM to ensure food and water security;
 - vi. Review and provide policy recommendations at the regional level for consideration by relevant regional bodies; and
 - vii. Use the partnership to share experiences on SDG implementation.
- (b) **Allow** the membership of the High level Advisory Group to be open to all Members of the United Nations and its specialized agencies including multi-lateral development agencies, and will be chaired by a Member State of ICID. The High Level Advisory Group shall meet on a regular basis (at least once a year) and constantly monitor and guide the progress
 - (c) **Invite** entities of the United Nations system, international and regional organizations, major groups, to contribute to the efforts, as appropriate. Countries are to participate on a voluntary basis in national, regional, and global multi-stakeholder dialogues;
 - (d) **Encourage** member countries to organize national multi-stakeholder partnership platforms in AWM, where possible through their National Committees affiliated with ICID, which could also contribute to the regional and global multi-stakeholder partnership through existing forums and meetings, where applicable; and
 - (e) **Recommend** ICID to establish a dedicated Task Force to provide support to the High Level Advisory Group.





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Forum Statement

6th November 2016, Chiang Mai, Thailand

The Second World Irrigation Forum (WIF2) was held from 6 to 8 November 2016 in Chiang Mai, Thailand. The Forum was organized by the International Commission of Irrigation and Drainage (ICID) and the Thailand National ICID Committee (THAICID) in cooperation with a number of international and national partners that brought together representatives of various stakeholders involved in irrigation of all types at all scales. About 1200 participants from 71 countries, 10 international organizations and 9 Ministers attended the Forum.

The main theme '**Water Management in a Changing World: Role of Irrigation for Sustainable Food Production**' recognizes that The world's population is growing rapidly and is expected to reach about 9 billion by 2050, mostly living in urban areas, which pose challenges in meeting the sharply growing water, food and energy demands. In order to feed this growing population it is estimated that agricultural production needs to be increased by about 70% globally and by as much as 100% in developing countries. It is likely that increased food production will have to be achieved with a reducing share of water for agriculture due to competition from other sectors including uncertainty due to climate change and variability. This calls for growing more with less water in a sustainable manner. New ways to grow food in ecologically and ethically responsible manners and expansion of irrigation to previously rainfed areas, along with supply and demand side management options will play a significant role in achieving this goal.

The key to sustainable development of irrigated agriculture in the changing environment and the on-going rural transformation lies around modernization of irrigation systems and related services to improve water use efficiency; improving water and land productivity supported by financial mechanisms; reform of management institutions; adoption of efficient water management techniques including recycling and reuse of waste water; use of modern technologies; increasing awareness about water scarcity and capacity development of service providers and farmers etc. with participation of all the stakeholders (public and private sector, academic and research institutions, industry, civil society, farmers' and their organizations etc.).

Within the context of the Main theme, more than 183 papers, short communications and posters were presented and discussed under three Sub-themes: (1) Key issues of irrigation and drainage in balancing water, food, energy and ecology; (2) Management of climatic extremes with focus on floods

and droughts; (3) Key and smart actions to alleviate hunger and poverty through irrigation and drainage. In addition to the thematic sessions there were 17 Side events and an Exhibition.

A WIF first was the roundtable Ministerial meeting where Ministers from Bhutan, Cambodia, China, Ethiopia, Indonesia, Laos, Nepal, Pakistan, Sudan participating in the Second World Irrigation Forum, hosted by the Kingdom of Thailand, under the chairmanship of Honourable Minister of Agriculture and Cooperatives of Thailand, made a press release based on their deliberations on 6 November 2016. They agreed to establish a High Level Advisory Group on "**Partnerships for Agriculture Water Management**" as an action-oriented multi-stakeholder partnership. The objective is to support member countries in achieving the Sustainable Development Goals (SDGs) and share experiences in implementation of targets related to agriculture water management which is key to both water and food security. It will also support the UN System efforts in monitoring the progress on related SDGs. The partnership will advocate strong policy support for higher investments in Agriculture Water Management (AWM) to ensure food and water security.

As a result of the presentations and discussions at the World Irrigation Forum, the following statements were agreed:

1. The great challenge for the coming decades will be to increase food production with fewer resources -water, soil, energy, and biodiversity.
2. In order to foster sustainable development, it is essential to maintain the balance between water, energy, food, and ecosystem services.
3. The issues that irrigation and drainage sector is facing are (a) safeguarding resource availability and its quality when designing new systems, (b) the operation and maintenance of existing systems and in turn their impact on resources and the environments that hold them, and (c) the stakeholder interaction and participation that lead to the governance of the systems and their underlying resources.
4. The future challenges require unconventional thinking and solutions. Thinking within the water-energy-ecosystem-food nexus framework with water resources at its heart is essential.
5. Increasing water supply to meet the future demand requires a more efficient water use, use of non-conventional water resources, and water harvesting.
6. Sustainability can only be achieved within a complete water chain approach and with full stakeholder involvement from

start to end and from farmer to minister.

