Workshops capacity building for agricultural water demand management

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Final report

P.W. Vehmeijer
W. Wolters (Eds.)

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ABSTRACT

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Agricultural Water Demand Management (AWDM) is at the core of the Water for Food Programme launched as a result of a pledge by the Netherlands' Minister for Agriculture at the 2nd World Water Forum in March 2000, The Hague. One of the projects that was started after the March 2000 pledge was Workshops Capacity Building for Agricultural Water Demand Management, with as objective Capacity building for management of agricultural water demand both in institutions in India and Vietnam, as well as in Wageningen UR, through two workshops in which the participating institutions identify needs and formulate project proposals.
As part of this project, a three-day workshop was held in the State of Andhra Pradesh, India, with as objective to assess the role research and educational institutes play in interacting with policy makers, government departments and water users to ensure the sustainable use of water by the agricultural sector (the Partners for Water Programme management decided that the planned workshop in Vietnam should not be funded by the programm).

The Project has greatly contributed to: (i) Awareness raising on the issue of Agricultural Water Demand Management in Andhra Pradesh; (ii) An assessment of the present situation in the capacity building for Agricultural Water Demand Management in Andhra Pradesh; (iii) A project proposal to address the identified gaps in knowledge and capacity building, building on the AP demand and the existing (and appreciated) bilateral co-operation

Keywords: capacity building, agricultural water demand management, sustainable water use

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Background
Agricultural Water Demand Management (AWDM) is at the core of the Water for Food Programme launched as a result of a pledge by the Netherlands' Minister for Agriculture at the 2nd World Water Forum in March 2000, The Hague. This pledge on Partners in Water for Food has led to the development of a collaborative programme under the theme Water for Food: Building Capacity for Agricultural-Water Demand Management. Wageningen UR and a large number of partners in the Netherlands and abroad are involved (www.waterfoodecosystems.nl).

The collaborative programme *Water for Food* aims at enhancing food security, particularly of the poor and vulnerable, through the more efficient mobilisation and use, and the more equitable allocation, of water for food production while carefully taking into account the ecological vitality of water systems.

Agricultural water demand management
Agricultural water demand management can be defined as a policy aimed at optimising the use of currently available water resources, instead of developing new water resources. Agriculture is known to be the largest "user" of water on earth, but it is also by far the largest processing industry of rainfall. While the traditional produce of this processing industry is food and fibre for feeding and clothing the world, we should be aware that agriculture also "produces" fresh water through surface runoff, and replenishes groundwater through deep percolation, both resulting from excess rainfall.

Tools for AWDM include: Water control structures; Field application methods; Water efficient crop varieties; Water pricing; Increased awareness, etc. Environmentalists see an important issue in creating awareness on the scarcity of good quality fresh water. Once people, and society as a whole, are aware of the increasing threat to their subsistence, the basis is created for implementing solutions. The listed tools can contribute to reducing the use of water in the agricultural sector, but in practice the impact of these tools has been rather limited. Counter-effects have appeared during implementation, questioning the sustainability of the implemented measures. Even when a certain measure succeeds in reducing the amount of water applied at a certain location, this may have serious repercussions on downstream irrigated and/or ecological areas that depend on excess water from upstream areas.

Workshops Capacity Building for Agricultural Water Demand Management
One of the projects that was started after the March 2000 pledge was *Workshops Capacity Building for Agricultural Water Demand Management*, with as objective:

> ***Capacity building for management of agricultural water demand both in institutions in India and Vietnam, as well as in Wageningen UR, through two workshops in which the participating institutions identify needs and formulate project proposals.***

As part of this project, a three-day workshop was held in the State of Andhra Pradesh, India, with the objective to assess the role that research and educational institutes play in interacting with policy makers, government departments and water users to ensure the sustainable use of water by the agricultural sector (the Workshop in Vietnam was cancelled by the Programme management). The set-up of the Workshop was that after plenary presentations, the participants split up in groups to discuss specific questions on agricultural water demand management in detail.

Workshop Conclusions and Recommendations

1. In water management for agriculture, the priority should be to focus on managing demand in such way that agricultural productivity is increased within the available supply of water (Agricultural Water Demand Management).
2. A research and educational institute should be established with a holistic and multidisciplinary approach to water management
3. An operational water management research programme should be started in a selected larger-scale area of 3000 to 5000 ha
4. Training towards Agricultural Water Demand Management should be institutionalised and training facilities should be established at district level
5. Information should be made available on both the present and historic water supply and water use for agriculture within the State

Final Project Result

The Project has greatly contributed to:

- Awareness raising on the issue of Agricultural Water Demand Management in Andhra Pradesh.
- An analysis of the present situation in the capacity building for Agricultural Water Demand Management in Andhra Pradesh.
- A project proposal to address the identified gaps in knowledge and capacity building, building on the AP demand and the existing (and appreciated) bilateral co-operation.

1 Introduction

1.1 Background

Agricultural Water Demand Management is at the core of the Water for Food Programme launched as a result of a pledge by the Netherlands' Minister for Agriculture at the 2nd World Water Forum in March 2000, The Hague. One of the projects that was started after the March 2000 pledge was *Workshops Capacity Building for Agricultural Water Demand Management*. It is funded through the "Partners for Water" programme of the Government of the Netherlands[1].

1.2 Original Objective

The original objective of the project was:

> ***Capacity building for management of agricultural water demand both in institutions in India and Vietnam, as well as in Wageningen UR, through two workshops in which the participating institutions identify needs and formulate project proposals.***

[1] Partners for water is a collaborative effort of the Ministries of Foreign Affairs; Economic Affairs; Agriculture, Nature and Food Quality; Transport, Public Works and Water Management; Housing, Spatial Planning and Environment; and Education, Culture and Science

More general, the project aimed at enhancing the exchange of knowledge and experience between countries and institutions in an effort to achieve a more sustainable use of water for food production.

As part of this project, a three-day workshop was held in the State of Andhra Pradesh (AP), India. The Partners for Water Programme management decided that the planned workshop in Vietnam should not be funded by the Programme. It was intended that the proposal to be developed between the involved institutions in both Andhra Pradesh and The Netherlands would take into account already existing lines of co-operation. However, the recent developments on bilateral co-operation between the Governments of India and The Netherlands had an impact on this. Nevertheless, the Workshop that was held under this project, aided substantially to the project that is currently in development between partners in Andhra Pradesh and The Netherlands, through FAO, and that is planned to be signed in the first half of 2004.

The workshop, held in Hyderabad, was organised under the central theme *Capacity Building for Agricultural Water Demand Management (AWDM)*. Over the last decades AP, like many other States, has been developing water resources to cope with the growing demand for water. In the workshop representatives of different disciplines and different stakeholders presented examples of technical, institutional and economic measures to manage water demand. They also discussed how to implement comprehensive demand management strategies and build the necessary capacity within the State of Andhra Pradesh.

1.3 Structure of this report

Chapter 2 describes the background for Programme Capacity Building for Agricultural Water Demand Management, Chapter 3 presents an introduction to agricultural water demand management, and Chapter 4 gives the details of the Workshop held in Andhra Pradesh, including the overall result of the project: analysis of the present situation in AP with respect to capacity building for AWDM in AP, and the contribution to the project proposal currently in development and to be agreed before mid 2004.

1.4 Acknowledgements

The Workshop in India was organized as part of the project Workshops Capacity Building for Agricultural Water Demand Management. The project was managed by Mrs. Catharien Terwisscha van Scheltinga. The Workshop was supported by the AP Government, and could not have been organized without the dedicated efforts of many, including officials of the Acharya N.G. Ranga Agricultural University, the chairman of the Organizing Committee, Dr. I.V. Subba Rao (Vice Chancellor), and Chairman of the management Committee Dr. T.V. Satyanarayana; Water

Conservation Mission Advisor Dr. K.V.G.K. Rao; the support of RNE New Dehli, represented by Dr. P.S. Rao; and representatives of Wageningen UR, including Messrs. P. Bindraban, G. van Vuren, P. Mollinga, J. Boonstra, H.P. Ritzema, and P.W. Vehmeyer.

2 Background for the Programme Capacity Building for Agricultural Water Demand Management[2]

2.1 Introduction

In March 2000, during the Second World Water Forum and the parallel Ministerial Conference at The Hague, the Government of the Netherlands made pledges to protect the security of the world's water supply in the twenty-first century. One of these pledges was made by Mr. Laurens Jan Brinkhorst, then Minister of Agriculture, Nature Management and Fisheries, who announced that the Government of the Netherlands would take the initiative and begin to deal with the issue of water for food and rural development under a programme entitled Partners in Water for Food.

Within Wageningen University and Research Centre (Wageningen UR), the pledge on Partners in Water for Food has led to the development of a collaborative programme under the theme Water for Food: Building Capacity for Agricultural-Water Demand Management, with a large number of international partners involved. This Chapter describes the background of this collaborative programme.

2.2 Avoiding fragmentation

Fragmentation of responsibilities within the water sector is seen as one of the most important obstacles in moving towards Integrated Water Resources Management. This is why it is considered essential that that those working in the domain of Water for Food have an understanding of the spirit and recommendations of the Forum and Ministerial Conference.

[2] Working Group "Water for Food", 2001

Box 1: Fragmentation of responsibilities hinders Integrated Water Resources Management/IWRM

The Ministerial Declaration of The Hague on Water Security in the 21st Century indicates that neither the threats to water security are new nor the attempts to address them. Reference is made to statements at the International Water Conference in Mar del Plata (1977) and chapter 18 on Water in Agenda 21 (Rio 1992). The Mar del Plata conference already emphasised the need for Integrated Water Resources Management: "Institutional arrangements adopted by each country should ensure that the **development and management of water resources take place in the context of national planning** and that there is **real co-ordination among all bodies responsible for the investigation, development and management of water resources**" (Mar del Plata Action Plan: Recommendation No. 2 on Policy, Planning and Management). The proceedings of the 1992 Rio Conference read: "The holistic management of freshwater as a finite and vulnerable resource, and the integration of sectoral water plans and programmes within the framework of national economic and social policy, are of paramount importance for action in the 1990's and beyond. **The fragmentation of responsibilities for water resources development among sectoral agencies is proving, however, to be an even greater impediment to promoting integrated water management than had been anticipated**" (par. 18.6, Ch.18, Agenda 21). Fragmentation is also mentioned in par.7 of the Second World Water Forum Ministerial Declaration (The Hague, 22 March 2000): "To achieve integrated water resources management, there is a need for coherent national and, where appropriate, regional and international policies **to overcome fragmentation**, and for transparent and accountable institutions at all levels."

2.3 Integrated Water Resources Management

Paragraph 5 of the final declaration of the Ministerial Conference (The Hague, 22 March 2000) indicates that all recommended actions are based on Integrated Water Resources Management (IWRM). Box 2 describes this term.

> Box 2: Integrated Water Resources Management
>
> IWRM is a process that promotes the co-ordinated development and management of water, land and related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. (Global Water Partnership, 2000)
>
> Two issues are at the core of IWRM:
> 1. Acknowledging that ecologically sound water-systems are essential for the sustainable use of water resources by humans, animals and plants.
> 2. Acknowledging that the management requires a careful process of balancing the interests of all users and uses, as well as a regulatory framework to guarantee the sustainable use of water resources.

At the time of the International Water Conference in Mar del Plata (1977) balancing different interests (Box 2, core issue 2) was seen as a task for governments. From the guiding principles and recommendations formulated in Dublin (Water & Environment in 1992), Rio (UNCED in 1992) and The Hague (Second World Water Forum in 2000) it follows that:

- Interests should be balanced at the lowest possible administrative level (subsidiarity);
- Users and other participants should be involved in the balancing process (participation)

The first core issue in Box 2 brings forward an important pre-condition in the decision process: ***ecosystems should remain healthy and sustainable (or be rehabilitated, if necessary).***

The 'Declaration of The Hague' of the Ministerial Conference on Water Security in the 21st Century (The Hague, 17-22 March 2000) mentions seven challenges (WWF2, 2000):

1. Meeting basic needs
2. Securing the food supply
3. Protecting ecosystems
4. Sharing water resources
5. Managing risks
6. Valuing water
7. Governing water wisely.

The programme *Partners in Water for Food* targets the second challenge (securing the food supply) within the context of the six other challenges.

The 'Declaration of The Hague' describes the second challenge as:

> ***Securing the food supply: to enhance food security, particularly of the poor and vulnerable, through the more efficient mobilisation and use, and the more equitable allocation of water for food production***

The Netherlands government's activities under the programme Partners in Water for Food included:

1. Adapting the programmes of the Ministry of Agriculture, Nature Management and Fisheries that deal with research, training and management in relation to water for food and rural development, so that they conform to the spirit and recommendations of the Forum and the Ministerial Conference;
2. Calling upon other governments to make similar efforts;
3. Inviting governments to participate in exchanges of their knowledge and experience;
4. Making resources available for such exchanges and supporting inter-governmental co-operation.

One of the first actions of Partners in Water for Food was the establishment of a working group on Water for Food at the Wageningen University and Research Centre (Wageningen-UR) in The Netherlands. Consistent with the second challenge of the Declaration of The Hague and Partners in Water for Food, the working group's specific aim is to promote capacity building for agricultural-water demand management in partner countries (Box 3). The working group on Water for Food contributed to such capacity building by participating in a collaborative research programme that involves organisations in The Netherlands and partner countries.

