2014 | Fourth Quarter

ICID NEWS

MANAGING WATER FOR SUSTAINABLE AGRICULTURE

MESSAGE FROM THE PRESIDENT

Dear Friends,

As the new ICID President on board, I would like to sincerely appreciate the support provided through various ICID National Committees for my election during the 65th International Executive Council meeting in Gwangju, South Korea, 20 September 2014. I would also like to take this opportunity to sincerely thank all National Committees for their support and invite them to effectively work with me in order to promote ICID's activities and achievements during my tenure (2014-2017) and beyond.

This will absolutely be an outstanding motivation assisting me to move with strong confidence. I will also like to take this opportunity to state that I will count on each and every of the offers provided to assist me in my mission.

History and background of ICID activities demonstrates a great deal of scientific contribution of this fraternity to the global knowledge of irrigation and drainage managements and hence agricultural production enhancement. However, during the last couple of decades, the sustainability of limited natural resources, particularly the fresh water availability, were mostly considered marginal and deemed to fail in meeting the ever growing pace of the global demand. Such unexpected pressure upon the available water resources are mainly due to many externalities imposed on the so perceived global water-food balances, which have created many concerns among all the stakeholders involved. Global changes in consumption pattern, environmental concerns, climate change, socio-economic viability of rural development, are examples of such externalities.

ICID, should rightfully welcome this challenge to direct its activities beyond the traditional irrigation, drainage and flood management issues towards more integrated and holistic approaches with the aim of effectively contributing to the Sustainable Development Goals (SDG) by advocating management approaches that recognize the diversity and amplitude of these externalities and their interactions.

Under the present global scenario, it seems to be an appropriate time for ICID to have a fresh look at the basic irrigation management concepts and their validity within the existing socio-economical models of water-food-energy nexus. Agricultural production processes consume energy, while there are also many cases of crop production contributing to some regional energy supplies as Bio-fuels. It is indeed our duty to respond to such global issues by assimilating them within ICID mandate and activities.

The blue-green water environment considerations would also extend the spectrum of ICID activities to the rainfed agriculture, which contributes about 60% of the existing global crop production. In spite of the facts that ICID from its past contribution has focused mainly on the irrigation side of the agricultural production, environment. However, rainwater and natural pastures productivities enhancement are also considered part of the solutions to the world food crises and poverty alleviation.

My dear colleagues, ICID as one of the largest and most prestigious knowledge base non-governmental organization dealing with water and food, outside the UN domain, should stand as the backbone and scientific platform that supports food supply struggle worldwide. We have an effective and updated National Committees network supported by the member countries and having the privilege of enjoying the collaboration of many eminent scientists and experts who could make any global programme a success. These potentials provides ICID a unique opportunity to implement and monitor any specific pilot project worldwide.

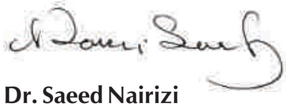
By taking into account the above mentioned facts, I would like to propose focusing our minds and capabilities on evolving a vision to fulfil our broader mission of global food security and poverty alleviation. Let us call this initiative the "ICID Vision 2030" with a defined roadmap to follow and milestones to reach. Such a Vision, under the present and future challenges in the water sector, should outline the role of ICID in the post 2015 global development agenda. Worth noting that a Consultative Group (CG), has already started to work with the Secretary General to develop the first draft of the Vision to be submitted for discussion at the 66th IEC meeting (Plenary Session) next year in Montpellier and adopted thereafter.

Upon having the Vision approved, I wish to observe, the Work Bodies and other ICID technical and organisational structures would work collectively towards the realisation of the Vision.

I am quite confident that the outcomes of the Vision, if well implemented will be a turning point in ICID's mission in the coming years.

Season's Greetings and Best Wishes for a Happy and Prosperous New Year 2015.

Best regards,



Dr. Saeed Nairizi
PRESIDENT, ICID

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Inside

Agricultural / Urban / Environmental Water Sharing in the Western United States: Can Engineers Engage Social Science for Successful Solutions?

MaryLou M. Smith[1], and Dr. Stephen W. Smith[2]

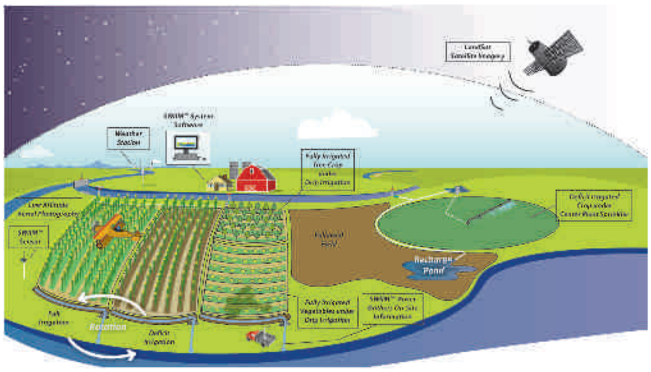
This article contains excerpts from the paper presented at the 21st ICID Congress on Irrigation and Drainage, Tehran, Iran, October 2011 and later selected for publishing in Irrigation and Drainage Journal, Issue 62.3. The Wiley-Blackwell 2014 Best Paper Award was presented to the authors at 22nd ICID Congress, Gwangju, Korea, for their outstanding contribution in the Irrigation and Drainage Journal.