7. We need to adopt a more integrated holistic approach to understand and sustainably manage resources with the aim to produce more from less "more crop per drop per kilowatt" without hampering natural ecosystem services.
8. Climate change is recognized as one of the most serious and urgent issue for human society and global environment. In the context of agriculture, improving irrigation and drainage systems and rural development will play a key role in achieving the rural water and food security under impending climate change, especially in the developing countries.
9. To reduce the disaster risks, the global and local society or community need to assess the magnitudes, frequencies, and variabilities of weather and climate events; the exposure of the society for these events; and the vulnerability of the region and society to these extremes.
10. Under the given uncertainties in climate change impact projections, improving resilience by reinforcing the capability of societies to better cope with the extreme events is one of the most favoured approaches.
11. In the pursuit of information to support the policies and actions to alleviate hunger and poverty from a perspective of the role and impacts of irrigation and drainage, correlation must be provided between water scarcity, community and poverty.
12. One of the main goals of the international community is to eliminate hunger and poverty and in this perspective, through the Millennium Development Goals much progress has been achieved and evidence obtained. Sustainable Development Goals and various United Nations and other initiatives, intend to move forward this agenda by making it a part of the broader development frameworks.
13. The important elements of irrigation and drainage that affect the alleviation of hunger and poverty can be grouped into governance, rights-based development, water rights and pricing, management, efficiency improvement, and role of technology.
14. Both the potential and the need to make use of innovative technology and solutions in irrigation are underlined and these can be used to cater the challenges in different sub-sectors with focus on maximizing productivity and efficiency, reducing water losses, achieving sustainable intensification and managing demands on water resources and the associated trade-offs.



Increasing crop productivity ecofriendly by improving sprinkler and micro irrigation design and management

The WatSave Technology Award 2016 was awarded to Prof. Li Jiusheng (China) for his research work on “Innovation and Extension of Sprinkler and Micro Irrigation Technologies in China”. Prof. Li has more than 30 years’ experience in improving modernized irrigation technologies in China and he works for the Department of Irrigation and Drainage, China Institute of Water Resources and Hydropower Research.

Irrigation has been playing an important role in agricultural production of China. Irrigated farmland contributed approximately 75% of grain production and more than 90% of vegetables. Unfortunately, the increasing scarce of water resources and challenging food security issues forced China’s irrigation development to strictly follow a direction of saving water while maintaining an acceptably high production. Sprinkler and micro irrigation systems have been considered as emerging water-saving irrigation technologies in many developing countries, including China. Since the mid-1980s, the author and his team have been making extensive contributions in the field of design, management, and extension of sprinkler and micro irrigation to enhance crop productivity using environment-friendly systems in China, and other parts of the world. The author, holds twelve patents on sprinklers and drip emitters. Since 1990, the innovative findings has been promoted on a total of 68,000 ha under a broad range of environments, from arid to sub-humid, for cotton, maize, and vegetable crops. These applications have resulted in saving approximately 220 million cubic m of water and 270 tons of fertilizer during the period 2000-2015.

Lack of knowledge on canopy interception resulted in hesitation in selecting sprinkler irrigation as a water-saving irrigation method for both government and farmers in China during last two decades. The author and his team conducted systematic studies to quantify the amounts of canopy interception for typical sprinkled crops and to investigate their consumption mechanism. The results indicated that the interception varied from 0.7 to 3 mm for winter wheat and 0.8 to 2.6 mm for maize, varying with growing stages. Moreover, the evaporation of water intercepted by canopy compensated for partial loss of sprinkled water as the plant transpiration and soil surface evaporation could be suppressed by increased humidity and reduced temperature within the sprinkled field resulted from evaporation of water intercepted. Through energy balance measurements (Bowen ratio and eddy covariance methods) and modeling, the net losses were separated from the gross losses



Prof. Li (center) with his research team

and quantified to be 4.3-6.5% of water applied during the irrigation season of maize and approaching zero for winter wheat. The net losses accounted for a relatively small portion of water applied, confirming the water-saving merits of sprinkler irrigation. A software package to determine net loss under varying environments and operation conditions of sprinkler irrigation systems was developed and registered. The author’s works provided a theoretical base and a tool for determining water losses of sprinkler irrigation and contributed greatly in developing strategic planning of the sprinkler irrigation system.

The pioneering work on water and solute transport under drip fertigation began in 1995 when designers and users in China expressed concerns about potentially toxic rhizospheric environments caused by fertigation. The research includes design and operation strategies for injectors, laboratory and field work on the fate of nitrogen in homogeneous and heterogeneous soils, and response of plant growth and crop yield to management practices for water and fertilizers under surface and subsurface drip irrigation. The authors work has provided a guide for the design, selection, operation, and management of drip fertigation systems.

Since 2004, the team led continuous and extensive studies on the influence of drip irrigation uniformity and spatial soil variability on the dynamics of water,

nitrogen, and salts on crop yield and quality. Through extensive experimentation and simulations it was confirmed that the influence of drip irrigation uniformity on crop yield, and on water and nitrogen deep percolation is less than expected. With the increasing use of reclaimed sewage effluent in irrigated agriculture, since 2007 the team is putting efforts for efficient and safe utilization of sewage effluent through micro irrigation. Findings on emitter clogging mechanisms, chlorination strategies for mitigating clogging and increasing crop growth and quality as well as preventing soil degradation, and on the potential pollution risk of pathogens have all made significant contributions in developing best management practices.

The author has been leading the research of variable rate irrigation (VRI), which is an emerging efficient irrigation technology in the world, in China since 2012. The first VRI system in China that includes network of soil moisture sensors and remote control unit was constructed with a three-span (142 m) center pivot. The field works suggested that AWC (available water holding capacity) can be an alternative parameter for zone identification in VRI management. These findings all significantly contributed to literature and provided a leading role in VRI research in the world.

For more information, please contact Prof. Li Jiusheng <jiushengli@126.com>