Box 3: Context Working Group *Water for Food*

Objective: The working group *Water for Food* aims at enhancing food security, particularly of the poor and vulnerable, through the more efficient mobilisation and use, and the more equitable allocation of water for food production, while carefully taking into account the ecological vitality of water systems.

Theme: The working group *Water for Food* of Wageningen UR contributes to capacity building for an integrated approach towards the management of water for food, rural development and healthy water systems.
This is meant as an extension and strengthening of the capacity building for integrated water resources management and focuses especially on stimulating *demand management* (with reference to water) within the agricultural sector.
At a later stage, in 2003, the working group was merged with with the working group *Water and Ecosystems*, becoming the working group *Water for Food and Ecosystems*.

As stated in the box the theme has, as key components, capacity building for integrated water resources management and demand management (with reference to water) within the agricultural sector. These terms are briefly explained below.

Capacity Building for Integrated Water Resources Management requires:
1. Knowledge on the current and future water system demands of all users and interest groups;
2. Knowledge on the ability of the water systems to meet the demands;
3. Identifying the problematic areas between 1 and 2;
4. Identifying possible measures to tackle these problematic areas;
5. Selecting the most appropriate measures;
6. Implementation;
7. Checking on proper implementation;
8. Monitoring and evaluating the effects of the measures.
9. Redirecting strategy on the basis of evaluation (8) and/or changing patterns of water demand (1).

Furthermore, capacity building in the spirit of the Second World Water Forum and the Ministerial Conference adds the following requirements:
1. Recognition that healthy ecosystems are the basis for sustainable water use;
2. Directing the above steps takes place at the lowest possible administrative level;
3. Users and interest groups are involved as much as possible.

2.4 Demand management

The investments in the water sector in the period between 1960 and 1980 were often aimed at maximising the economic benefit of natural resources. After 1990, the increasing water scarcity brought the term ***demand management*** into being. Demand management can be defined as a policy aimed at optimising the use of currently available resources, instead of developing new resources. Box 4 gives a wider explanation.

Box 4: Demand management

Demand management is a policy for the water sector, which prefers optimising the use of existing resources above the development of new resources.

The term can be clarified by comparing it with it's opposite: Increasing the supply of new resources; until recently the prevailing approach. With a *supply-orientation* the common response towards perceived water scarcity is to:

- Commission an assessment study of current resources;
- Project demands on the basis of 'unlimited' supplies;
- Compare alternatives to increase supplies;

Recommend the alternative that increases the supply against the lowest costs;
Execute the work through a government organisation and with subsidised prices.
The key words of this traditional approach are: central planning and decision making; government organisation responsible for execution and management; increased supplies; subsidies; and dependency on administrative and legal instruments for the allocation of water.

In contrast, *demand management* represents: decreasing waste; economising use; development of water-efficient methods and technologies; stimulating more careful handling by managers and users; improved recollection of funds, reallocation from low-value to high-value uses; public-private partnerships; allocating responsibilities to a lower administrative level and to users; and an increased use of economic instruments (price, market).
Demand management includes measures aimed at relating the value of water to the costs of supplying it, and motivating users to change their pattern of use to these costs. In this way water is treated more as an economic good instead of an unquestionable public service.

After: Winpenny, J.T. *Demand management for efficient and equitable use.* 296-303 in: Water: Kay, M. et al, *Economics, Management & Demand.* E&FN Spon. 1997.

At present, the call for *demand management* is sounding in other sectors, and is often targeted against agriculture, which is seen as the largest (70-80% of the total use) and least efficient water user.

However, agriculture also has the largest potential for demand management. This potential can be utilised for example by investing in public irrigation systems only after the possibilities for productivity increases in rain-fed agriculture have been considered, investigated and utilised.

Moreover, agriculture is not just the largest water user; it is also the largest rainfall processing industry. According to FAO statistics, the total area used for agriculture in developing countries in 1997 was 956 million ha, of which 202 million ha – or 21 % - were irrigated. The total withdrawal for irrigation amounted to 2128 cubic kilometers; on 202 million ha this provides an average irrigation depth of 1053 mm p/year. Average rainfall on the total area was 1043 mm; on 956 million ha this corresponds with a volume of 9971 cubic kilometers. These figures indicate that the volume of rainfall received by the agricultural sector is 4.7 times as large as the volume withdrawn for irrigation. This means that agriculture is not just the largest user of fresh water, it is also by far the largest processing industry of rainfall. While the traditional produce of this processing industry is food and fibre for feeding and clothing the world, we should be aware that agriculture also "produces" fresh water through the surface runoff and replenishes groundwater through deep percolation, both resulting from excess rainfall. Agricultural practices – and the degree to which they are consistent with soil type, topography and climate – determine the partitioning of rainfall: at the soil surface between infiltration and runoff, within the root-zone between evapo-transpiration and deep percolation. Due their traditional focus, the agricultural sector – including the scientific institutions supporting it – has been keen to identify water management practices that result in maximum agricultural production. As soon as we are ready to consider agriculture as a rainfall processing industry, we will recognize that other ecological services, such as water for nature, domestic use or industry in some cases produce higher revenues than the traditional products food and fiber.

3 Agricultural Water Demand Management[3]

Sustainable Development and Integrated Water Resources Management are key to managing the world's water resources. For the agricultural sector the adoption of these concepts means that it should manage its water use more carefully through Agricultural Water Demand Management. Different tools have been developed to save on water use in agriculture. However, the implementation of these tools does not always lead to sustainable solutions. A multidisciplinary approach is required, which balances the overriding economic, social and ecological sustainability criteria. An approach, which does not only pay attention to the implementation of the tools, but also to the Enabling Environment and Institutional Framework governing the functioning of these tools. As has been stated in Chapter 2, Wageningen UR and its partners are involved in a variety of projects under the "Water for Food" programme, which relate to Agricultural Water Demand Management. These projects provide a useful platform to learn how to improve the implementation of Agricultural Water Demand Management.

3.1 Importance of Agricultural Water Demand Management for the World's Water Resources

The worlds' fresh water resources are limited. Care should be taken how these water resources are used.
Historically, agriculture has been either rain-fed or supported by small-scale irrigated systems. Since the end of the 19th century large-scale irrigated systems have been constructed. Initially, with run-of-the-river supplies, but later also fed by large reservoirs. These developments have increased the use of fresh water resources for agricultural purposes tremendously. The resulting increased agricultural production occurred simultaneously with increasing population growth, industrialisation, urban development and general welfare. All have had their influence on the growing demand for water and the subsequent pollution of water 'drained' from areas, where it has been used.

In the 1970's a first group of people, called the Club of Rome, started a general campaign to warn against the unsustainable exploitation of the worlds' natural resources. In the mid 1980's, the United Nations asked Gro Harlem Brundtlandt, a former prime-minister of Norway, to lead a commission to advise on a strategy how the world could use its natural resources in a sustainable way. The final report of the commission under the title "Our Common Future" (Brundtlant, 1987) introduces the concept of Sustainable Development. For Sustainable Development, economic, social and ecological aspects of the use of natural resources should all three be taken into account.

[3] This Chapter is based on Vehmeyer (2002)

In the water sector, the growing competition for water and the increasing pollution, has led to the call for Integrated Water Resources Management. No longer can agriculture use water, without reviewing the other uses of water in the same river basin, whether it be upstream or downstream in that basin. In many countries, especially amongst those regarded as developing countries, agriculture is by far the largest user of water. In many cases its share is up to 80-90% of all water diverted for human use. In case of scarcity of water, it is quite obvious that any actions to save on the use of water in the agricultural sector could have a major impact on the water availability for other uses. Many have responded to this challenge and have brought solutions to the table to try to increase the efficiency of water use in the cultivation of crops.

3.2 Tools for Agricultural Water Demand Management

The solutions for increasing the efficiency of water use in agriculture come from different disciplines, and the tools include:

Water control structures
Civil engineers have reviewed the way irrigation canals are controlled. Instead of designing irrigation systems, which are focussed on supplying whatever quantity of water is available at the head of the system, engineers have developed control systems, which allow farmers to take the amount of water they really need.

Field application methods
Agricultural engineers advise on cultivation methods, which increase the application efficiency. For example, fields cultivated with the bed-and-furrow method use less water per irrigation in comparison to fields irrigated with the basin-method. In addition, engineers have developed pressurised systems like sprinkler and drip irrigation to apply water more efficiently to the crops.

Water efficient crop varieties
Crop breeders are putting their efforts into creating crop varieties, which evaporate less water while maintaining their normal growth pattern. They are also keen to limit the vulnerability of crops to extreme conditions like drought periods and flooding, which can affect the total production of a cropping season.

Water pricing
Economists have looked at the issue of valuing and pricing water. In many countries irrigation water is free or practically free. Economists argue that if water would have a realistic price, the crop cultivators would use it more efficiently.

Increased awareness
Environmentalists see an important issue in creating awareness on the scarcity of good quality fresh water. Once people and society as a whole are aware of the increasing threat to their subsistence, the basis is created for implementing solutions.

This listing mentions a selection of tools for water demand management. Mohamed (2001) gives a more extensive list of demand management tools. He not only lists tools used for reducing water demand in agriculture, but also tools for controlling industrial and domestic water uses.

The above tools from different disciplines can contribute to reducing the use of water in the agricultural sector. However, in practice the impact of these tools has been rather limited. Serious counter-effects have appeared during the course of implementation, questioning the sustainability of the taken measures.

Even when developed tools seem to succeed in reducing the amount of water applied at a certain location, this may have serious repercussions on downstream irrigated and/or ecological areas, which depend on excess water drained from upstream areas.

3.3 Linking the Tools to Achieve Sustainability

Sprinkler and drip irrigation systems are expensive, which means that these tools are only available to relatively wealthy farming communities. If water is priced, poorer farmers are the first ones to be unable to pay for the water, losing an important source for sustaining their livelihoods. The bed-and-furrow technique reduces overall water use, but requires an increased frequency of irrigation events. Something irrigation systems do not always allow. In arid or semi-arid areas the use of bed-and-furrows increases the risk of salt accumulation near the soil surface.

These are just some indications of problems encountered with tools that try to increase the efficiency of water use. They have a common denominator. The developed solutions often do not balance the three aspects of sustainable development: economical; social; and ecological sustainability.

Water pricing is a measure aimed at improving the economically efficient use of water. However, it might reduce the access to water of the poor, neglecting the social aspect of sustainability, the criterion for water to sustain as many livelihoods as possible.

If the use of the bed-and-furrow technique in irrigating a field results in a more economically efficient use of water on one hand, but an increased soil salinity on the other, the ecological sustainability of the proposed measure is not weighted properly. The degradation of natural resources and the organisms, which rely on them, should be avoided, both with regard to time at one location as to interactions with the basin.

The effectiveness of developed tools lies in their ability to balance the three overriding criteria for sustainable development. To achieve this requires integrating the knowledge of the different disciplinary groups engaged in the aspects of water use for agriculture. Engineers, economists, sociologists and environmentalists should get together to identify a combination of tools, which reduces the use of water for food as part of a strategy for sustainable development. The required combination of expertise can be found within Wageningen UR and with its partners.

3.4 How to Implement Agricultural Water Demand Management

Past experience has sufficiently shown that developing, combining and implementing tools is not enough for a successful strategy towards the efficient use of water in the agricultural sector. For a strategy to work it needs to be more comprehensive.

Addressing the use of water in the agricultural sector requires a careful assessment of the quantity and quality of the available land and water resources. Understanding the interactions between rainfall, soils, groundwater and the surface water system is of the utmost importance for a sustainable strategy to use these resources.

In addition, the use of water for other purposes, and linked to the use of resources by the agricultural sector should be clearly identified. Examples are the use of water in irrigation systems as drinking water and the use of urban wastewater for irrigation.

Agricultural Water Demand Management should be regarded as a part of Integrated Water Resources Management. It focuses on how the agricultural sector can contribute to implementing the Integrated Water Resources Management concept.

In accordance with the generally acknowledged way how to implement Integrated Water Resources Management (Global Water Partnership, 2000), prerequisites for Agricultural Water Demand Management are:

The Enabling Environment

This consists of all policies, legislation and regulations that provide "the rules of the game" for the development, management and use of water resources. Thus, this includes the policies, legislation and regulations that enhance an economically, socially and ecologically sustainable water use. The Enabling Environment also determines how and through which means the different stakeholders can voice their interests. The Enabling Environment basically covers the role of the government in facilitating Integrated Water Resources Management.

The Institutional Framework

The roles and functions of the various administrative levels and stakeholders. Important considerations are management according to hydrological boundaries, effective co-ordination between organisations having different functions related to the water management system, management at the lowest feasible level and participation of stakeholders/beneficiaries. Although the Global Water Partnership (GWP) separates the Institutional Framework from the Enabling Environment, they are closely inter-linked.

The Management Instruments
These are the tools and methods available to decision-makers to choose between alternative actions. It includes comprehensive information about the availability and use of water resources; the social, economic and environmental consequences of interventions; communication and information systems to share information with all stakeholders; and relevant direct regulatory, social, economic and technical instruments.