Need for stakeholder involvement in multi-sector water sharing solutions

Throughout much of the world, demand exceeds supply when it comes to water for agriculture, urban needs and a healthy environment. In the western United States water is being permanently transferred from agriculture, putting food security and the viability of rural communities at risk. If this trend is to be reversed, engineers will need to work with social scientists to promote policy that will allow the various sectors — agricultural, urban, and environmental —to collaborate in ways that effectively stretch supplies, with benefits to all. Engineering solutions will be necessary. But legal and institutional changes and alternative approaches to achieve economic and other social benefits must be addressed as well. Stakeholders from all sectors must be fully engaged at all levels.

International examples

One example comes from Bolivia, where water engineer Juan Carlos Alurralde in the late 1990's engaged social groups opposed to the privatization of water to become involved in research upon which a new water management law was eventually based. Alurralde was convinced that dialogue based on solid research could help point to a fair and efficient model for water management that everyone could accept. But if social groups did not trust the research, there was a risk that they would reject the findings. He proposed a research project to use a water simulation model developed by the Danish Hydraulic Institute to build a computerized replica of Bolivian water systems, to simulate and compare the effectiveness of various approaches to allocating water rights among competing sectors. Farmers, irrigation company representatives and others participated in the research design, data gathering, and communication of findings. Ultimately it was found that the government's privatization approach would lead to more inefficient use of water and cause larger differences in water availability between communities and sectors, actually resulting in water deficits in many cases. Subsequently, the government of Bolivia enacted a water rights law that gained widespread acceptance - a successful example of combining high-tech science with grassroots dialogue.



Dipak Gyawali, speaking at the 2006 World Water Forum in Mexico City about a report regarding EU Integrated Water Resource Management Projects, said hard technical research on 67 projects lead to three major findings—all related to the social sciences. The first finding was that "research must constructively engage stakeholders in all phases - from design to interpretation." He said we must constructively engage all stakeholders by incorporating, not just tolerating, what each brings to the table. The second finding was that "researchers must find better ways to communicate the results of their research to those who are in positions to make policy." The third finding was that "the most critical need for research is not for more technical solutions, but for socio-political solutions to water problems." Gyawali proposes that we need research integrating water law, economics, human mindsets and behaviour, and that we should conduct such research as confidently as we address hydrology and hydraulics.

From the United States, Stephen Snyder investigated what could be learned from those involved in trying to mediate water use conflicts between fishermen, farmers, and loggers in the Klamath Basin of Oregon. He describes joint fact-finding in which stakeholders actually "participate in an interactive dialogue with the neutral experts so as to enhance their understanding of the complexities involved in addressing problems to which there are no clear answers." Snyder purports that "many debates over science are in fact debates over values. Pretending that uncertainty does not exist, or that there are scientific answers to questions that are in reality questions of values does nothing to further resolution of difficult issues."

South Platte River Basin water sharing model

In northeast Colorado of the United States, expectations are that water demand will significantly exceed supply by 2030 and that agricultural lands will be dried up and water transferred to cities to meet the gap.

Researchers in Colorado are experimenting with a model to assist farmers in evaluating alternative irrigation or cropping practices that could allow them to stay in farming but make part of their water available for temporary transfer to cities, for example for drought recovery. While such changed practices might negatively affect yield, the farmer could be compensated by an additional revenue stream for the transferred water. Under water law as practiced in most of the western United States, that portion of the diverted water that is fully consumed by the crop can theoretically be transferred for other uses.

One changed practice that could allow for this kind of transfer is rotational fallowing, a situation whereby a farmer chooses to allow some segment of his or her farm to lay fallow for a period of time so that the consumptive use water formerly used becomes available for temporary transfer for some other use.

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A successful run of the South Platte Basin research optimization model indicates the projected net return associated with the crops to be grown, along with crop yields, the practices to be adopted, and the anticipated unit prices. This modelled net return can then be contrasted with the historic net return from the farming operation. The model utilizes farmer-user inputs for the simulated farming operation to mathematically optimize future farming operations against a quantified or presumed consumptive use water budget for the farm. When finished, the farmer has a precise computer-generated map of the farm that becomes the basis for planning and running scenarios.

Optimization algorithms are used to evaluate a farmer-considered package of changed practices which may include regulated deficit irrigation, new crops, dryland crops, permanent or rotational fallowing of fields, and crop rotations as well as upgraded irrigation systems. Annual water supply forecasts can be coupled with cropping plans, all to help farmers decide how best to use their water and to allow cities easy entry to a water market where farmers can sell the use of an acre-foot of water almost as easily as they can sell a bushel of corn.

Technology, however, isn't the only issue with re-allocating water to protect farms and streams from permanent dry-up. Social scientists are needed to help evaluate other barriers and opportunities. In Colorado and other western states, water laws make water marketing and leasing difficult. Primary issues and pitfalls to implementing the process and strategies in this model must be considered, including whether the rights of all irrigators on a system are protected, whether farmers are willing to change their historic practices to embrace these changes, how regional communities dependent on farm revenue will be affected by changes, and others.

