

EXTENSION AND ADVISORY SERVICES FOR SUSTAINABLE WATER USE: LEARNING FROM THE EXPERIENCES OF CWRDM



As the world prepares to celebrate this year's World Water Week during 23-27 August, through this blog U Surendran and Manoj P Samuel discuss the role of Extension and Advisory Services in promoting sustainable water use.

CONTEXT

Water is truly at the core of sustainable development. Water is significantly linked to climate change, agriculture, food security, health, equality, gender and education, and there is already international agreement that water and sanitation are essential to the achievement of many of the UN's sustainable development goals. More than any other natural resource, water is considered to be the elixir of life. So, the conservation of water resources is very important, especially for our collective future. The utilization of water and water resources will become more crucial in the coming years. Sustainable water management is designed and practiced for the conservation and utilization of water and water resources. This concept intends to minimise water consumption, maximise the use of sustainable water resources, make water systems sustainable and reduce water pollution.



World Water Week 2021 will be held under the theme *Building Resilience Faster*, with a focus on finding concrete solutions to the world's greatest water-related challenges, starting with the climate crisis and including water scarcity, food security, health, biodiversity, and impacts of the Covid-19 pandemic.

Currently, agriculture accounts (on average) for 70 percent of all freshwater withdrawals globally (and an even higher share of 'consumptive water use' due to the evapotranspiration of crops). Water plays an important role in food security by being a critical input for agricultural production. Irrigated agriculture represents 20 percent of the total cultivated land and contributes 40 percent of the total food produced worldwide. Due to population growth, urbanization, industrialisation and climate change, competition for water resources is expected to increase, with particular impact on agriculture. Promoting sustainable water use therefore should be a priority for both research as well as Extension and Advisory Services (EAS) in the agricultural sector.

"When the well's dry, we know the worth of water." – Benjamin Franklin

EXTENSION AND ADVISORY SERVICES FOR SUSTAINABLE WATER USE

Extension and Advisory Services (EAS) is often presented as one of the most important influences on the adoption of any innovations, especially from the point of view of the technology supply push theory. This is because extension can help users/stakeholders overcome barriers or constraints in achieving their goals. In the case of Agricultural Extension Services, it has been shown that when the extension services are more accountable, and work in tandem with farmers' needs, and provide the required technical knowledge and information, then it is more successful. EAS for sustainable water

use should support application of scientific research, knowledge, and technologies to improve water use efficiency in agriculture through farmer education.

Centre for Water Resources Development and Management (CWRDM)

Recognising the need for catering to the R&D needs in the field of water management, the Government of Kerala established a premier R&D institution named 'Centre for Water Resources Development and Management' (CWRDM) at Kozhikode, Kerala (<http://www.cwrddm.org/>). The mission of CWRDM is to enhance the quality of life by ensuring water security for all by providing necessary Research and Development inputs, with special emphasis on the humid tropics. Training and extension services are also an important mandate of CWRDM.



Box 1. CWRDM

CWRDM has been playing the role of Water and Land Management Institute (WALMI) for Kerala since the late 1980s, and it has been training officials from all stakeholder departments/agencies on all water-related topics. Approximately 50 training programmes on capacity building on water resources are conducted every year. National level courses on selected topics sponsored by different agencies, and tailor-made training programmes based on specific requests, are also organized. Many workshops, seminars, conferences on various scientific themes in the water sector are being organized by CWRDM. CWRDM has established a Water Heritage Museum, which remains open to the public. The museum portrays the history of development and management of water resources in Kerala and helps to create awareness on conservation and management of water.

CWRDM has implemented a large number of rainwater harvesting structures under different projects and evaluated its impact. It has implemented several programmes on the following techniques viz., Drip Irrigation & Fertigation; Wick Irrigation Techniques; Renovation of Condemned Public Wells; Spring Based Rural Water Supply Schemes; Artificial Wetlands & Urban Drainage; Water Resources Development; Polyhouse Farming- High-tech Farming, and all these activities have resulted in significant improvement in water use efficiency and saving of water.