Implementing Agricultural Water Demand Management requires accounting for all the above mentioned elements. At many occasions, tools have been implemented without looking at the other prerequisites. To take notice of all elements is not easy and as such, is not very common. For a more comprehensive approach, capacity needs to be built. Society, institutions and people should all be given the opportunity to adjust themselves. They should look towards a multi-disciplinary approach, combining technical disciplines with society-oriented disciplines. This β- and γ-approach is one of the spearheads of Wageningen UR.

Although the Enabling Environment and the Institutional Framework are typically designed and changed at national or state level, it is important to move to the local level to study all interactions and impacts of a strategy to manage water use by the agricultural sector.

3.5 Examples of Agricultural Water Demand Management

In this last section, examples of projects related to Agricultural Water Demand Management are provided from the range of "Water for Food" projects, funded by the Netherlands' Partners for Water Programme.
(see also www.waterfoodecosystems.nl):

3.5.1 WATERMUK

The WATERMUK project aims to improve water management in the southern region of the Ukraine. During the last decade, local large-scale sprinkler irrigation systems have gradually moved into deplorable state affecting irrigation practices. Salinity has appeared and yields have dropped as a result of unsustainable water management. The traditional large scale co-operative farms are not able to take care of the operation and maintenance of the immense irrigation infrastructure, at the time when the irrigated land itself has been subdivided into smaller plots owned by the once employees of the co-operatives. Creating a sustainable and efficient water management approach in this situation is not a matter of just engineering. An important factor is the Institutional Framework and the responsibility of the landowners for the operation and maintenance of a joined irrigation system. Participatory management will only be possible with changes in policies, legislation and financing structures, components of the Enabling Environment.
The Ukrainian and Netherlands partners in the WATERMUK project have used GIS and Remote Sensing tools as Management Instruments to assess developments in water management and its influence on cropping practices. In addition, options have been reviewed for developing a strategy to introduce participatory management in the region.

3.5.2 Reuse of Wastewater for irrigation

The Reuse of Wastewater for Irrigation project compares reuse practices in Ghana, Tunisia and Bolivia. Wastewater from urban areas is a non-conventional water resource for irrigation, saving on the use from fresh water sources. Thus, it contributes to Agricultural Water Demand Management. Wastewater contains large quantities of nutrients, but also provides a health hazard for the irrigators exposed to the water, if not properly treated beforehand. In some countries, like in Tunisia, strict regulations as part of the Enabling Environment control the use of wastewater. Agricultural products irrigated with it are not meant for consumptive use. In Accra, capital of Ghana, nearly all vegetables are irrigated with wastewater. In Bolivia's city of Cochabamba the use of treated wastewater as an additional resource to control overall demand is complicated by the location of wastewater treatment plants in the downstream part of the peri-urban area.

3.5.3 Waterless Rice Network

The Waterless Rice Network links researchers in countries like China, India, Indonesia and Madagascar. Within the network knowledge is shared on methodologies to reduce the water use in rice-based cropping systems and the application of these methodologies in different countries and settings. Savings on water in rice cultivation can only be realised if a larger perspective is taken of the water management in the river basin. The existing water management system should be able to cope with new irrigation schedules. Apart from the technical dimensions, economic, environmental as well as cultural dimensions come into play. Cultivation with less or no flooding of fields, improves soil aeration and reduces methane emissions (Hengsdijk and Bindraban, 2001). Methane contributes to the greenhouse effect. A reduction in its emission helps the environmental sustainability. An example of a cultural dimension is that rice cultivated with waterless methodologies tastes different from traditionally cultivated rice, causing local markets to prefer rice grown using more water.

3.6 Concluding Remarks

The "Water for Food" projects mentioned above are not examples of an all-encompassing approach to Agricultural Water Demand Management. However, they are real collaborative activities between partners in the Netherlands and partners in other countries, and focus on aspects of Agricultural Water Demand Management in the host country. The concepts of Sustainable Development and Integrated Water Resource Management provide a useful platform to highlight missing aspects towards Agricultural Water Demand Management in such projects. By addressing gaps and gaining experience capacity is built for Agricultural Water Demand Management.

4 The Workshop in Andhra Pradesh

The Workshop 'Capacity Building for Agricultural Water Demand Management' was held from 28-30 November 2001 in the Green Park Hotel, Hyderabad, Andhra Pradesh, Iudia.

4.1 Background

Water is essential for life. Essential for us and for the production of our food. Water resources are often limited, and their availability is variable in time and place. Balancing the needs for water with the available supplies is an increasingly difficult challenge. Populations are growing, industries are expanding, ecosystems are under pressure. No longer can the needs for water be met by just developing more water resources. Attention needs to be paid to the demand for water. Can it be influenced? And if so, how? What needs to be done to get more attention for water demand management?

A three-day workshop was held in Hyderabad, India, in order to take a different perspective at water management in the State of Andhra Pradesh. Participants from inside and out of the state assembled to present their views and discuss on the possibilities for water demand management within the agricultural sector.

4.2 Workshop Objectives

The workshop had the objective to assess the role research and educational institutes play in interacting with policy makers, government departments and water users to ensure the sustainable use of water by the agricultural sector. The workshop aimed to present a synthesis of the present situation, identify gaps in knowledge and capacity building and prepare proposals to address these identified gaps.

At the start of the Workshop, a "Souvenir"-publication was distributed (ANGRAU, 2001), which contained a wide selection of papers submitted for the workshop. In addition, a number of invited presentations were made during the workshop. The programme of the workshop consisted of technical sessions and working sessions. The technical sessions were meant for presentations by the participants, while during the working sessions the participants divided themselves in three groups and addressed the key issues of the workshop.

4.3 Andhra Pradesh

In 1997, the Government initiated an ambitious program of reform in the irrigation sector. Through these institutional reforms, the responsibility for operation and maintenance of irrigation schemes was transferred to the water users.

Another significant development has been the constitution of the Water Conservation Mission in 2000. This high-level advisory panel ensures an enabling environment on topics as water harvesting, watershed management and water conservation.

Both mentioned developments are clear indications of the movement of Andhra Pradesh towards a more sustainable management of water resources. The question rises what role the research and educational institutes play in these recent developments.

4.4 The Workshop

4.4.1 Objective

The workshop on Capacity Building for Agricultural Water Demand Management has the objective to assess the role research and educational institutes play in interacting with policy makers, government departments and water users to ensure the sustainable use of water by the agricultural sector. The workshop will present a synthesis of the present situation, identify gaps in knowledge and capacity building and prepare proposals to address these identified gaps.

4.4.2 Set-up of the workshop

The set-up of the Workshop was that after plenary presentations, the participants split up in groups to discuss specific questions on agricultural water demand management in detail. The Programme of the Workshop is presented in Appendix 1, and the participants in Appendix 2. Prior to the Workshop, a "souvenir" publication was prepared containing the AP presentations (For the contents of this publication, see Appendix 3). The keynote presentations of Messrs. H.P. Ritzema, P.S. Bindhraban, and C.A. Scott, are presented in Appendix 4.

4.4.3 The working sessions

During the working sessions participants were divided in three groups. These three groups stayed the same during all three working sessions.

4.4.4 Working Session I

The groups were asked to address and come to an agreement on the following questions:

1. What is agricultural water demand management?
2. How does it fit into the context of Integrated Water Resources Management (IWRM)?
3. How does it fit into the context of sustainability? And how does it relate to the three aspects of sustainability (economic, ecological and social)?
4. How do water conservation and agricultural water demand management relate to each other?
5. Where does drainage come in…or should we forget it?

4.4.5 Working Session II

The groups were asked to specify and come to an agreement on what is required for agricultural water demand management in the state of Andhra Pradesh and organise these items under one of the following elements for implementation:

- The Enabling Environment
- The Institutional Framework
- The Management Instruments

4.4.6 Working Session III

The groups were asked to address and come to an agreement on the following:

1. Give an analysis of the present situation in the capacity building for Agricultural Water Demand Management.
2. Identify the gaps towards capacity building for agricultural water demand management.
3. Identify the role research and educational institutes should play in capacity building.

The three working sessions allowed the groups to work in parallel towards the objective of the workshop. After each of the working session the groups presented their results in the plenary. In this way, participants were exposed to the lines of thought in the other groups. The reports of the three groups after each of the three sessions are found further in the appendices of these proceedings.

4.5 Gaps

In the final session on Friday afternoon, the results of the three working groups were assembled. In summary, the working groups concluded the following regarding gaps towards capacity for Agricultural Water Demand Management:

- The perspective of Agricultural Water Demand Management is quite new to the State of Andhra Pradesh. There is a well-defined policy towards water conservation. However, the policy towards an efficient management of the use of water is less clear.
- Agricultural Water Demand Management requires a holistic and multi-disciplinary approach. Such an approach is not yet part of research or teaching at academic and training institutes.
- The present teaching related to water management is more theoretical than practical. As a result it is not driven by practical requirements. There is no on-the-job training incorporated.
- The government has implemented a state-wide participatory irrigation management programme. With respect to facilitating the efficient management of water for agriculture, there is insufficient communication between farmers and government departments on matching the demand and supply for irrigation. This could be explained by unclarity in roles and responsibilities of participatory agencies and other departments. In addition, a lack of co-ordination among participatory agencies contributes to it.
- The information available in data bases on the historic and present use of water for agricultural purposes is insufficient. This also reflects itself in knowledge of the water balance at different levels.

4.6 Result of the Project

The Project has greatly contributed to:

- Awareness raising on the issue of Agricultural Water Demand Management in Andhra Pradesh
- An assessment of the present situation in the capacity building for Agricultural Water Demand Management in Andhra Pradesh.
- A project proposal to address the identified gaps in knowledge and capacity building, building on the AP demand and the existing (and appreciated) bilateral co-operation.

4.6.1 Workshop Conclusions and Recommendations

1. In water management for agriculture, the priority should be to focus on managing demand in such way that agricultural productivity is increased within the available supply of water (Agricultural Water Demand Management).

The three-day workshop introduced a promising and refined perspective towards water management for agriculture in the State of Andhra Pradesh. The Water

Conservation Mission should take a further step towards their objective by endorsing a strategy towards Agricultural Water Demand Management.

2. A research and educational institute should be established with a holistic and multidisciplinary approach to water management

Within this institute, existing agricultural and engineering institutes should combine their activities and present a joined academic and training programme. Subjects covered in the new curriculum should include: (geo-)hydrology, irrigation and drainage engineering, crop science, soil science, economics, law, social science, environmental engineering, river basin management. The institute should ensure a practical-oriented multidisciplinary curriculum and research agenda with substantial field-level interactions. The institute should be a focus point between state-wide and national and international research and development regarding Integrated Water Resource Management and Agricultural Water Demand Management. It should be able to disseminate quality teaching and training material.

3. An operational water management research programme should be started in a selected larger-scale area of 3000 to 5000 ha

Research and education towards Agricultural Water Demand Management should not encompass a mere theoretical subject. It should be demand driven and firmly based on the practical realities in the field. It should assimilate into regular and local development programmes through on-the-job and field-level interactions. It should take into account the farmers' perspective and address the farmer-agency and agency-agency interactions. In the programme academic and training institutes, local government representatives, water users' organisations and non-governmental organisations should participate.

4. Training towards Agricultural Water Demand Management should be institutionalised and training facilities should be established at district level

If Agricultural Water Demand Management is to become an integral part of water management and agricultural practices within the state, training programmes for farmers and government representatives will have to be established. These training programmes should not just include one time training courses but should be part of a wider capacity building effort. To facilitate appropriate long-term interactions, training facilities should be established at district level. WALAMTARI could play a role. Currently however, it is part of the Irrigation Department and targeted towards training at its central facility for engineering and Participatory Irrigation Management.

5. Information should be made available on both the present and historic water supply and water use for agriculture within the state

For an effective strategy towards Agricultural Water Demand Management it is important to generate and maintain a resource base on the water supply and water use of the agricultural sector. IWMI with their office in Hyderabad could be of assistance, as they are currently engaged in a world-wide Comprehensive Assessment on Water Management for Agriculture.