Convening Western US water leaders from different sectors

"States, working with interested stakeholders, should identify innovative ways to allow water transfers from agricultural to urban uses while avoiding or mitigating damages to agricultural economies and environmental values." This challenge came in 2008 from an association of U.S. western governors in response to a report from their water policy arm, Western States Water Council.

Reacting to that challenge, in 2010 Colorado Water Institute convened representatives from The Nature Conservancy, Family Farm Alliance, Western Urban Water Coalition and two dozen other influential groups to determine if long-held adversarial positions could be set aside and new alliances built in order to remove obstacles to creative water sharing strategies for mutual benefit. Their work resulted in a report and recommendations: Agricultural/Urban/Environmental Water Sharing: Innovative Strategies for the Colorado River Basin and the West. Examples of multi-sector water sharing reported include farmers and cities in Arizona trading use of surface water and groundwater to the advantage of both; ranchers in Oregon paid by environmentalists to forego a third cutting of hay to leave water in the stream for late summer fish flows; a ditch company in New Mexico willing to sell shares of water to New Mexico Audubon for bird habitat on the same terms offered to a farmer to grow cantaloupe; seven ditch companies cooperating in Colorado in a 'Super Ditch' scheme to pool part of their water through rotational fallowing, for lease to cities, while maintaining agricultural ownership of the water rights.

"While these strategies sound like good common sense, they all face sizable obstacles," said Reagan Waskom, director of the Colorado Water Institute. If we want to share water for the benefit of all, we need a lot more flexibility, all members of the group agreed. The group's recommendations to the Western Governors, developed to provide that flexibility, include:

- design robust processes that give environmental, urban and agricultural stakeholders opportunities to plan together early on, instead of after one sector proposes a project that then meets opposition from other sectors
- foster a flexible, river basin based approach that can lead to cross-jurisdictional sharing of infrastructure, cooperatively timed water deliveries, and strategies to facilitate real-time, on-the-ground, state-of-the-art water management for optimal benefit of cities, farms, and the environment;
- expedite the permitting process when programs or projects have broad support of agricultural, urban, and environmental sectors.

Conclusion

Whether in the South Platte Basin of Colorado or elsewhere in the western United States or in Bolivia and other places in the world, water supply challenges are expected to increase. How scientists and engineers choose to tackle those challenges will determine whether water conflict is resolved or exacerbated. Technology is an important part of the solution, but drawing on the fields of economics, law, sociology, and other social sciences will be critical going forward. Engaging stakeholders in research and giving them a voice in the development of water policy will greatly increase the chances of success at solving very difficult water challenges. Whether humankind has the capacity to understand the necessity of setting aside personal gain for the benefit of all is yet to be seen, but our survival as a species may very well depend on it.

Eco-Friendly Waste Water Treatment and Reuse

An innovative initiative of Indian Agricultural Research Institute (IARI)

Dr. Ravinder Kaur*

The population growth and rapid urbanization is intensifying pressure on the world fresh water resources. Increasing water demand is leading to water scarcity and stress and is consequently driving us to use nonconventional waters, such as (treated) urban wastewater.

FAO together with WHO, UNEP, UNU-INWEH, UNW-DPC, IWMI, and ICID took a lead role to initiate a Capacity Development Project on the Safe Use of Wastewater in Agriculture in the year 2011 and organized various international workshops to understand the impact. In this direction, Dr. Ravinder Kaur at IARI has developed an innovative approach driving eco-services from the nature which can help stabilize the quality of wastewater outflows.

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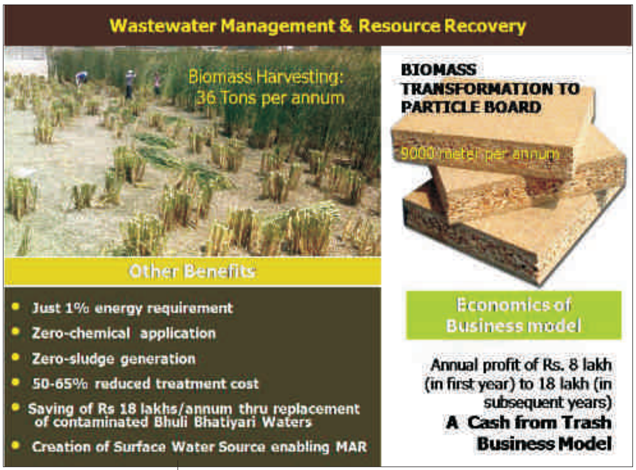
Wastewater production and disposal