Understanding the importance of participatory approaches, CWRDM used to have this as an important component of *institutional frameworks* for the governance of water resources and services. It has made it possible to engage new actors in water monitoring, with a shift from reliance on technical experts to the inclusion of non-experts, including local communities. The feedback received from local communities helps researchers/policy makers to develop technologies in a way that takes site- and culture-specific circumstances into consideration, making their implementation easier. For instance, some of the successful projects are implemented in community based participatory approach viz., DST-funded project on drip fertigation technology, which was done in a farmer participatory mode, community drinking water schemes, community-based water and sanitation programmes, etc.

Based on our experiences in this sector we proposed the following broad categories where EAS should focus on promoting sustainable water use. The agencies involved should have a thorough understanding on all these aspects. The topics discussed are exclusively made in the context of Kerala, but it will hold good for any other region.



Figure 1. Broad categories for EAS in sustainable water use

I. Supply Augmentation

The prime objectives under the supply augmentation sector are classified into three sections (A to C) as discussed below.

A. Suitable and equitable water allocation for all water use sectors and fulfilment of basic water requirements

Strategies

- Prioritization of water use for various sectors, i.e., domestic, agriculture, industry, conservation of ecosystem, etc., and setting up of water-use criteria/allocation to various sectors from Grama/Block Panchayat to District level.
- Promotion of conjunctive use of surface water and groundwater.

Action Plan

- Updating and building up of information on water requirements for various sectors under changing climatic scenarios;
- Development of water resource potential and management plan for Block Panchayats and setting up guidelines for sector wise water allocation;
- Allocation of water for the various sectors under the framework of river basin management plan, including ecosystem services;
- Augmentation through groundwater-based irrigation in surface water irrigated areas during the lean season.

B. Improving the water use/management efficiency

Strategies

- Renovation of existing water resource infrastructure;
- Protection of natural resources, especially the water recharging ecosystems;
- Replication of successful models of supply/water management in other feasible areas.

Action Plan

- Rehabilitation of water sources and waterways, including their development and conservation plans.
- Repair and improvement of distribution systems and control structures in order to reduce water losses and ensure improved water delivery.
- Periodic de-silting of reservoirs for increasing water storage capacity.
- Renovation of the dilapidated irrigation ponds/tanks (*Thalakkulams*) at the head portion of *Padasekharams*.
- Renovation of VCBs, barrages, check dams, and other water storage/diversion/distribution structures.
- Empowering community organizations for taking care (planning, implementation and monitoring) of the common property resources.
- Prevention of encroachments and protection of river banks by eco-friendly measures.
- Protection of water recharging ecosystems such as forests, wetlands, paddy fields, sacred groves, and so on.
- Prevention of uncontrolled mining of sand, granite, clay, soil, etc.
- Replication of successful models in the district to gear up the water conservation programmes.
- Repair and renovation of unused/defunct tanks/ponds for domestic/public use.
- Rejuvenation and development of springs.
- Implementation of micro irrigation schemes such as drip, sprinkler and wick irrigation.

Box 2. Demonstration of Wick Irrigation

CWRDM has successfully developed two types of wick irrigation systems for potted/grow bag raised plants and field grown plants. The first system consists of a grow bag filled with potting mixture, one used water bottle, wick made of glass wool and two bricks. In the second system, instead of water bottle, PVC pipes were used along with the water source. Wick irrigation works on the principle of capillary action. Plants use capillary action to bring water up the roots and stems from the soil to the rest of the plant. Wick irrigation provides the water needed for the growth of the plant and hence water use efficiency is high. Our experiment and demonstration showed a saving of water to the tune of 35 to 40% and yield improvement ranged from 28 to 64% as against the conventional flood irrigation method. The demonstrations and awareness programme helped to popularize this technology and many farmers are adopting this technology now.



© CWRDM

C. Creation of new water conservation/storage structures

Strategies

- Promotion of water conservation measures;
- Creation of new structures on a priority basis.

Action Plan

- Construction of rainwater harvesting and recharge pits and percolation tanks in suitable areas on a watershed basis.
- Implementation of mechanisms for open well recharge from roof top rainwater harvesting in all households.
- Adoption of suitable erosion control measures such as contour bunds, terracing, etc., for better soil and water conservation.
- Promotion of rooftop rainwater harvesting at household and institutional levels.
- Construction of check dams, barrages, dykes, VCBs, etc., on rivers/streams, wherever it is feasible.
- Construction of ponds/tanks etc., at ideal locations.
- Development of abandoned quarries as water harvesting and storage structures.