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Appendix 1 Participants of the Workshop

Acharya N.G. Ranga Agricultural University

Workshop Capacity Building for Agricultural Water Demand Management

Hotel Green Park, Hyderabad
28-30, November 2001

LIST OF PARTICIPANTS

S.No	Name and Organisation	Address
1.	**Dr. S. Raghuvardhan Reddy** ANGRAU	Registrar, Administrative Office, ANGRAU Rajendranagar, Hyderabad – 500 030
2.	**Dr. B. Bhaskara Reddy** ANGRAU	Professor of Agronomy, College of Agriculture Rajendranagar, Hyderabad – 500 030
3.	**Dr. V. Praveen Rao** ANGRAU	Professor of Agronomy, College of Agriculture Rajendranagar, Hyderabad – 500 030
4.	**Dr. K.G. Varshney** ANGRAU	Professor (MP) and University Head (SWE) Dept. of Agricultural Engineering S.V. Agricultural College, Tirupati – 517 502
5.	**Dr. M.Singa Rao** ANGRAU	Professor of Soil Science, College Of Agriculture Rajendranagar, Hyderabad – 500 030
6.	**Er. K.R.K. Prasad** ANGRAU	Senior Scientist (Agril. Engg.), AICRP on AD Pedana Road, Machilipatnam
7.	**Dr. K. Surender Reddy** ANGRAU	Senior Scientist (Agro) Agricultural Research Station, Karimnagar
8.	**Dr.A. Srinivas** ANGRAU	Senior Scientist (Argo) Agricultural Research Station, Karimnager
9.	**Dr. B. Sahadeva Reddy** ANGRAU	Scientist (Agronomy) Regional Agricultural Research Station, Nandyal
10.	**Dr. R.P.S. Ahlawat** GAU	Director of Research Gujarat Agricultural University
11.	**Dr. S. Raman** IDNP,GAU	Chief Scientist IDNP, Navasari
12.	**Dr. G. Malliwal** Narmada Irrigation Project, GAU	Research Scientist Narmada Irrigation Project, Khandha
13.	**Dr. G.H. Ghaganda** CAE, Junagadh, GAU	Professor of Soil & Water Engg. CAE, Junaadh
14.	**Dr. P.T. Patel** ARNEJ, GAU	Associate Director of Research ARNEJ
15.	**Dr. K.D. Sharma** Principal Scientist (SWCE) CRIDA	Head, Division of Resource Managementm Head, ARIS & OIC Works Central Research Institute for Dryland Agriculture (CRIDA) Santoshnagar, Saidabad Hyderabad – 500 059
16.	**Dr. G.R. Korwar** CRIDA	Principal Scientist (Agronomy) CRIDA
17.	**Dr. P.K. Mishra** CRIDA	Principal Scientist (SWE) CRIDA

S.No	Name and Organisation	Address
18.	**Sri. G. Kishan** WCM	Addl. Chief Executive Officer Water Conservation Mission 6th Floor, Insurance Building Tilak Road, ABIDS Hyderabad – 500 001 Ph: 4756109
19.	**Sri. P. Dharmendra Kumar** WCM	Scientist (Soil Conservation) WCM
20.	**Dr. T.N. Reddy** MSU, WCM	WCM
21.	**Dr. K.V.G.K. Rao** MSU, WCM	Water Management Specialist WCM
22.	**Mr. S. Hriday Raj** MSU, WCM	WCM
23.	**Sri. Syed Turabul Hassan** IRDAS	Institute of Research Development & Social Management (IRDAS) H.No. 10-1-123/A/3/1 P.G. Science College Road, Saifabad Hyderabad – 500 004
24.	**Sri C. Sithapathi Rao** IRDAS	Institute of Research Development & Social Management (IRDAS) H.No. 10-1-123/A/3/1 P.G. Science College Road. Saifabad Hyderabad – 500 004
25.	**Dr. Christopher Scott** IWMI, Regional Director	Director, Indian Regional Office International Water Management Inst. ICRISAT, Patancheru, Hyderabad
26.	**Sri. A.V.S. Prasad** WAPCOS	Regional Manager WAPCOS (I) LTD. Hyderabad – 500 004
27.	**Prof.T.D.J. Nagabhushanam** WAPCOS	PBME Expert WAPCOS (I) LTD. Hydrerabad – 500 004
28.	**MR. P. ter Weel** RNE	First Secretary & sector Specialist Land and Water Royal Netherlands Embassy 6/50 F, Shantipath Chanakyapuri, New Delhi – 110 021
29.	**Dr. P.S. Rao** RNE	Senior Program Officer Royal Netherlands Embassy 6/50 F, Shantipath Chanakyapuri New Delhi – 110 021
30.	**Dr. D. Appa Rao**	Associate Dean Professor & Head (Dept. of Soil and Water Engineering)(Retd.)
31.	**Dr. V.V.N. Murthy**	Professor of Soil Water Engineering (PAU, Retd) H.No: 1-10-132/1(363) Ashok Nagar, 9th Street Hyderabad – 500 020
32.	**Dr. Peter Mollinga** ASCI	Administrative Staff College of India Bella Vista, Hyderabad – 500 082

S.No	Name and Organisation	Address
33.	**Dr. Prem Bindraban**	Plant Research International (PRI) Wageningen University & Research Centre, Wageningen
34.	**Sri. M. Mrutyunjaya Rao** Dy. Director (GW)	Ground Water Department Andhra Pradesh
35.	**Dr. B.N. Prasad** Dy. Director (GW)	Ground Water Department Andhra Pradesh
36.	**Sri. N.Malla Reddy** Tech. Assistant (Agronomy)	Ground Water Department Andhra Pradesh
37.	**Dr. R. Ratnakar**	AP Well Project
38.	**Dr S.V.Goverdhan Das**	AP Well Project
39.	**Sri. M.Rajeshwar** Assistant Director (Agriculture)	Rural Development
40.	**Dr. R.N. SubbaReddy** Consultant	Consultant O/o Commissioner of Agriculture Department of Agriculture Govt. of Andhra Pradesh Hyderabad
41.	**Sri. M.Srinivasa Raju** Jt. Director of Agriculture	Joint Director of Agriculture (IAC) O/o Commissioner of Agriculture Department of Agriculture Govt. of Andhra Pradesh Hyderabad
42.	**Sri. M. Jayaraj**	Assistant Director of Agriculture WALAMTARI Himayatsagar Hyderabad – 500 030
43.	**Eng. D. Rama Krishna**	Deputy Executive Engineer Medium Irrigation
44.	**Dr. B Radha Krishna**	

Appendix 2 Programme of the Workshop

Wednesday 28 November 2001

08:30 - 09:00 Registration of participants

INAUGURAL SESSION

(09:00 - 11:15)

09:00 – 09:15	Opening and Welcome	- Dr. A. Padma Raju
09:15 – 09:30	Introduction to the workshop	- Ir. P.W. Vehmeyer
09:30 – 09:50	Water Conservation Mission of A.P.	- Sri. A.C. Punetha, IAS
09:50 – 10:05	Address on behalf of ILRI	- Dr. J. Boonstra
10:05 – 10:25	Technology for better irrigation water management in Andhra Pradesh	- Er. T.Hanumantha Rao
10:25 – 10:45	Presidential address	- Dr. I.V. Subba Rao
10:45 – 11:05	Chief Guest address	- Dr. A. Appa Rao
11:05 – 11:15	Ceremony and Vote of Thanks	- Dr. T.V. Satyanarayana

11:15 - 11:45 Coffee/Tea break

TECHNICAL SESSION I

(11:45 - 12:15)

Integrated Water Resources Management

Chair: Dr. Malaviya
Rapporteur: Dr. S. Raman

11:45 – 12:15	Concept of IWRM and demand management	- Dr. P. Mollinga
12:15 – 12:45	Mission Support to Water Conservation Mission of A.P.	- Dr. K.V.G.K. Rao

12:45 - 14:30 Lunch break

TECHNICAL SESSION II

(14:30 – 15:15)

Land and Water Conservation

Chair: Dr. V.V.N. Murthy
Rapporteur: Dr. T.V. Satyanarayana

14:30 – 15:00	Drainage and water management	- Dr. H.P.Ritzema
	incl. A case study of Konanki Pilot Area	- Dr. T.V. Satyanarayana
15:00 – 15:15	Water conservation and rainwater harvesting	- Dr. K.D. Sharma

15:15 - 15:45 Coffee/Tea break

WORKING SESSION IA

(15:45 - 17:30)

Proposed chairs and rapporteurs for three groups A, B and C:

	Group A	Group B	Group C
Chair	Dr. K.V.G.K. Rao	Dr. V. Praveen Rao	Dr. J. Jairath
Rapporteur	Dr. H.P. Ritzema	Dr. P.S. Bindraban	Dr. P.K.Mishra

<u>Thursday 29 November 2001</u>

WORKING SESSION IB
(09:00 – 09:30)

Groups A, B and C report to plenary

TECHNICAL SESSION III
(09:30 - 10:30)

Agricultural Water Demand Management
Chair: Dr. K.V.G.K. Rao
Rapporteur: Dr. R. Ratnakar

09:30 – 10:00	Water-less Rice Initiative	- Dr. P.S. Bindraban - Dr. Tyagarajan
10:00 – 10:30	Water Conservation Mission of A.P.	- Sri. A.C. Punetha, IAS
10:30 - 11:00	*Coffee/Tea break*	
11:00 – 11:15	Technical options for reducing water use in agriculture	- Dr. S. Raman
11:15 – 11:30	Water resources and agricultural water demand in Gujarat	- Dr. R.P.S. Ahlawat - Dr. S. Raman
11:30 – 11:45	Agricultural water demand in rice fields	- Dr. V.V.N. Murthy

WORKING SESSION IIA
(11:45 – 13:00)

Groups A, B and C (same as working session I)

13:00 - 14:30 *Lunch break*

WORKING SESSION IIB
(14:30 – 15:45)

Groups A, B and C report to plenary between 15:15 and 15:45.

15:45 - 16:15 *Coffee/Tea break*

TECHNICAL SESSION IVA
(16:15 - 17:30)

Institutional Reform, Enabling Environment and Capacity Building

Chair: Dr. P. Mollinga
Rapporteur: Dr. B. Bhaskar Reddy

16:15 – 16:45	Participatory Irrigation Management and Demand Management	- Dr. J. Jairath
16:45 – 17:00	Participatory Irrigation Management- A.P. Experience	- Sri. C. Sitapati Rao
17:00 – 17:15	Tank Institutions and Demand Management	- Ms. Goparaju Sudha
17:15 – 17:30	Needed new laws and institutional reforms for sustainable irrigation	- Syed Turabal Hassan

Friday 30 November 2001

TECHNICAL SESSION IVB

(09:00 - 10:00)

Institutional Reform, Enabling Environment and Capacity Building

09:00 – 09:30	Water Resources Education	- Mr. Gopal
09:30 – 09:45	Participatory Irrigation Management in the AP Well project	- Dr. R. Ratnakar - Dr. J. Plakkoottam
09:45 – 10:00	Monitoring, assessment and legislation of groundwater resources in Andhra Pradesh- recent developments	- Dr. S.V.Govardhan Das
10:00 - 10:30	*Coffee/Tea break*	
10:30 – 11:00	Increasing water productivity in water scarce river basins	- Dr. C. Scott

WORKING SESSION III

(11:00 - 13:00)

Groups A, B and C (same as working session I)
They report to plenary between 14:00 and 14:30 hrs.

13:00 - 14:00 *Lunch break*

PLENARY WRAP-UP SESSION

(14:30 - 16:00)

Chair: Dr. K.V.G.K. Rao
Rapporteurs: Dr. T.V. Satyanarayana
Ir. P.W. Vehmeyer

16:00 - 16:30 *Coffee/Tea break*

CLOSING OF THE WORKSHOP

(16:30 - 17:30)

Appendix 3 Contents of the "Souvenir" Publication

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Appendix 4 Selected Keynotes

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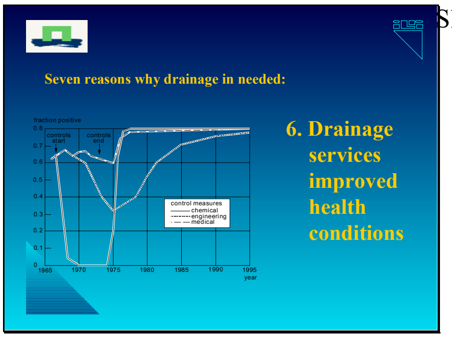

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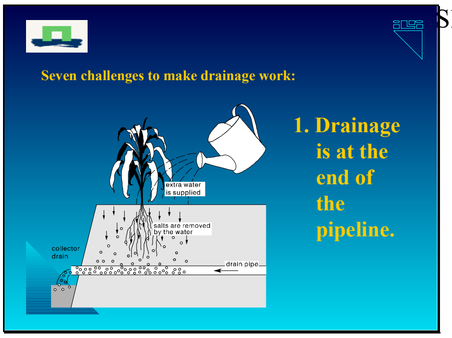

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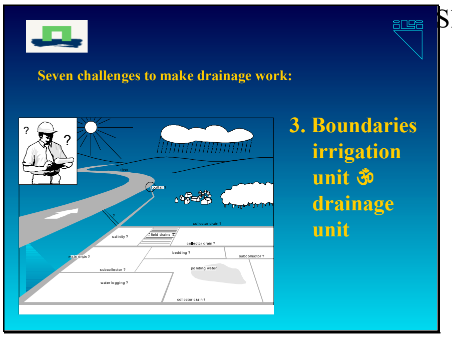

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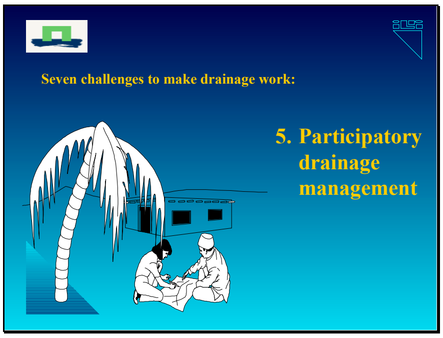