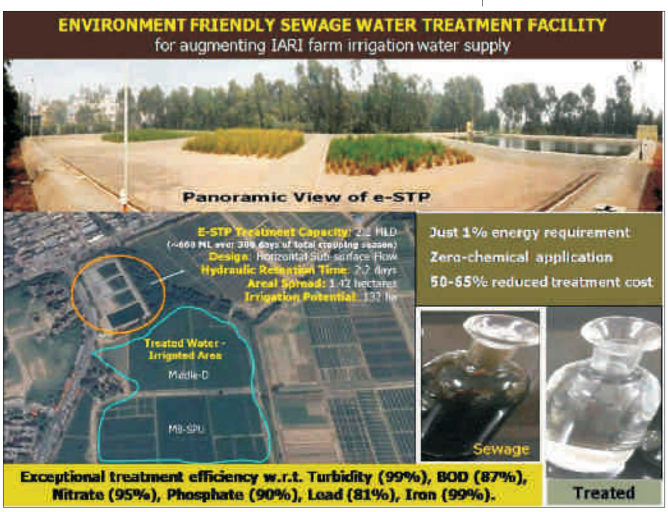
With rapid expansion of cities and domestic water supply, quantity of gray/wastewater is increasing in the same proportion. As per recent estimates, about 70-80% of total water supplied for domestic use gets generated as wastewater. The per capita wastewater generation by the Class I cities (population > 1 million) and Class II towns (population < 1 million), representing 72% of urban population in India, has been estimated to be around 98 LPCD (liters per capita per day), while that from the National Capital Territory-Delhi alone (discharging 3,663 MLD of wastewaters) is over 220 LPCD. As per Central Pollution Control Board (CPCB) estimates, the total wastewater generation from Class I cities and Class II towns in the country is around 40 BLD. While, the installed sewage treatment capacity is just 30%. It is projected that by 2050, about 132 BLD of wastewaters (with a potential to meet 4.5% of the total irrigation water demand) would be generated. Thus, overall analysis of water resources indicates that in coming years, there will be a twin edged problem of reduced fresh water availability and increased wastewater generation to be dealt with.

Wastewater use and treatment

Insufficient capacity of wastewater treatment and increasing sewage generation pose big question of disposal of wastewater. As a result, a significant portion of waste water is being bypassed from STPs (Sewage Treatment Plants) and sold to the nearby farmers on very nominal charges as decided by Water and Sewerage Board. This wastewater is also disposed off into rivers/drains and being indirectly used for irrigation. However, wastewater carries many biological and chemical agents that pose hazards and have been impacting environment and human health. Wastewater related health impacts could be manifesting as short- or long-term illness episodes depending on the pollution load, irrigation history and level of exposure on the respective sites. Some studies report that the consumption of heavy metal contaminated food can deplete some essential nutrients in the body that are further responsible for decreased immunological defence, high prevalence of upper gastrointestinal cancer rates and a number of neurobehavioral disorders (such as fatigue, insomnia, decreased concentration, depression, irritability, and gastric, sensory and motor symptoms). Thus, this calls for the treatment of wastewaters, up to the standards recommended for irrigation by WHO, before their use in agriculture.



In India, hardly 10% of the sewage generated is treated effectively, while the rest finds its way into the natural ecosystems and is responsible for large-scale pollution of rivers and ground waters. One of the major problems with waste water treatment methods is that the conventional wastewater treatment processes are expensive and require complex operations and maintenance. Besides, the sludge removal, treatment and handling have been observed to be the most neglected areas in the operation of the sewage treatment plants in the country. Due to improper design, poor maintenance, frequent electricity break downs and lack of technical knowhow /manpower, the facilities constructed to treat wastewater often do not function properly and therefore remain closed most of the time. Further, none of the available technologies have a direct economic return. Due to economic reasons, local authorities are unable to give priority in waste water treatment.



Innovative eco-friendly wastewater treatment

Design and process

The newly created facility utilizes emergent wetland plants (Typha latifolia, etc.), local media, and native microorganisms, present in natural wastewaters, for treating 2.2 MLD (Million Litres per Day) of sewage waters, sourced from the Krishi Kunj colony. The eco-friendly sewage treatment plant (e-STP) has 3-treatment cells (of 80 meter by 40 meter dimension each) and is capable of irrigating 132 ha of IARI farmlands. The facility is spread over 1.42 ha and ensures complete gravity flow of the wastewater from the sewage wells to the treated water containing cell of the system. Each treatment cell is stratified with a thick layer of media of varying sizes/ grades, onto which Typha latifolia – a hyper-accumulating emergent wetland vegetation is planted. These wetland plants have the ability to transfer oxygen from its leaves, down through its stem, and rhizomes, and out via its root system, into the rhizosphere (root system). As a result of this, a very high population of the native micro-organisms tends to naturally build-up in its root-zone, where most of the organic and inorganic (i.e. nutrient and metal) transformations take place. The flow of wastewater in each treatment cell is regulated to ensure its sub-surface flow, thereby leading to no direct contact or ponding of wastewater over the media. Thus, with the wastewater moving very slowly and carefully through the root-mass of these wetland plants and its interaction with the native micro-organisms and the planting media, various nutrients and heavy metals in the wastewater get transformed, sequestered and removed from the treatment zone thereby remediating the wastewater. The treated water is collected in an 80 meter by 40 meter by 1.5 meter holding tank, from where it is finally pumped, through a riser, into the irrigation network of the IARI farm.