II. Demand Management

Demand management sector is grouped into five user categories: Domestic (including drinking water), Irrigation, Industry, Hydropower, and Ecosystem services including wildlife needs. However, by considering relevance to this blog, here only irrigation is discussed.

Irrigation: Improving the irrigated area and crop water productivity

Strategies

- Preparation of block level and panchayat level irrigation plan by considering all the existing schemes and feasible new schemes at AEU level;
- Improvement of the water use efficiency for maximizing water productivity which is the limiting resource (i.e., More crop per drop of water used);
- Better stakeholder participation in irrigation management through decentralization.

Action Plan

- Preparation of framework for strategies to be adopted for increasing the irrigated area at district level, block level and panchayat level on AEU basis.
- Completion of all ongoing medium/minor irrigation structures on a war footing.
- Promoting more minor irrigation projects/schemes, where feasible.
- Creation of new storage and diversion structures, such as ponds, VCBs, barrages, check dams, percolation tanks, etc., in all feasible areas. Highland areas and current overexploited, critical and semi-critical areas of groundwater usage (Chittoor block, Malampuzha block, Pattambi block and Thrithala block), etc., to be given top priority.
- Development of springs in highland and midland areas.
- Provide more lift irrigation schemes in lowland areas, wherever feasible.
- Irrigation of high value horticultural crops such as pepper, cardamom, vegetables, banana, etc., to attain maximum productivity.
- Increased involvement of Water User Associations (WUAs) through Participatory Irrigation Management (PIM) for enhancing physical access of each individual plot to water, and thereby more cultivable area may be brought under assured irrigation.
- Promotion of extension activities relating to water harvesting, water management and crop alignment for farmers and grassroots level field functionaries.
- Increase of irrigation water availability through watershed management programmes – soil and water conservation, groundwater recharge, minimizing runoff losses, providing livelihood options and other natural resource management activities.

- Enhancement of water utilization capacity of irrigation projects (including MI schemes) by timely/annual repair and maintenance of structures as well as entire canal network, introducing piped water supply up to the field on a pilot basis in selected projects in critically water scarce areas. Improving the adoption of advanced micro irrigation and water saving technologies, precision farming, polyhouse farming, and hydroponics to achieve more crop per drop of water including in the command areas.
- Reduction of irrigation water demand by proper planning viz., proper irrigation scheduling, early sowing of variety, uniform way of planting in group approach, laser land levelling, mulching, etc., on a watershed basis.

Box 3. Case studies on demonstrations of drip fertigation under Farmer Participatory Action Research Programme

‘Farmer Participatory Demonstration and Evaluation of Drip Fertigation Technique in Kerala’ was implemented by CWRDM in collaboration with the State Agriculture Department. The project involved laying out of 21 demonstration plots of drip fertigation in farmers’ fields for various crops in Thiruvananthapuram, Alappuzha, Idukki, Ernakulam, Thrissur, Palakkad, Malappuram, Kozhikode, Wayanad, and Kasaragod districts of Kerala. About 850 farmers of these districts were given awareness on drip fertigation through seminars /workshop and field visits arranged in the demonstration plots. Majority of them held a favourable opinion on drip fertigation after observing the demonstrations. Data collected from the plots has shown that there is an improvement in crop yield through drip fertigation. The Benefit-Cost Ratio of drip fertigation worked out under the project ranges from 2.05 to 3.50 for selected crops. The positive outcome of the demonstrations was also evident through the adoption of drip irrigation and drip fertigation by some farmers who attended the seminars/workshop and field visits. The collaboration of the Department of Agriculture, Govt. of Kerala, has helped CWRDM very much in the implementation of the project, including identification of suitable farmers’ plots in various districts, arranging seminars/workshop and field visits for farmers, and conducting questionnaire survey among drip irrigation adopters.



Drip fertigation plot- Cow pea

III. Water Governance

The prime objective here is to frame/modify the statutory mechanisms for effective management of water resources in the district that is in transition to polycentric water governance.’ Participatory

irrigation management’ is a concept that allows farmers to become decision makers while ensuring equity in water supply. This system addresses the water woes of tail end farmers – to some extent – by scheduling and regularizing water supply and associated irrigation. It considers both the temporal and spatial distribution of water ensuring canal water availability at the right time and the right place, mainly through farmer cooperatives societies, which work in association with the concerned irrigation department. This system is still under practice in some of the command areas.