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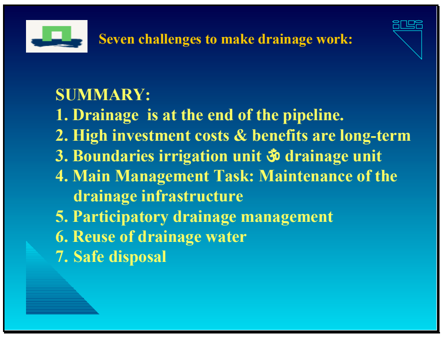

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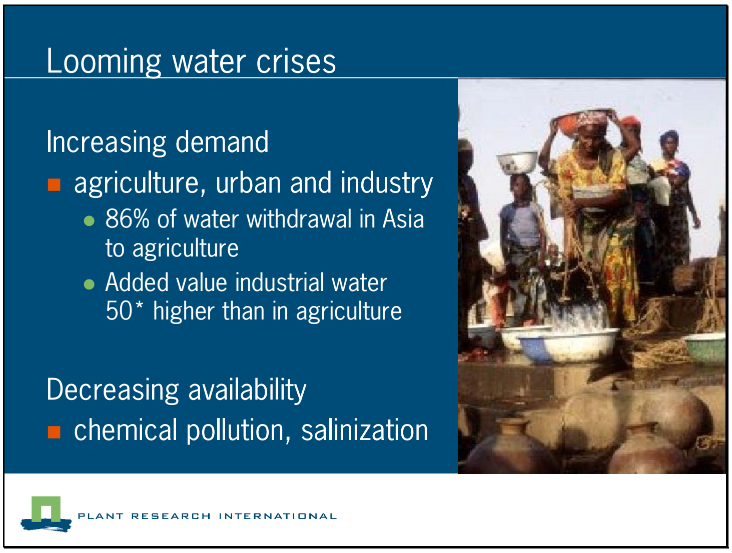

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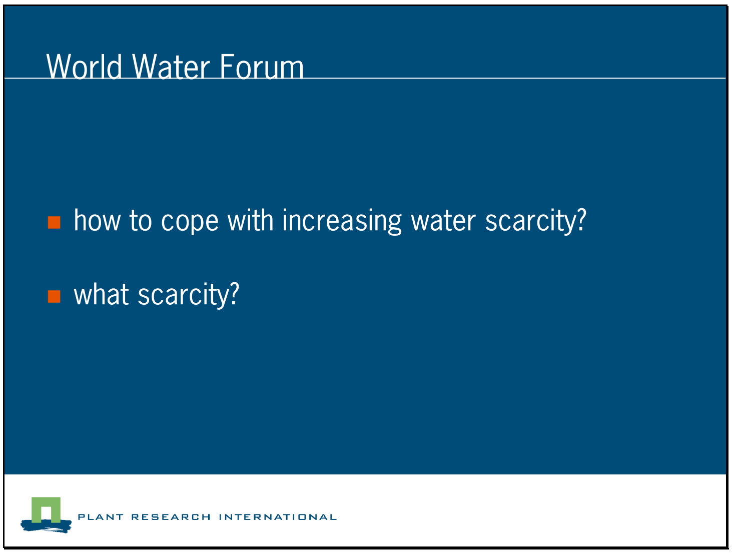

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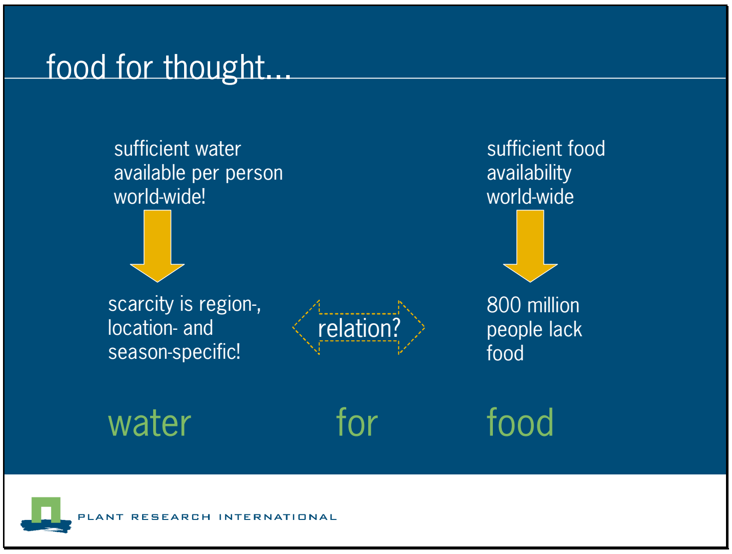

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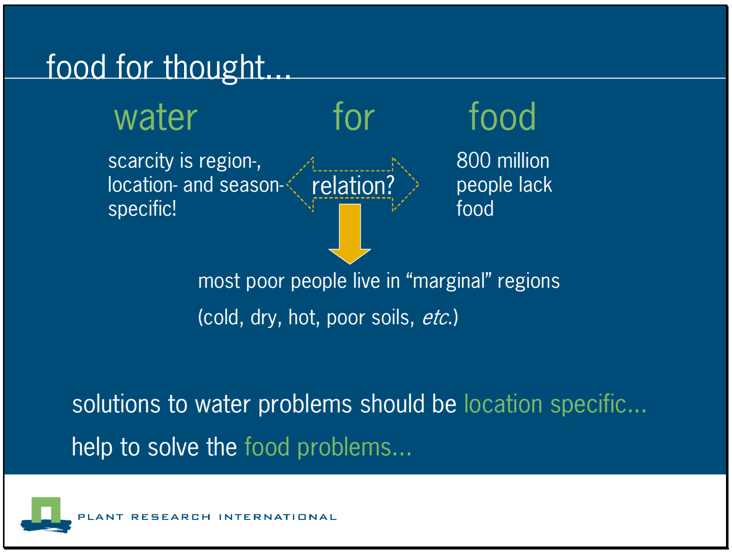

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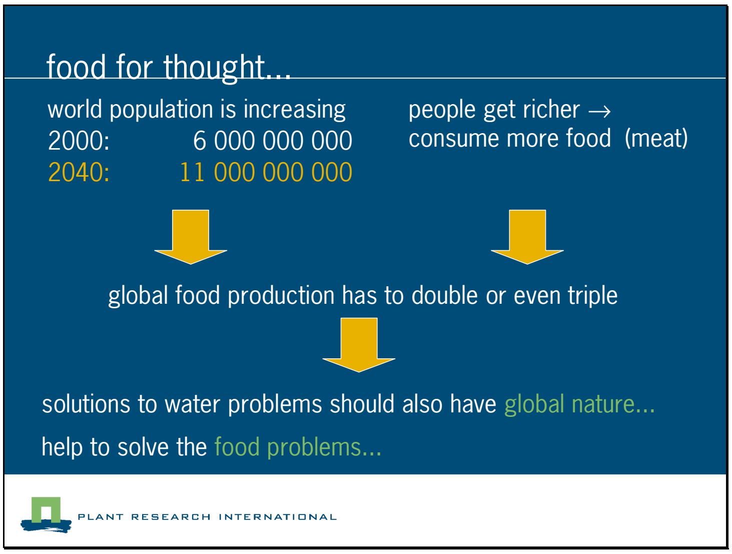

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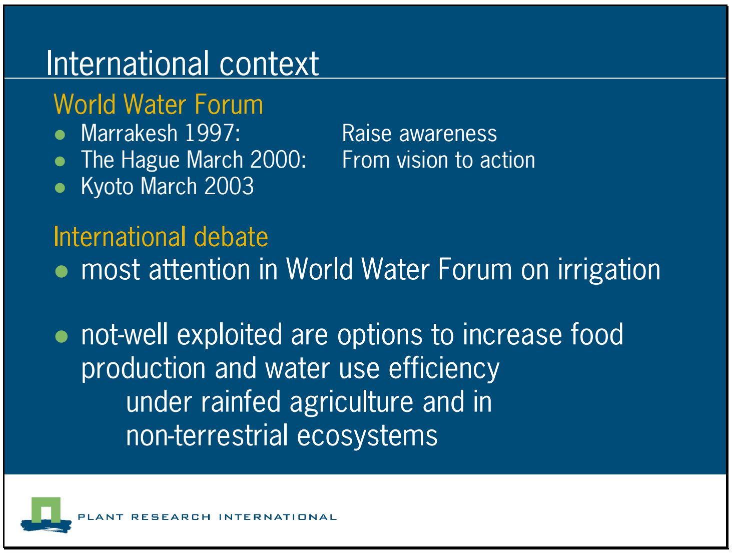

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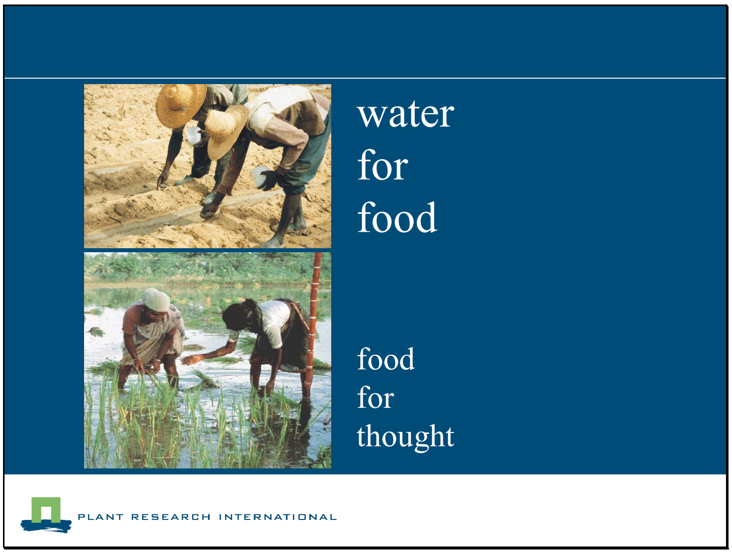

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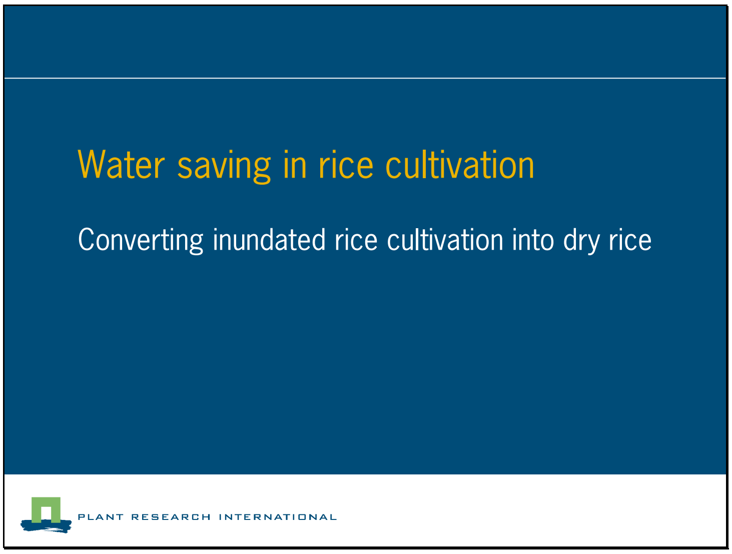

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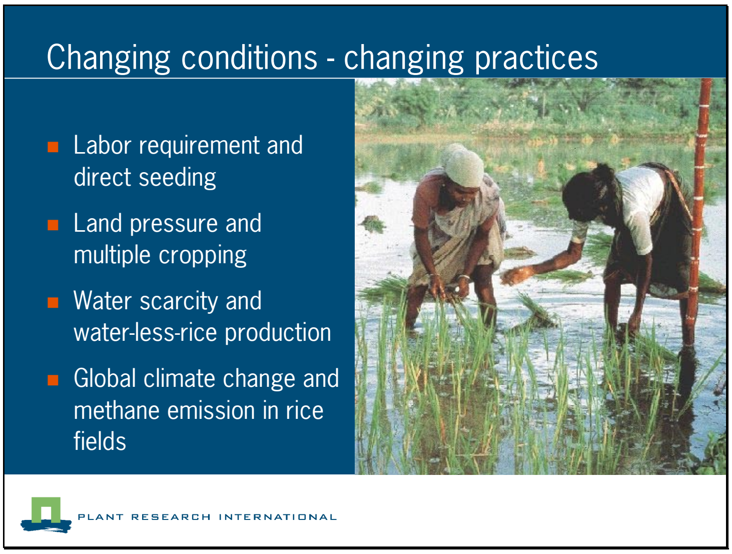

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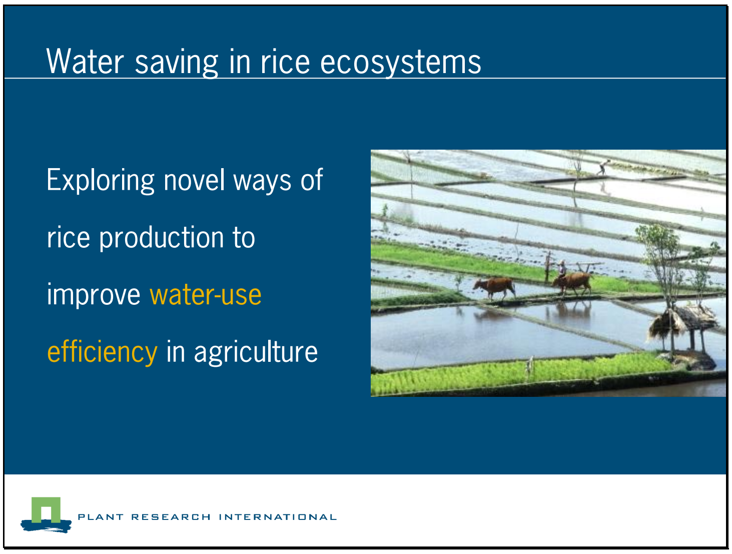