Treatment efficiency

Long term monitoring of the treatment capacity of the developed wastewater treatment plant of IARI, over last one and half years has revealed its exceptional performance especially with reference to turbidity (99%), BOD (93%), nitrate (95%), phosphate (90%), lead (81%), and iron (99%). A comparison of the so treated wastewaters with the local groundwater samples sourced from the area surrounding the innovative wastewater treatment facility, further showed that these treated waters were associated with either better or same EC, pH, turbidity, nitrate, sulphate, phosphate and metal concentrations.

Benefits

The facility could thus create a good annual local surface water source of about 660 Million litres and thus stop the practice of purchasing contaminated surface waters (from Bhuli-Bhatiyaari Drain), to meet irrigation water demand of IARI farmlands. It could thus lead to an annual saving of about Rs 18.5 lakh (Rs.1.85 million), besides bridging an annual gap of 520 ML between the irrigation water demand and supply of IARI farmlands. Additionally, the planted biomass in each treatment cell of the fully operational wastewater treatment system can be harvested, once in every two months, to yield up to 36 tons per annum of dry biomass per annum per cell that can be either transformed to particle board (9000 sq. meters) with a market price of Rs.200-250/ sq. meter (1 US$ = Rs.60), for sold to particle board manufacturers @ Rs. 2000 per ton as dry matter. Thereby, demonstrating an integrated Cash from Trash business model associated with a maximum income of about Rs.18 lakh (1.8 million) per annum, from second year onwards.

A comparison of this eco-friendly wastewater treatment system with the conventional wastewater treatment systems showed that the proposed technology is associated with less than 1% energy requirement; zero-chemical application; zero-sludge generation; 50-65% reduced treatment cost; no skilled manpower requirement. With all these advantages this showcases a self sustainable wastewater treatment technology with an integrated business model.

On long term scale, a conjunctive use of this model, is expected to generate good quality surface water source, which when used in conjuction with the existing groundwater source is expected to not only recharge water-levels in the receding groundwater aquifers of the IARI but also reduce total groundwater energy requirement.

How Irrigation and Drainage Play an Important Role in Climate Change Adaptation?

Prof. Tsugihiro Watanabe*

Considering the impending climate change, intervention to mitigate the climate change impacts and consequent extreme events, such as floods and drought, have to be factored in all decision making processes in the irrigation and drainage activities. To address these issues ICID selected the theme of its 22nd ICID Congress held in Gwangju, Republic of Korea, September 2014, as "Securing Water for Food and Rural Community under Climate Change". Under this theme, two congress questions were raised. This article by Prof. T Watanabe, the General Reporter, provides a brief outcome of the Question 58: "How Irrigation and Drainage play an important role in Climate Change Adaptation?" with three sub-sections: Understanding Impacts of Climate Change on Land and Water Use; Revisiting Design and Operation Criteria for Irrigation and Drainage Facilities: and Managing Frequent Floods and Droughts.

Highlights of the IPCC-AR5 with special reference to irrigation and drainage

The Intergovernmental Panel on Climate Change (IPCC) has released its Fifth Assessment Report (AR5), which provides a clear and up-to-date view of the current state of scientific knowledge relevant to climate change <http://ipcc-wg2.gov/AR5/report/>. It consists of three Working Group (WG) reports and a Synthesis Report (SYR).

The Working Group II <http://ipcc-wg2.gov/AR5/report/full-report/> contribution considers "the vulnerability and exposure of human and natural systems, the observed impacts and future risks of climate change, and the potential for and limits to adaptation". The impacts of climate change on food production, irrigation and drainage, as well as rural environment, and adaptation to the climate change in these fields are the topics of the WG II. The Report of WG II is overviewed paying special attention to climate change impacts on and adaptation in irrigation and drainage.

Impacts of the changes of temperature and hydrological system on food production are summarized as: negative impacts of climate change on crop yields have been more common than positive impacts; Climate change has negatively affected wheat and maize yields in many regions and in the global aggregate; and Effects on rice and soybean yield have been smaller in major production regions and globally, with a median change of zero across all available data. This information implies that the climate change impacts on food production, even on the major crops, are still under assessment, and the assessment results are expected to be more dependable.

AR5 makes clear that impacts from recent climate-related extremes reveal significant vulnerability and exposure of some ecosystems and many human systems to current climate variability. Impacts of such climate-related extremes include disruption of food production and water supply, and damage to infrastructure and settlements, which are the consequence of significant lack of preparedness for current climate variability in some sectors.

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The report discusses the risk on fresh water in detail. With the information like changes of temperature, water availability, flood damage, etc., adaptations in rural areas both in production and life and environment will need to be developed. Regarding the impacts and adaptation in rural area, the report concludes that major future rural impacts are expected through impacts on water availability and supply, food security, and agricultural incomes. These impacts are expected to disproportionately affect the welfare of the poor in rural areas.

How irrigation and drainage play an important role in climate change adaptation?