Box 4. A unique case from Kerala

A unique type of participatory irrigation management system has been prevailing for years at Yethadka village of Kasaragod District of Kerala. The farmer groups construct check dams across the Yethadka river every year, mostly towards the end of the predominant south-west monsoon season and store water. They construct three to four dams every year and its carrying capacity varies from 20 to 120 million litres of water. The expenses towards the construction are divided among the participating farmers based on the extent of farm land they irrigate with the stored water. This type of participatory water harvesting, sharing and irrigation has been in practice for almost three decades

Strategies

- Defining the rights and responsibilities for various water users;
- Involvement of stakeholders at different levels of governance.

Action Plan

- Implementation of decentralized water governance spelling out rights and responsibilities of various stakeholders.
- Framing/modification of rules/acts based on emerging situations, especially with regard to punitive/penalty measures for water/environment pollution, water misuse, etc.
- Creation of awareness about emerging scenarios/trends in water crisis/management in institutions/agencies, executives, elected representatives and judiciary.

IV. Capacity Building

The prime objective is to empower human resources in the water management sector and Extension Advisory Services (EAS) so that they can take a lead role in this.

Strategies

- Human resources development for scientific water management;
- Reorganization and strengthening of institutional mechanisms, wherever necessary;
- Establishment of river basin authorities for the major river basins in the district;
- Strengthening of Research and Development activities in the water sector;
- Awareness and skill development.

Action Plan

- Development of human resources and thereby local organizations and stakeholders for scientific water management through capacity building programmes.
- Involvement of students in awareness campaign and community action for water conservation.
- Organization of public campaigns and community forums at the district and local levels for a clear understanding of potential and problems with regard to water resources.
- Inducing participation of public and private organizations in the water resources management process.
- Development of Water Resource Information System (WRIS) for the district similar to the one developed for the country by ISRO.

Box 5. Demonstrations on use of domestic waste water for vegetable production

CWRDM implemented demonstrations on the use of domestic waste water for vegetable production. The treatment system includes: primary, secondary and tertiary system, and treated water was used for irrigation using drip/wick irrigation. Results showed that vegetable production increased, apart from increasing water productivity and protecting the environment.



IMPLICATIONS FOR EAS

Capacity Development on Sustainable Water Use

There is a need for continuous training of EAS staff and others on different aspects of Sustainable Water Use. Since the 1990s, CWRDM has been organising extensive trainings on integrated watershed management for elected representatives of local self-government departments (LSGDs) and NGOs under the People's Planning Programme. Currently the Water Resources Management Training Programme (WRMTP) at CWRDM is providing training on various aspects of water and land management for different stakeholders, including farmers, officers of line departments, elected representatives of local self-government, and NGOs (Box 6).

Box 6. Trainings at CWRDM

CWRDM organises induction training programmes for newly recruited engineers of the State Department of Irrigation and Kerala Water Authority, especially on the hydrological and irrigation management aspects. Officers of State Agriculture, Soil Conservation and Soil Survey departments are also being trained on various land, water and irrigation management technologies. Apart from these, training programmes on watershed management and livelihood improvement have been organised in coordination with various watershed development projects of State Planning Board and Central and State departments of Rural Development and Agriculture & Farmer's Welfare. The sociological aspects of water management are specifically taken care of in all the training programmes. Many national level training programmes on irrigation management, drip and sprinkler irrigation, watershed development, participatory irrigation management, and wetland management are conducted at CWRDM. The Centre also provides training and research opportunities for students and research scholars from universities and other academic institutions.

In addition to CWRDM, many other Training Institutions under the Ministry of Agriculture & Farmer's Welfare, such as State Agricultural Management and Extension Training Institute (SAMETI), Agricultural Technology Management Agency (ATMA), Extension Training Centre (ETC), Soil Conservation Training Centre, etc., and Irrigation Design and Research Board (IDRB) under Ministry of Water Resources, Government of Kerala, are also offering training programmes on water and land management. Krishi Vigyan Kendras (KVKs) of ICAR and Kerala Agricultural University (KAU) and NGOs in all districts are also giving training on natural resources management to extension workers. These training institutions need to be interlinked and partnerships have to be established to make their training programmes successful.