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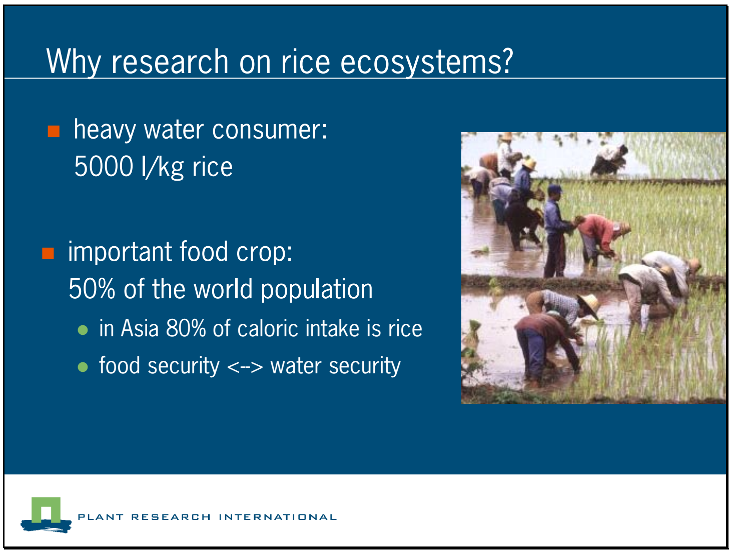


Slide 15

Labour requirement and direct seeding

(Collier, 1979; Shanthi et al., 1998)	Hours/ha
Field preparation	660
Planting seeds in seedbed	100
Transplanting	100-400
Weeding	300
Harvesting	300
Drying	100
Total	**1560**

- Labor requirement not changed with introduction HYV
- Increasing labor costs (declining real prices of rice and herbicides)
- No yield decline under direct seeding

(Shanthi et al., 1998)	grain yield (t/ha)		Straw yield (t/ha)	
	Kuruvai	Thaladi	Kuruvai	Thaladi
Transplanted	5.5	4.8	6.6	5.1
Sowing	5.5	4.9	6.7	5.3

PLANT RESEARCH INTERNATIONAL

Slide 16

Land pressure and multiple cropping

- Rice production should increase by 40% in coming 30 years
- Agricultural land area is declining (urbanization, degradation,..)
- Intensification land use (rotation: rice-wheat-(potato))
- Puddling affects yield non-rice crop unfavorably (rooting, bulk density)

(Bajpai and Tripathi (2000)	Rice yield (t/ha)		Wheat yield (t/ha)	
	1992	1993	1992/93	1993/94
Puddling	5880	5890	3075	4046
Non-puddling	5340	5420	3558	4600
LSD (0.05)	NS	NS	320	460

PLANT RESEARCH INTERNATIONAL

Slide 17

Water scarcity and water-less-rice production

- Rice yield decline proportionately with water use (De Datta, 1981)
- Trade-off between land and water (Bouman, 2001)

- 40% reduction in water reduces yield slightly, but with proper herbicides no loss (Bhadat et al., 2000)
- Promising results in SRI system ?

Slide 18

Global climate change and methane emission

- 15-20% greenhouse effect caused by methane emissions
- 20% from inundated rice fields

- Emissions depend on numerous factors ==> numerous opportunities to reduce emissions
- Emissions reduced by 50-75% by “dry” cultivation
- (Claim that cultivation under “dry” conditions is sink, rather than source)

Slide 19

Changing practices, changing cultivars

- Much success in increasing yield potential for inundated cultivation
- Little progress breeding “dry” conditions
- Claims that biotechnology is needed to adjust rice to “dry” cultivation
- Enough physiological insight on yield formation under transplanting and dry conditions? (sink vs. source)

PLANT RESEARCH INTERNATIONAL

Slide 20

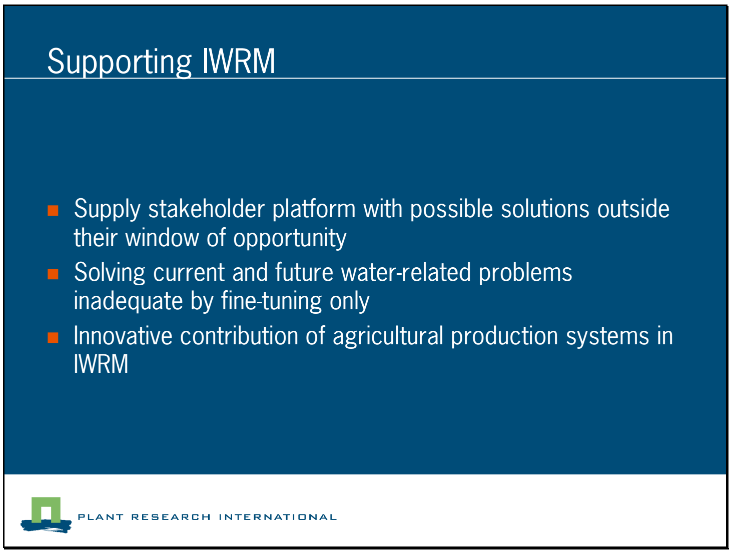
Project aims

- Design of water-use efficient rice systems at the field level
- Assess opportunities and consequences of such systems for farms
- Asses the implications for regional hydrology and food production
- Strengthening international rice networks

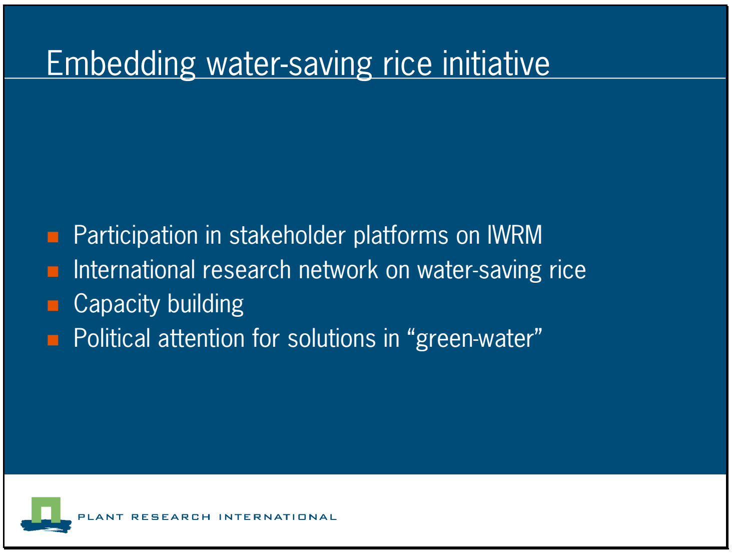
PLANT RESEARCH INTERNATIONAL

Slide 21

Slide 22



Slide 23


Embedding water-saving rice initiative
Participation in stakeholder platforms on IWRM
International research network on water-saving rice
Capacity building
Political attention for solutions in “green-water”
PLANT RESEARCH INTERNATIONAL

Conjunctive Management of Surface Water and Groundwater in the Middle Río Lerma Basin, Mexico

Christopher A. Scott
Carlos Garcés Restrepo

http://www.cgiar.org/iwmi

INSTITUTO INTERNACIONAL DEL MANEJO DEL AGUA
INTERNATIONAL WATER MANAGEMENT INSTITUTE

Conventional initiatives to rehabilitate or modernize surface irrigation may:

- reduce a third party's water supply, i.e., produce "dry water savings,"
- really increase volumes available for third parties, i.e., produce "wet water savings."

Integrated River Basin Management Conceptual Approach

- manage water rationally to provide for optimal [multiple] uses of water resources.
- in water-short basins, identify and control water "losses."
- water "saved" is available for other uses.

In typical river basins:

- surface and groundwater resources are coupled,
- "low efficiency", or "leaky" surface irrigation systems play an important aquifer recharge function.

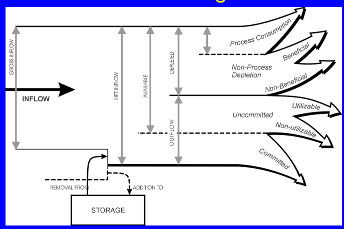
"Saving water" through more efficient use of irrigation water results in:

- increase in reservoir storage carryover for the next irrigation season,
- increase in the area irrigated under present cropping patterns,
- intensification of irrigation leading to higher water demand crops (higher value crops) planted on the present irrigated area.

Objectives of this paper, which reports on applied research:

- understand the coupled (conjunctive) nature of surface water and groundwater resources in a basin context,
- explore the implications of various management scenarios on groundwater trends

IWMI River Basin Accounting Framework



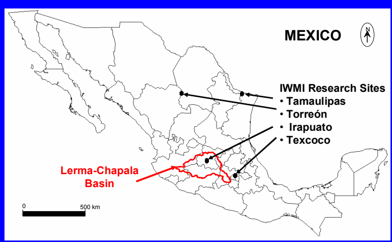
IWMI

Socio-Economic Processes

- rapid economic and social change
- 10 % of the population and 14 percent of the irrigated area in the country,
- dynamic agricultural sector and a rapidly growing industrial sector, which accounts for 35% of Mexico's industrial GNP,
- average annual per capita water availability 950 m³ and falling.

IWMI

IWMI-Mexico Research Projects



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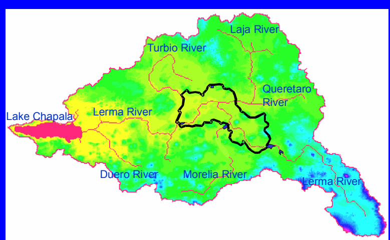
Lerma-Chapala IRBM

- 1989 five-state treaty on IRBM
- the first of Mexico's river basin councils has been established in the basin; it will likely be a model for others to follow,
- the council has passed binding regulations on upstream surface water withdrawals in order to control the rapid decline in surface water availability and quality in the lower basin,
- significant problems operationalizing IRBM.

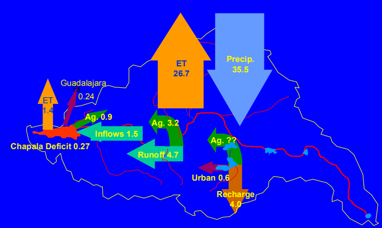
IWMI

Lerma-Chapala Basin

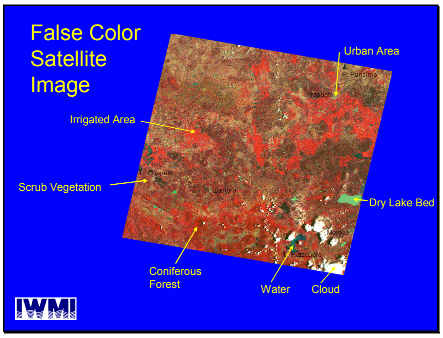


IWMI

Lerma Basin Annual Hydrologic Balance (10^9 m³ = km³)



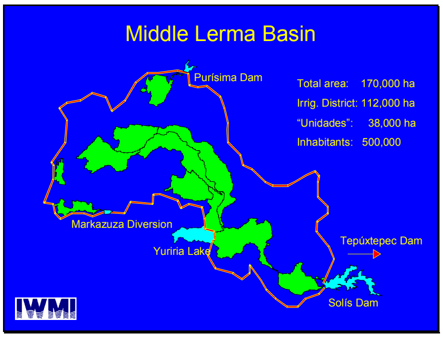
IWMI



Water Applied Significantly in Excess of Crop Demand as Indicated by Measured Relative Water Supplies

Water Source	Season	ARLID District	Cortazar Module	Salvatierra Module	Cortazar On-farm
Surface Irrig.	Winter 95-6	2.4	2.1	4.4	n.a.
	Summer 96	1.9	1.9	2.0	1.8
Private wells	Winter 95-6	2.1	2.1	2.1	n.a.
	Summer 96	2.2	2.2	2.3	1.8

IWMI



What happens to this excess water?

Can it be saved and reused in an IRBM approach?