While impact assessment was the main focus of most of the papers, the number of paper that simulate the situation with changes of conditions, or project future changes due to climate change is not so large, just one-fifth of the total. The papers on observations are one-third of the total, and the papers on evaluation, both with and without numerical model, form the major group. Reflecting the contents explained above, half of the paper is discussing the hydrological regime, including land and water condition and regional environment, while the number of papers discussing institution, including design criteria, regulation, and organization of irrigation and drainage management is not so large.

The topic and method of each paper or poster is quite different with wide variety of location in the whole process of approaching to climate change issues. Then, major findings are identified in exact implementation of research and development in the limited parts of the whole process. At this stage, it is very hard to do integrated impact assessment, which covers the whole agricultural and hydrological process. Therefore, each sub-process is to be evaluated and accumulation of its outcomes is to be promoted.

For example, with projected higher solar radiation and ambient temperature, it is predicted that crops will grow faster resulting in shorter growing period, which might lead to less crop water requirement. The changes, however, of precipitation is also projected and it might affect river discharge and available water resources for irrigation. To know actual changes of crop growth, on-farm water sufficiency, and crop production, predicting the future hydrological regime of the basin where the irrigated area is located is needed. To assess the impacts of pest and diseased caused by changed climate, and changes of cropping pattern is also important. Since these integrated approaches are quite difficult to adopt, many papers or authors/researchers are focusing on some limited paths in the whole process or mechanism of the climate change impacts.

To assess the climate change impacts and to establish the adaptation measures, hydrological tools surely play important roles, as many papers presented under Question 58 develop or apply the hydrological model from farm to basin level. There are many excellent and state-of-the art models developed for evaluation and simulation of irrigation and drainage management, conserving local hydrological environment, which should utilize these models for climate change related issues.

Understanding impacts of climate change on land and water use requires an understanding of the role and categories of the relevant models including the development and/or the modification of hydrologic models. These models involve modelling of anthropogenic water use activities, coupling of surface water models with groundwater flow models etc. The importance of analysis of observed data and continuous data acquisition was also emphasized.

To assess the climate change impacts and establish the adaptation measures, the future climate scenario is generated. There are many GCMs and regional climate models/ methods to downscale the outputs of GCMs. Therefore, with selection of climate scenario generation method and hydrological model, one can see different outputs with wide range.

Many authors proposed innovative tools and challenging approaches, for example, proposal of step-wise integrated approach for the impact assessment, treatment of water temperature, usage of RCP scenario, integration of climate smart agriculture, and climate trust fund. The necessity of research on extreme events due to climate change, such as heavy rainfalls, floods, droughts, landslides and so on was also emphasized. As much more basic and important base, application of the latest and common scenarios of the RCP for GCM experiments is recommend to be introduced in the climate change impact assessments at this stage.

For integrated approach, it is needed to analyse the relationship between climate and basin hydrology regime with water resources availability, and water management and agricultural production of the basin. These analysis/ diagnoses include various factors, which are often uncertain and inter-dependent. Therefore, integrated assessment is to be developed for better projection and evaluation of climate change impacts as the basis for better adaptation. While the "integrated assessment" is, however, actually very difficult to be developed and implemented, since the behaviour and future statuses of the various factors and players affecting each other are difficult to be projected in detail. Practically, the step-wise approaches are acceptable with scenario based projection. This scenario generation process in these approaches is to be used to assess the vulnerability of the present system.

Although, the case study utilizing the step-wise integrated approach has made the preliminary, but very logical conclusions, predicting future changes of the whole system caused by global climate change is still a difficult undertaking, and predicting future irrigation and agriculture in a specific place and year is to be considered almost "impossible". At the moment, future climate change projections are still uncertain and a challenging topic, while their reliability is surely getting higher.

Approach to adaptive adaptation

If the phenomena or factors associated with climate change and its apparent impacts are difficult to be projected and evaluated, one of the more effective and feasible measures for adapting to the impacts is to take actions incrementally; as in a trial-and-error manner, utilizing the best available current knowledge and past experience; and collecting additional information as needed. In pursuing such an adaptive approach, the step-wise integrated assessment is effective and reliable.

At present, using on-going observation and advanced modelling technologies, future events are to be predicted to some extent within certain bounds of accuracy, while in the past natural events were largely unpredictable and we could only react passively to them. With a combination of advanced prediction and local traditional knowledge, there is the possibility for wise irrigation and drainage management, smart agricultural production, and improvement of regional environments. To keep function of adaptive adaptation in local areas, it is needed to maintain local resource in systematic manner, including water resource management system. All stakeholders should participate at some level or some extent in the process of monitoring, assessing the baseline and impacts of climate change, making decision for adaptation, and establishing mitigation measures. Although, the well-designed preparedness is quite general to be proposed, it would be most dependable and reliable action. Research and development for establishing better management system should be promoted, not only against the climate change but also for everlasting improvement of the system.

Irrigation Development in Africa

(Excerpts from IFPRI Discussion Paper 00993, Published in June 2010)

The potential for irrigation investments in Africa is highly dependent upon geographic, hydrologic, agronomic, and economic factors that need to be taken into account when assessing the long-term viability and sustainability of planned projects. Here are some excerpts from a report "What is the irrigation potential of Africa?" produced by the International Food Policy Research Institute (IFPRI) for the World Bank. The report analyses large, dam-based and small-scale irrigation investment needs in Africa based on agronomic, hydrologic, and economic factors and provides a first filter that helps to identify the areas of greatest potential.

