

Managing water equitably, efficiently and sustainably for agricultural and rural development in sub-Saharan Africa and the Caribbean

Synthesis Report on the CTA Seminar

Cordoba, Spain, 20–25 September 1999



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Technical Centre for Agricultural and Rural Cooperation

The Technical Centre for Agricultural and Rural Cooperation (CTA) was established in 1983 under the Lomé Convention between the African, Caribbean and Pacific (CTA) States and the European Union Member States.

CTA's tasks are to develop and provide services that improve access to information for agricultural and rural development, and to strengthen the capacity of ACP countries to produce, acquire, exchange and utilize information in these areas. CTA's programmes are organized around three principal themes: strengthening facilities at ACP information centres, promoting contact and exchange of experience among CTA's partners, and providing information on demand.

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Table of Contents

Foreword	5
The Problem	7
Topical questions on the development of irrigation throughout the world	7
The problem-oriented approach to irrigation in the ACP countries	9
Seminar objectives	9
Seminar Methodology	11
Main Conferences	15
The Spanish Example	15
The orientation of the European Union	17
Decentralisation, institutional reforms, farmers' strategies	18
Gender relations and land tenure policies for irrigated lands	19
Water, social resources scarcity, and risks of conflicts within countries: the turning of a screw	20
Water availability, environment and social issues	22
Exchanging Experiences	24
Institutional and legislative issues	24
Social issues	25
Economic and financial issues	25
Environment and quality of life issues	27
Information, education and communication	27
Technology	28
Small-scale irrigation	28
The Three Andalusian Field Visits	30
General Recommendations	32
Conclusion	34



Foreword

In many parts of the world, the availability of water – perhaps the world’s most precious resource – is being threatened. Both its quantity and quality are at stake. Irrigated agriculture is often the number one consumer and vies with other uses, like water for the urban areas, industry or livestock production. Large scale irrigation often leads to social problems, such as relocation of communities, increased inequality, technological dependency, and to environmental degradation such as pollution, parasitic diseases, soil salinisation, water logging, etc. Improved water management policy must take account of farmers’ priorities; this in turn requires policies reflecting appropriate tariffs, technologies, organisational approaches and land tenure. The preparation of a new “social contract for water”, with due regard for equity and permanency, will require active participation by all the stakeholders, namely, the vulnerable groups (women, livestock producers, fishermen, various minority groups), as well as farmers, policy-makers and financial investors.

These themes were studied at the seminar on “managing water equitably, efficiently and sustainably for agricultural and rural development in sub-Saharan Africa and the Caribbean”, organised by CTA and the National Federation of Irrigators of Spain in Cordoba from 20 to 25 September 1999.

This report was written for CTA by **Thierry Ruf**, and is based on presentations, working group reports and plenary sessions. As a result of the tremendous work done by the participants throughout the meeting, I hope that this report will prove a useful contribution to agricultural and rural development services in the ACP countries.

Dr R D Cooke

CTA Director



The Problem

a) Topical questions on the development of irrigation throughout the world.

The title of the seminar, *managing water equitably, efficiently and sustainably for agricultural and rural development in Sub-Saharan Africa and the Caribbean*, indicates the scope of the issues being studied, namely:

1. the place of irrigated agriculture in the world economy and the ACP countries;
2. the various facets of its development, in terms of growth, environment and society;
3. the considerable changes in management models for irrigated schemes.

Irrigated agriculture is practiced on lands that have been transformed as a result of specific water resource development. Estimates indicate that worldwide irrigated agriculture is practiced on some 235 million hectares, in other words 16% of the world's croplands. These lands produce 40% of our food production and thus constitute one of the keys to future food security. They can sustain a population density of over 2000 inhab/km², well above that of undeveloped neighbouring lands. In very general terms, these regions are located in intertropical and Mediterranean regions with rainfall levels of between 200 and 1500 mm per annum. These are regions where seasonal water shortages make rainfed agriculture very risky and infrastructure has been developed as a result of unusual ancient and contemporary historical conditions. The dynamics of these regions stem from cultivated, highly artificialised ecosystems that are organised as links with different and diversified usages. Yet, in most regions of the world, and especially in the ACP countries, the development of irrigated agriculture leads to crises either because of stagnation or failures, or, on the contrary, because of ill-controlled expansion and the consequences for the Society as a whole.

In other words, and as the data integration plan shows, in a context marked by uncertainties, the main problem now is the medium- and long-term viability of these lands.

Let us look at four components sketched in Figure 1.

1. Can irrigated agriculture become productive enough to cope with the food security challenge looming on the horizon of the year 2020? This question involves both failures in the development of irrigation (extensive agriculture, low yields) and very intensive agriculture where leeway for innovations is very limited. In any case, it is better to think in terms of combined of agricultural activities.