IWMI

Previous IWMI Field Research in Lerma Basin focused on:

$$\text{Relative Water Supply} = \frac{\text{Total Water Supply (Irrig. + Precip.)}}{\text{Total Crop Demand}}$$

IWMI

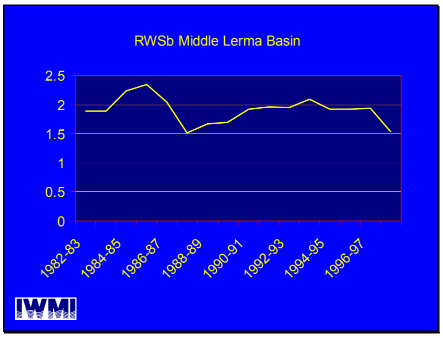
Basin definition of relative water supply

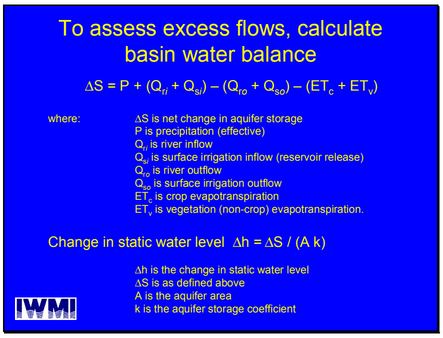
$$RWS_{basin}\ (RWS_b) = \frac{\text{Total surface water supply } (TWS_s)}{\text{Crop and natural vegetation ET}}$$

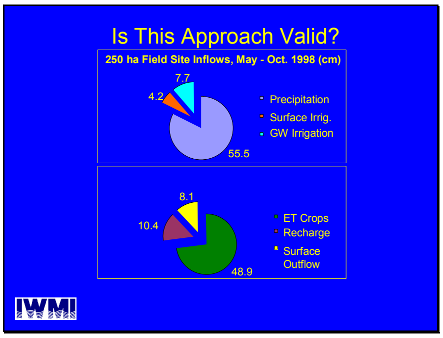
$$TWS_s = P + (Q_{ri} + Q_{si}) - (Q_{ro} + Q_{so})$$

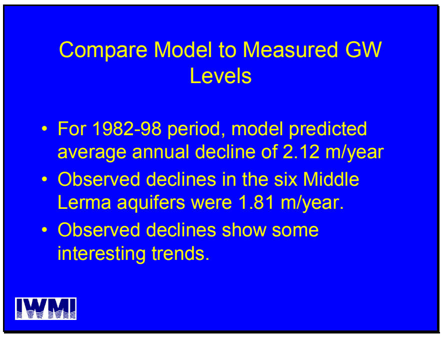
where: P is precipitation (effective, $0.8*P_{total}$)
Q_{ri} is river inflow
Q_{si} is surface irrigation inflow (reservoir release)
Q_{ro} is river outflow
Q_{so} is surface irrigation outflow (downstream release to irrigated area outside the system)

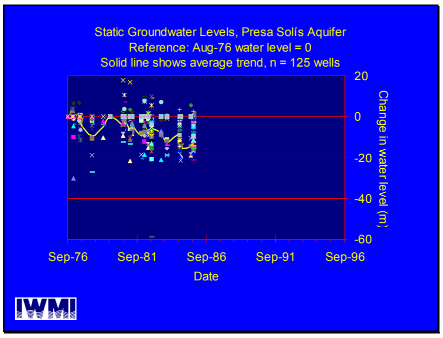
IWMI

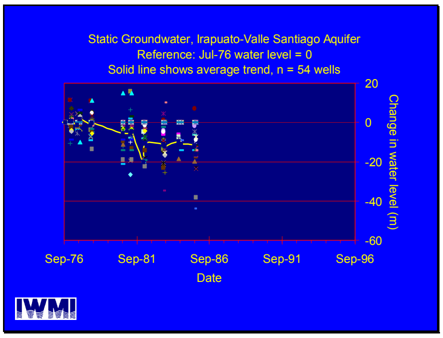

RWSb Middle Lerma Basin
2.5
2
1.5
1
0.5
0
1982-83
1984-85
1986-87
1988-89
1990-91
1992-93
1994-95
1996-97
IWMI

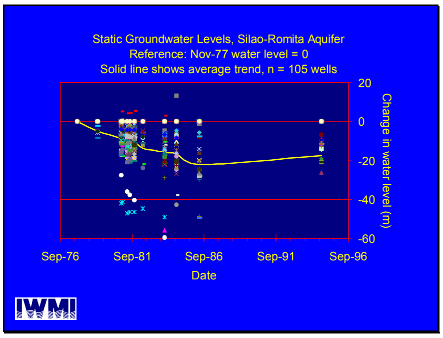

To assess excess flows, calculate basin water balance
$\Delta S = P + (Q_{ri} + Q_{si}) - (Q_{ro} + Q_{so}) - (ET_c + ET_v)$
where:
ΔS is net change in aquifer storage
P is precipitation (effective)
Q_{ri} is river inflow
Q_{si} is surface irrigation inflow (reservoir release)
Q_{ro} is river outflow
Q_{so} is surface irrigation outflow
ET_c is crop evapotranspiration
ET_v is vegetation (non-crop) evapotranspiration.
Change in static water level $\Delta h = \Delta S / (A k)$
Δh is the change in static water level
ΔS is as defined above
A is the aquifer area
k is the aquifer storage coefficient
IWMI

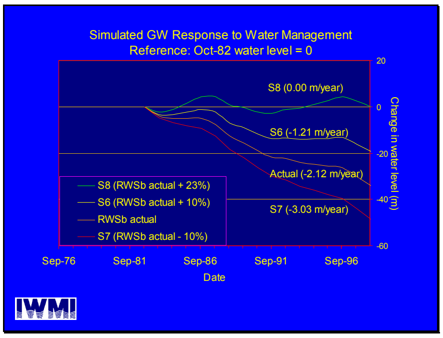

Is This Approach Valid?
250 ha Field Site Inflows, May - Oct. 1998 (cm)
7.7
4.2
55.5
Precipitation
Surface Irrig.
GW Irrigation
8.1
10.4
48.9
ET Crops
Recharge
Surface Outflow
IWMI


Compare Model to Measured GW Levels
• For 1982-98 period, model predicted average annual decline of 2.12 m/year
• Observed declines in the six Middle Lerma aquifers were 1.81 m/year.
• Observed declines show some interesting trends.
IWMI


Static Groundwater Levels, Presa Solis Aquifer
Reference: Aug-76 water level = 0
Solid line shows average trend, n = 125 wells
20
0
-20
-40
-60
Change in water level (m)
Sep-76
Sep-81
Sep-86
Sep-91
Sep-96
Date
IWMI


Static Groundwater, Irapuato-Valle Santiago Aquifer
Reference: Jul-76 water level = 0
Solid line shows average trend, n = 54 wells
20
0
-20
-40
-60
Change in water level (m)
Sep-76
Sep-81
Sep-86
Sep-91
Sep-96
Date
IWMI



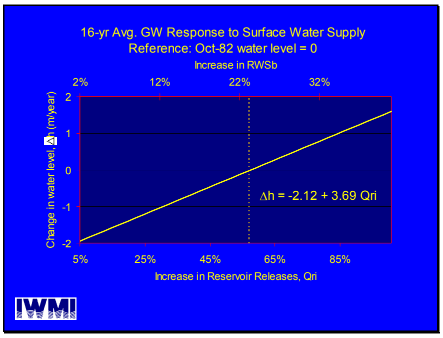


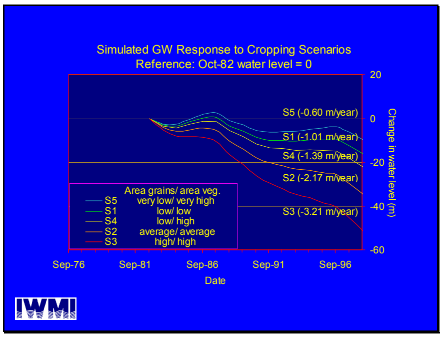
Simulate GW Response to Alternative Crop and Water Management Scenarios

	Scenario	Area under grains	Area under vegetables	Basin Surface RWS_b
Ag. out / migration	S1	low	low	actual
Status quo	S2	average	average	actual
Ag. expands	S3	high	high	actual
Taking place	S4	low	high	actual
NAFTA scenario	S5	very low	very high	actual
Lower efficiency	S6	actual	actual	actual + 10%
Modern./rehabilitation	S7	actual	actual	actual – 10%
Unfeasible	S8	actual	actual	actual + 23%

where: very low $= A - 2\sigma_A$
low $= A - \sigma_A$
average $= A$
high $= A + \sigma_A$
very high $= A + 2\sigma_A$

IWMI

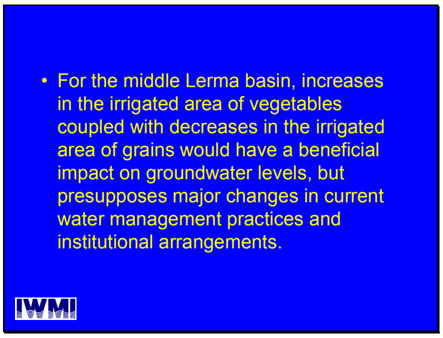


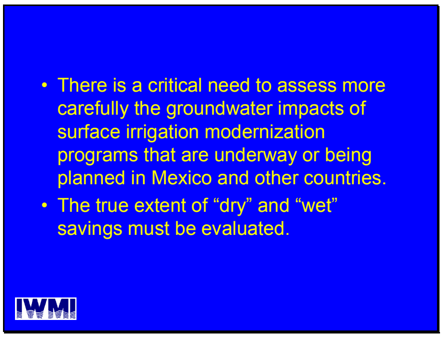


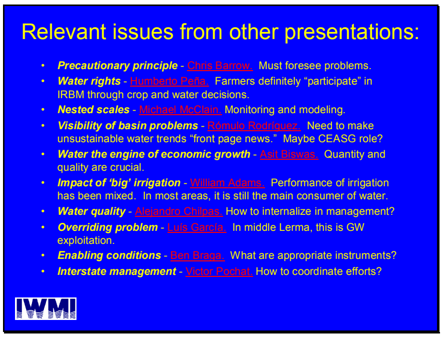
Conclusions

- The results are highly illustrative of the tradeoffs involved in conjunctive surface water – groundwater systems.
- Management of the middle Lerma basin has not produced sustainable groundwater trends.

IWMI


• For the middle Lerma basin, increases in the irrigated area of vegetables coupled with decreases in the irrigated area of grains would have a beneficial impact on groundwater levels, but presupposes major changes in current water management practices and institutional arrangements.
IWMI


• There is a critical need to assess more carefully the groundwater impacts of surface irrigation modernization programs that are underway or being planned in Mexico and other countries.
• The true extent of "dry" and "wet" savings must be evaluated.
IWMI


Relevant issues from other presentations:
• Precautionary principle - Chris Barrow. Must foresee problems.
• Water rights - Humberto Peña. Farmers definitely "participate" in IRBM through crop and water decisions.
• Nested scales - Michael McClain. Monitoring and modeling.
• Visibility of basin problems - Rómulo Rodríguez. Need to make unsustainable water trends "front page news." Maybe CEASG role?
• Water the engine of economic growth - Asit Biswas. Quantity and quality are crucial.
• Impact of 'big' irrigation - William Adams. Performance of irrigation has been mixed. In most areas, it is still the main consumer of water.
• Water quality - Alejandro Chilpas. How to internalize in management?
• Overriding problem - Luís García. In middle Lerma, this is GW exploitation.
• Enabling conditions - Ben Braga. What are appropriate instruments?
• Interstate management - Victor Pochat. How to coordinate efforts?
IWMI

Appendix 5 Group Session Reports

Working Group A – Session I

1. What is Agricultural Water Demand Management?

We have answered the question by defining the four key words:

Agricultural:	Crops: perennial and seasonal, horticultural crops as well as agricultural crops.
Water:	Source that makes the agriculture possible: rainfall, irrigation and groundwater
Demand:	- Crop (water requirements) - Farmer ('s capabilities to supply the water and to grow crops) - Environment (leaching salts, recharge to groundwater etc.) **Note**: these three elements have each a different time-scale
Management:	Balancing the demands with the resources or meeting the demands based on (limited) resources

2. How does it fit into the context of IWRM?

Agricultural Water Demand Management (AWDM) is part of IWRM and other sectors (Drinking water supply, industry, etc) also have to be considered.

3. How does it fit into the context of sustainability?

And how does it relate to the three aspects of sustainability (economic, ecological and social)? Sustainability of the resources.

N.B. The three aspects will be discussed in working session II.

4. How do water conservation and Agricultural Water Demand Management relate to each other?

They are positively related ➔ balancing the resources.

5. Where does drainage come in … or should we forget it?

In meeting the demands, not only the demands for the crop (maximum soil salinity level) but also the demands of the farmer and environment.

Thus we cannot forget it!!!

Working Group A – Session II

ENABLING ENVIRONMENT

- Legislation: groundwater (use, organization, participation), water quality (use, reuse & effluent)
- Water pricing, incentives and penalties
- Farmer's participation (from research, project formulation to O & M): watershed committees, water users associations, water conservation and/or utilization committees.
- Infrastructure facilities: engineering (land development, water systems, communication etc.), marketing and management

INSTITUTIONAL FRAMEWORK-

- Institutional set-up for capacity building

- Co-ordination between organizations should be institutionalized (including government departments, WUA's etc.)
- Reshaping/reforming of Government departments/organization to facilitate farmers participation and to promote AWDM
- Involvement of NGO's
- Transparency & accountability
- Audit & evaluation

MANAGEMENT INSTRUMENTS

- Knowledge transfer to farmers and organizations: social, technical, agricultural, financial, etc
- Institutional set-up for capacity building (including field demonstration)
- Research and development
- Education on AWDM from primary school level up.