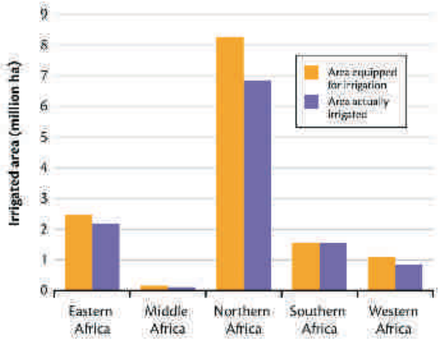
Africa's agricultural productivity is the lowest in the world, in part because of the underuse of irrigation in Sub-Saharan Africa. Irrigation does not currently play a significant role in African agriculture. Despite highly variable and—in many cases—insufficient rainfall and a high incidence of droughts, food production in Africa is almost entirely rainfed. Irrigated area as a share of total cultivated area is estimated at only 6 percent for Africa.

Moreover, more than two-thirds of existing irrigated area is concentrated in five countries—Egypt, Madagascar, Morocco, South Africa, and Sudan—which each have more than 1 million hectares of irrigated area. For the remaining countries, the irrigated area varies from a few thousand hectares to almost half a million hectares each for Algeria, Libya, and Tunisia (FAOSTAT, 2009).

The African continent has ample water resources overall; however, they are spread unevenly over a wide range of agro-ecologic zones. Efforts to manage water and to make it available where it is most needed are hampered by the undeveloped state of institutions for irrigation (and water-resource management more generally) and by the prevalence of subsistence farming. Ample groundwater resources in much of the continent remain largely untapped, except in southern Africa and parts of northern Africa.

Irrigation is an important vehicle for promoting increased productivity, provided investments in irrigation are properly targeted and accompanied by complementary improvements in other agricultural inputs. Many development organizations have recently proposed to significantly increase investments in irrigation in the region.

In terms of country potential, Nigeria stands out as having particularly great potential for both large- and small-scale schemes. Mali stands out as a particularly lucrative site for small-scale irrigation investments. More than half of the large, dam-based potential for irrigation expansion is with operational dams. This shows the large potential for adding irrigation facilities at existing dam sites. In general, adding large-scale irrigation to dams in need of rehabilitation appears more profitable than either operational or planned reservoirs. For small-scale irrigation, rates of return are highest in the Sudano-Sahelian zone, followed by the eastern Africa zone.



Area equipped for irrigation and area actually irrigated per region (FAO 2012)

In geographical terms, clear patterns emerge. The Gulf of Guinea area has the largest potential for area expansion for both operational and planned dams within Africa, reflecting the rich water resources in this region. For small-scale irrigation, almost half of total suitable area is located in the Gulf of Guinea, followed by 1.3 million hectares in the Sudano-Sahelian zone and 1.2 million hectares in the eastern Africa zone.

The results for large- and small-scale irrigation present a striking contrast. Although the total area expansion potential is small for small-scale irrigation, internal rate of returns (IRRs) are considerably higher for this type of expansion. The average IRR for large-scale irrigation is 6.6 percent, versus an average IRR of 28 percent for small-scale irrigation in our baseline.

The results presented, for large and small schemes alike, are sensitive to assumptions about the unit costs of their components, and the study conducted tests to determine the extent of that sensitivity. The unit investment cost is a particularly sensitive parameter. The lower values, up to and including the baseline assumption of $3,000, correspond to the incremental investment costs of developing a large-scale scheme when all or most of the costs of the dam are paid from some other source (typically hydropower revenues). The higher values, on the other hand, correspond to situations where some portion of the water-storage costs must be borne by the agricultural sector. When storage costs are excluded, the area in which dam-based irrigation would be profitable encompasses from 16 to 18 million hectares. However, if they are included, the viable area shrinks to just 3 to 6 million hectares. Similarly, for small-scale irrigation, traditional forms of small-scale irrigation, as well as some low-cost higher-end systems—up to investment costs of $600 per hectare—result in a viable area of

ICID's Africa Region Regains Vigour

The African Regional Working Group (AFRWG) of the International Commission on Irrigation and Drainage (ICID) with the mandate to promote networking among the African countries and other key stakeholders for enhancing cooperation and coordination on integrated river basin development and management, training and research issues, and information system for African needs with a focus on irrigation and drainage, has been making its efforts to contribute to improve the change in food security scenario. AFWRG held its 25th meeting on the 17th of September 2014 at Gwangju, South Korea during the 22nd ICID Congress and 65th International Executive Council (IEC) Meetings.

Recently ICID addressed a letter jointly with the International Commission on Large Dams (ICOLD) to the World Bank advocating the renewal of international funding of large-scale water infrastructure for water storage and irrigation particularly in Africa. This letter was well received and is expected to re-ignite large-scale irrigation development in Africa.