The major constraints of the above-mentioned training institutions are as follows:

- i) Lack of funds;
- ii) Lack of expert trainers/subject matter specialists;
- iii) Difficulty in conducting hands-on training due to pandemic restrictions;
- iv) Lack of infrastructure and instruments;
- v) Lack of training needs assessment and feedback studies; and
- vi) Training activities and capacity building programmes not figuring in the priority list of concerned departments/agencies.

Many KVKs lack experts or subject matter specialists in the domain of water resources management. Hence scientific and technical experts have to be appointed in KVKs located in those districts that are facing issues with water stress, floods, decline of groundwater table, and other natural resources management problems. However, a few KVKs have successfully taken up activities on sustainable use of water resources and effectively demonstrated them at community and field levels, by ensuring farmer participation.

Hence these concerns need to be addressed in order to make the training programmes more meaningful and to achieve the desired impacts on sustainable water use.

Strengthening inter-departmental coordination

Major irrigation projects that are dealing with dams and command area are managed by the Department of Irrigation and Water Resources. However, the micro-irrigation projects are managed at different levels by both – the Departments of Agriculture and Irrigation. Most often their interventions are limited only to the command area and hence the catchment area interventions including drainage line treatments, source protection and groundwater recharge activities, are ignored. Departments working in water conservation and management activities therefore need to be linked with those managing irrigation projects and there is a need for better coordination in this area. For instance, water conservation and use efficiency improvement is being dealt with by many departments including Irrigation and Water Resources, Agriculture, Soil Survey and Soil Conservation, Ground Water, Rural Development, Local Self Government Departments (LSGDs), etc., under programmes such as *Pradhan Mantri Krishi Sinchayee Yojana* (PMKSY), Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA), *Jal Jeevan*, etc.

In Kerala, as the three-tier decentralization of powers is working well, the efficiency of projects implemented is relatively better than in other states of India. However, still there is scope for improvement for better coordination and partnership activities between the line departments and it is suggested that these activities can be coordinated by an agency like CWRDM /KAU/similar research and development organizations.

Strengthening Evaluation

Since the Government of India is nowadays placing more emphasis on water conservation programmes through different missions brought under the umbrella of *Pradhan Mantri Krishi Sinchayee Yojana* (PMKSY) programme, in which financial assistance to State Governments are being provided. Line departments at the state level, in collaboration with research organizations such as CWRDM, and KAU should have programmes for evaluation of these techniques after implementation; and also carryout relevant extension programmes such as large-scale demonstrations and associated seminars over a longer period of time, till the desired impact is achieved.



Experiments for developing appropriate water management options

Curricula Reforms

The management of natural resources (NR) is generally viewed as a topic related to ecology and environment and not to agriculture. Natural resource management, especially water resources management, has to be included as an important component of the BSc Agriculture curricula. EAS providers should have an in-depth understanding of the water-energy-greenhouse gas emission-agriculture-climate change nexus. The curricula have to be reoriented and aligned with SDG-6: Water

and sanitation for all by 2030, mainly to mobilize EAS actions which help to transform how we manage and use water sustainably and efficiently.

END NOTE

EAS for sustainable water use should be supported by an adequate knowledge-exchange system and the success of EAS would depend on how greater institutional responsibility is shared among all the stakeholders in water-related policies and development of strategies. This, in turn, would create an enabling environment and provide an incentive for all relevant stakeholders to share greater responsibility for sustainable water management across the entire gamut of water resources. The capacity of EAS on the topic of sustainable water use needs to be considerably enhanced. Promotion of more water-efficient practices have wider environmental benefits and is critical for ensuring economic profitability and prosperity to posterity.

Dr U Surendran, is Senior Scientist, at the Centre for Water Resources Development and Management (CWRDM), Kozhikode, Kerala, India. (Email: suren@cwrmdm.org)

Dr Manoj P Samuel is Executive Director at the Centre for Water Resources Development and Management (CWRDM), Kozhikode, Kerala, India. (Email: ed@cwrmdm.org)