Working Group A – Session III

Analysis of the present situation

Capacity building for Agricultural Water Demand Management & Gaps towards capacity building for Agricultural Water Demand Management:

- Training in AWDM is not institutionalized at all levels: colleges, planners, extension and farmers level.
- No on-the-job training
- Training more theoretical than practical
- Capacity building not demand driven.
- AWDM is not (yet) accepted as a interdisciplinary subject.
- No teaching aids & training facilities on ADMW available at all levels mentioned above.

The Role research and educational institutes should play in capacity building

- Research and education should be an interdisciplinary effort between Engineering, and Agricultural Institutes, i.e. combined programs and activities. To make the capacity building on AWDM demand driven Representatives of Farmers Organizations should be involved in the planning and evaluation.
- To make education on AWDM demand-driven, curriculums should be made flexible/optional.
- Research and education projects should assimilate into regular programs.
- Training in AWDM should be institutionalized at all levels (colleges, planners, extension and farmers level).
- On-the-job training should be institutionalized.
- Training should include practical-oriented activities.
- Teaching aids & training facilities on ADMW should be developed and made available at all levels mentioned above.
- Training facilities should be established at district level (WALAMTARI's ➔ DTU).
- Research on AWDM should be strengthened, and include the following subjects: basin level management, system distribution, operation & maintenance, implications of basin level actions, relationship groundwater- surface water, conjunctive use of rain-, canal- and groundwater, ecology & environment, soil & water conservation, drainage, water quality, community organization, communication skills.

Working Group B – Session I

What is agricultural water demand management?

Management of a finite available water resource regardless of its source to satisfy the water requirements of a crop or a diversified pattern of crops during a given period of time for maximizing the productivity per unit amount of water without any serious implications in terms of food security and irreparable damage to ecosystems.
It reflects the changes in basic production cycle. The levels direct and indirect water production through savings and improved efficiency of water use are important as they represent a permanent reduction in water demand.
This policy requires a complete package of elements including legislation, administrative sanctions, funds for R&D, demonstrations, and adoption of new technology.
The promotion of demand management concept is viewed not as short-term measure but must be examined for its long-term effect with a view to achieving sustainable irrigated agriculture for livelihood security.

How does it fit into the context of IWRM?

The AWDM forms an integral component of IWRM in the view of the following:

- Promotes sustained use of two of the most important natural resources – water and land – in order to maximize the benefits
- Maximizes the agricultural productivity and total production in a given region / command
- Maintains equity and equality
- Protects the ecosystem without compromising on sustainability

How does it fit into the context of sustainability? In addition, how does it relate to the three aspects of sustainability (economic, ecological and social)?

- Continued mismanagement of our limited & variable water resource is likely to endanger the food security, socio-economic development and cause irreparable damage to the resource base. The wastefulness in the use of limited water resource is coupled with disparities in the availability of basic water supply and sanitation services to the urban and rural poor. It is necessary to bear in mind that these are permanent assets of every nation, in fact of humanity at large. Nothing should be done, which would deprive future generations of any part of their means of livelihood and well-being. To ensure this it is important to undertake AWDM for achieving all time benefit (i.e. sustainability).
- Economic - sustained productivity leading to livelihood security, increased per capita income, credit worthiness, standard of living, better education etc.
- Ecological – reduction in salinity, alkalinity, waterlogging, sea water intrusion, etc.
- Social – improves social fabric, unites people & institutions, through activities like self-help groups, water users associations, cooperatives, federations, etc.

How does water conservation and AWDM relate to each other?

- Water conservation forms the first priority short-term strategy in the propesd plan of AWDM.
- As water becomes scarce, it becomes increasingly more important to conserve the available water supplies for improved water demand management. Water conservation & AWDM are two complimentary activities.
- There are several off-farm (improvements in water delivery, reduction in canal seepage by lining, metering, evaporation suppression) and on-farm (irrigation scheduling, pressurized

irrigation systems, reuse of irrigation drain water, conservation tillage, use of marginal & waste waters) activities.

Where does drainage (and reclamation) come in …or to forget it?

Irrigation, drainage and reclamation must be regarded as COMPLEMENTARY PROCESSES. For the best results a proper balance must be maintained between the first two in terms of right amount of soil moisture available to the crops in different crop growth sub-periods. Also to maintain fertility (potentiality of the system) year after year, injurious salts must not be allowed to accumulate in the root zone; in other words an appropriate distribution of salts in the soil profile must be maintained by the necessary reclamation measures. Lack of attention to these fundamentals have, in the past, led to serious catastrophes.
Irrigation science and technique of today must therefore be regarded as the science and technique of irrigation, drainage and reclamation, all three processes singly and collectively.

Working Group B – Session II

Chairman- Dr. V.Praveen Rao
Raporteur- Dr. P.S. Bindraban

The enabling environment

1. An authority (Irrigation, Agriculture, SAU, Groundwater, Environment etc) concerned with canal water distribution and efficient on-farm use of irrigation water together with economists and sociologists and progressive farmers be constituted in each region with the following objective:
   - To overcome the existing mismatch between crop water requirements and supply of water because of rigid canal schedules
- To workout the procedures to ensure uniform supply to head-end and tail-end farmers by making compensation in time for the reduced tail-end discharge
   - To suggest optimal allocation of water to competing crops especially in the event of water shortage
2. Lining of optimum lengths of minor water courses / distributories in selective sections of canals be taken up to conserve the water
3. At present a cadre of Field guideline service team i.e., Irrigation extension team concerning optimal irrigation scheduling and agronomic practices for increasing water use efficiency of crops is badly lacking. There is a strong need to create such a cadre who could interact with farmers / WUA /SHG / Watershed Committees and appraise them with latest expertise. The projected need for next two decades must be assessed and the existing educational facilities must be strengthened as well as new programmes may be established wherever needed to meet the demands of adequate man power for irrigation system

B. The institutional framework

1. It is well known that farmers are the primary actors in managing irrigation water and that general awareness, responsiveness and appreciation of benefits from participatory approach have perceivably increased over years. Hence transfer of irrigation management activity to WUA in respect of decision on cropping systems, planning and implementation of water release schedules, collection of water rates, maintenance to maximise benefits from water, organisation of other production

inputs and co-ordination of marketing of produce with guidance from expert authority

2. The existing law on water quality needs to be effectively implemented for prevention of pollution of surface and ground water. In terms of degree, ground water pollution is more serious and hazardous than surface water pollution and would require different institutions for prevention and abatement of pollution
3. Conjunctive use of surface and grounds water provides a greater control on timelines of irrigation and should be encouraged. Nevertheless, for sustained availability of ground water average annual withdrawals should not exceed average annual recharge. Ground water of marginal quality could be advantageously used in combination with good quality water or of alternate irrigation's
4. Water markets – Skyrocketing cost of development of water resources are making water resources project economically unsustainable. If market mechanism is allowed to play its role, the chances are that not only enough funds will be generated to develop the water resources, but also the quality of service and the use of water will become efficient. A case in point is that of promoting the ground water markets that have developed in states like Gujarat and Tamil Nadu
5. Linkage between the Ministry of Water Resources State Irrigation & Ground water Department, State Departments of Agriculture, State Agricultural Universities about the canal water management, reservoir sedimentation, conjunctive use planning, execution & management should be strengthened. Also Institutional linkages between Environmental, ground water, Research institutes be forged to identify the researchable issues arising from intensive use of agri-chemicals in production agriculture are needed
6. Institution of awards and other associated incentives for promoting efficient use of water
7. Roles and responsibilities of various agencies/ organisations involved in water resource development and utilisation be defined and appropriate infrastructure to promote proper linkages between them be developed
8. Water use policy for dryland/ rainfed agriculture areas

C. The management instruments

1. Information on ET requirements and water production functions of important crops in various agro-climatic regions should be generated through research studies. This is essential for optimal allocation of water among competing crops
2. Intensive awareness and demonstration programmes on modern techniques like drip and sprinkler tools be taken up to promote these tools particularly in crops like orchards, high value crops like vegetables, spices, medicinal & aromatic plants, sugarcane, cotton, groundnut etc., besides in water scarcity areas and areas where soil conditions do not permit efficient irrigation by existing methods.
3. Development of MIS on water use technology
4. Increased use of modern scientific procedures like remote sensing, simulation, optimisation and expert system technology using computers needs to be encouraged for assessing both supplies and demand management of water.

Working Group B – Session III

Present situation

1. Few institutions involved in HRD for AWDM
2. No clarity in water use policy for dist. Farming situations.
3. Low woman participation in irrigation water management decision making process
4. Lack operational water pricing structure?
5. Inadequate data base for Agricultural Water Demand Management.

Gaps

1. Training capacity building
2. Holistic approach (Lacking)
3. Week communication skills.
4. Insufficient information material
5. Insufficient irrigation Extension Services.
6. Clarity in role & responsibilities of participatory agencies/ departments.
7. Lack of co-ordination among participatory agencies.

Role of Institutions

1. Education on demand management at primary level.
2. Generation of resource base and management data for efficient use of water.
3. Development of human resource in water demand management
4. Incentives for agencies involved in AWDM
5. Transfer of Technology
6. Certificate courses on specialised aspects of AWDM
   - Water balance
   - Irrigation system management
   - Micro irrigation
   - Water quality
   - Water conservation
   - ----------- etc.
7. Establishment of WTC

Working Group C – Session I

Agricultural Water Demand Management

India is not a water scarce country at the aggregate level. However, problems pertaining to water supply are region and use specific. There are imbalances exist in its supply and demand. Therefore, bridging the gap between supply and demand for water in agricultural sector is agricultural water demand management.

The major issues pertaining to AWDM problem are

- Cultivation of heavy duty crops (Because limited resources of water are monopolised by few wet cultivators.)
- Unequal distribution of water
- How to motivate the user to adopt the low water requirement crop
- Regulation of water use either directly or indirectly
- Operationalising of existing technologies, knowledge, research output, recommendations
- On farm demonstrations with minimum support
- Controlling percolation losses in wet land areas using green manure crops

How does it fit into the context of IWRM

The demand for water in agriculture is to be viewed in the broader context of IWRM. It cannot be viewed in isolation as the uses and supply of water is Tran boundary in nature.

- Share for AWDM has to be computed in the context of competing demands which is IWRM
- Since water is a common resource, whole community has a right to use it. IWRM recognises the right of entire community including the less from the total available water resources.

- If it is not viewed in the context of IWRM, several problem areas of extraction and end up with depletion and pollution problems. This leads to imbalances between different users and allocations.

Sustainability issues related to water

Sustainability issues are related to resources, technologies and institutions and their relationships in a dynamic manner.

- Sustainability issues are dynamic in nature, it has implications to ecology spreading to economic system and social system in meeting the needs and aspirations of growing population.
- Though water is a renewable natural resource, it is also exhaustible resource beyond certain limits of regeneration. As it is important input in agriculture, its supply and distribution has serious consequences on economy and society. As a consequence of problems of availability and sharing, water is priced accordingly in the market.
- Since, water is an integral part of economy, the society has the responsibility in its development, equitable sharing for welfare of the society. As it is a common property resource, the rights are not properly defined. As a consequence, its exploitation is inevitable by a few in the society. Participatory approaches are paying dividends which need to be encouraged.

Water conservation and AWDM relate to each other

- Water conservation typically enhances the supply and reinforces the existing wet cultivation.
- Water conservation and regulation should go hand in hand
- In the context of both surface water and ground water

Drainage comes in or should we forget it

- It is essential

Recommendations

- Identify the constraints in technology / recommendations being absorbed, adopted and operationalised
- Motivate the water users for adopting the dry cultivation by attractive options
- Prepare the IWR accounting (Status report) in AP through wide stake holder participation
- Evolve draft for AP water policy
- Explore strategies for direct and water regulation

Working Group C – Session II

1. **Enabling Environment:**

Irrigation Act 1997 (AFMIS)

- Equal distribution of water
- Creation of WUA

Future improvement is needed in enforcing the legislation

- Creation of Awareness on policy regulation technology and Water rights (viable Mechanism).
- No formal legislation on Ground Water use and its quality

- Encourage the farmer for cultivating low water requirement crop by providing post harvest technology to increase the value of the produce & assured marketing. Support price for other crops

2. Institutional Frame Work:

- Present Frame work of WUA is functioning well.
- Irrigation, Agriculture and revenue departments should be linked to WUA.
- Capacity building is necessary for the above change.
- Accountability?

3. Management Instruments

- Water Resource Database should be made available to all state jholders.
- Institutional mechanism has to be evolved.
- Environmental consequences and interactions (social, technical & operational).
- Transparency
  Exposures
  Pricing policy
- Role of present institutional set up – Not Adequately exposed for this capacity building

Working Group C – Session III

Q1. Give an analysis of the present situation in the capacity building for Agricultural Water Demand Management

WM: Management the present supply should have priority.

Q2. Identify the Gaps

i. The Knowledge of water balance at different levels
ii. The capacity to manage efficiently at Government level.
iii. Capacity building at local level

Q3. Identify the role of the research and educational institutes

i. Research should be field oriented (farmers problems)
ii. Change in curriculum (Appropriate)