At the 25th meeting of the AFRWG, Dr. Sylvester Mpandeli, Chairman, welcomed Burkina Faso, Madagascar, Nigeria to ICID Membership Network and requested active participation in the AFRWG meetings. He also emphasized the need to strengthen Southern Africa Regional Irrigation Association (SARIA) and Association Régional pour l'irrigation et le Drainage en Afrique de L'ouest et du Centre (ARID), represents ICID in West and Central Africa) for accomplishment of many important goals for Africa.

VPH Adama Sangare from Mali emphasized that the Sahel region of West Africa particularly, urgently requires major investments in large-scale irrigation infrastructure. AFRWG called for support to this regions and the entirety of Africa that looks forward to major irrigation investments in the near future.

16 million hectares; this area shrinks to 0.3 million hectares at high-end small-scale irrigation, valued at $5,000 per hectare.

Thus, Africa has significant potential to develop both large- and small-scale irrigation, but economic viability depends on keeping costs down. Only lower-cost technologies and approaches are viable on any significant scale in Africa. Although not a focus of this analysis, there is also significant potential for rehabilitating existing irrigated area in the region, estimated at 2 million hectares.

Given Sub-Saharan Africa's limited experience with irrigation investments, it is important to ensure that planned investments do not surpass a country's financial capacity and that investments are proportional to other agricultural expenditures and value added. One way of keeping the investments affordable would be for the donor community to provide sequenced financing reflecting certain priorities. This could be done in several ways. A purely economic approach would set priorities based on the highest benefit–cost ratios identified previously, with the effort focusing on a handful of countries where the impact would be greatest. An approach driven by food security, by contrast, would target those countries that are both extremely poor and that import more than half of their total cereal demand and would lead to a focus on the Sudano-Sahelian region.

Market access conditions have been shown to be critical for irrigation development to succeed. Whereas they are explicit in the case of small-scale irrigation, they will also play an important role for large-scale irrigation.

Moreover, although there is considerable scope for the expansion of both dam-based and small-scale irrigation in Africa, investment decisions seldom depend on biophysical and economic criteria alone. Government policy objectives, donor suggestions, and other factors not related to irrigation and agriculture—ranging from plans for energy security and urban water supply to rural development and income generation, and national food security goals—all play a role in the final policy decision to expand irrigation.

Sub-Saharan Africa faces large challenges to implementing irrigation. Those challenges are related to low levels of expertise, knowledge, and capacity to develop and manage irrigation; the absence of an adequate policy and strategic framework; the often disappointing results of previous irrigation development and the need for continued support for recurrent costs from the public sector; relatively high costs of conventional irrigation development (but see also Inocencio et al. 2005); and increasing competition over water.

In addition, irrigation is only one of several deficient productivity-improving capital investments and technological inputs in the region. Others include fertilizer, advanced seed-delivery systems, postharvest processing facilities, and access to markets. Thus, even when supported by national agencies and farmers, irrigation thrives only when complementary inputs and rural services are available. Thus, significant efforts are required not only to develop irrigation but also to ensure that irrigation develops its full potential for poverty reduction, food security, and economic growth.

Thus, institutional settings, extension and management systems, availability of complementary inputs, and the involvement of farmers in the design and management of irrigation systems will determine final system performance. Thus, strengthening African countries' capacity to address institutional and strategic challenges for irrigation will be just as important as accelerated investments in irrigation infrastructure.

66th International Executive Council Meeting and 26th European Regional Conference

11-16 October 2015, Montpellier, France

Euro-Mediterranean Conference on Irrigation

Theme: Innovate to Improve Irrigation Performances

Innovations for smallholders in irrigation

Today drip irrigation is spreading fast across the world, both in formal settings (via state subsidies to farmers) and informal private investment. New business opportunities arise in the resale of used equipment and installation of equipment at the local level. Drip irrigation develops a lot for small farmers who are innovative in adapting technology to their needs.

Wastewater use in agriculture

Tensions over water resources and development of peri-urban agriculture generates an increasing massive use of wastewater in agriculture. The use of such water is regulated by the policies of many countries that have issued standard treatments to define their possible uses (agricultural food and non-food, green areas). However the actual use of these waters by farmers does often not comply with these rules with health and environmental consequences. In contrast, other countries where this resource useful supplements conventional resources prohibit or severely restrict its use by an excessive application of the precautionary principle.

Governance of surface water and groundwater

Groundwater use is increasing worldwide due to the easy access to the resource. It generates a groundwater economy but creates the conditions for overuse. Access to groundwater occurs most often individually but with many arrangements processes resulting in the establishment of informal groundwater markets at the local level. This is occurring both within irrigated schemes with groundwater questioning the conventional surface water governance, or outside the schemes with limited water renewal.

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From 16 Mar. 2015 to 31 May 2015

Early Bird Registration:
From 01 Apr. 2015 to 30 Jul. 2015

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From 01 Apr. 2015 to 30 Aug. 2015

Hotel Reservation:
From 01 Apr. 2015 to 30 Aug. 2015

Contact: *For more information, please contact icid2015@irstea.fr or visit Website: http://icid2015.sciencesconf.org/?lang=en*

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