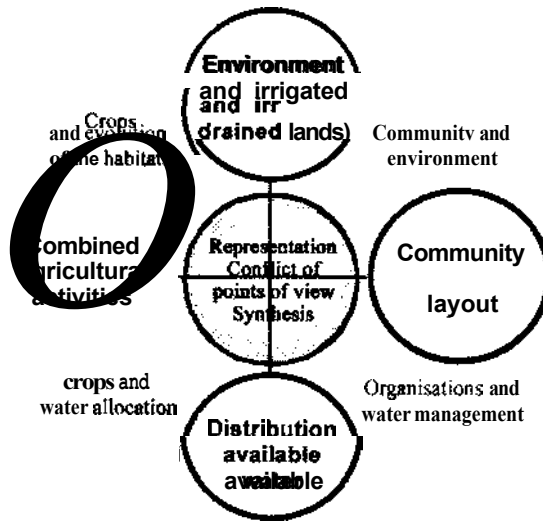


Figure 1. The integration of knowledge is necessary for the sustainable management of irrigated systems (Thierry Ruf, 1998)

2. The relations of rural societies with developed lands will change as a result of institutional changes and the globalisation of agricultural economics and the agro-food sector. What do intervention models look like and what behaviour patterns are emerging? How is access to natural resources defined and how are these resources managed (land, water, plants and animals, the organisation of labour)? What are the role and position of the most vulnerable social groups?

3. The relative scarcity of water (at least good quality water) creates tensions. What happens when one goes from relative abundance to a shortage of water? How do the parties involved adapt to relative shortages at the local level? How can we move from offer-based water management to demand-based resource distribution?

4. The environment surrounding irrigated and drained lands develops along contradictory lines. In some places it supports the emergence of new agricultural activities, in other places it narrows possible activity because of phenomena such as salinisation, water logging, water pollution or incidences that seriously harm human health. How can effects stemming from changes in cultivated areas be contained? How can people be drawn to preventive and precautionary policies rather than to emergency and rehabilitation policies?

It is not easy to find answers to these troves of questions often asked in rural communities, public services and service companies, non-governmental organisations, universities and research centres and by landscape planners and funders. Everyone seems

to agree that the administered and centralised management model for irrigated schemes needs to be changed; the next question is, what models will the future hold for sustainable management of irrigation? By bringing together representatives of the various ACP countries, the Cordoba seminar sought first and foremost to have people involved in irrigation work, in one of the many ways listed above, share their experiences.

b) The problem-oriented approach to irrigation in the ACP countries

In Africa on the whole, irrigation was a mode colonial powers used in their very authoritarian methods of land management. After independence, this heritage weighed heavily, and most irrigation development projects required large investments for limited results, in terms of land areas cultivated and economic benefits. Irrigation is going through a crisis, but this crisis maybe reflects a transformation period or a transition to new African water management models.

The participants' responses to the questionnaire they received when registering confirms that many countries have to cope with universally shared uncertainties. Problems mentioned most often included:

- social equity, the position of women;
- environmental degradation;
- land tenure reforms;
- water policies;
- the fact that transferring management responsibility for land areas demarcated by central authorities to the more local level amounted to nothing more than transferring burdens;
- problems of reconstruction after wars in certain countries and rehabilitation more generally;
- the applicability of certain concepts put forth by international organisations, e.g. water markets, quotas.

c) Seminar objectives

Remember the contents of the invitation to participate in the seminar:

Giving attention to the farmers' objectives and strategies is essential in water management improvement since such improvement presupposes changes in water policies, technologies, traditional access rights to water and lands, and various systems (land tenure, organisational, economic and billing). Better participation by all stakeholders will improve life styles thanks to a new "social contract on water" that involves the most vulnerable groups, (women, livestock producers, fishermen, various minorities, landless tenants, etc.), and farmers as

well as policy-makers and financial investors in the twofold aim of equity and sustainability.

Four specific objectives were proposed to the participants so that they could efficiently organise the way they wanted to share their experiences because, need I recall, there are very few universal, well established models for sustainable management of irrigated schemes.

The first objective is, for each situation, to identify all the stakeholders, *i.e.* public and private players, political players and associations that are, in one way or another, involved in mobilising, allocating and sharing water resources. This, obviously, means trying to understand the powers of the various parties in a given place and historical context.

The second objective is to work out the changes in roles, responsibilities and practices of the various stakeholders, in particular how they are effected **by** changing economic and institutional environments.

The third objective is to identify the main constraints that prevent the various players from developing equitable, efficient, sustainable water management.

The fourth objective is to draw up specific action plans for the various groups of stakeholders, in particular in the field of information and communication, since it is often at this level that opinions need to be matched in order to formulate new common rules.



Seminar Methodology

During the same period as the Cordoba seminar, the Development Directorate of the European Commission is publishing a reference book called “Towards Sustainable Water Resources Management” that sets out the guidelines for development-oriented cooperation for water resources (DG VIII-EU, 1998).

This book is available at DG VIII in English, French and Portuguese. It is a practical book based on guidelines for managing the large number of very varied activities related to water resources in a sustainable, integrated, methodological manner. The six main groups of principles adopted in this book were used as the basis for experience-sharing among seminar participants.

Institutional and managerial principles

Social principles

Economic and financial principles

Environmental principles

Information, education and communication principles

Technological principles.

The seminar methodology was to propose a series of questions from each category, for discussion in working groups composed of 15 or so persons from different professional environments and countries. For reasons of efficiency, since there were so many questions and the aim of the seminars, *inter alia*, was to have French- and English-speakers join together, some working groups examined the institutional, economic and information issues while others focused on the social, environmental and technological domains. The guiding questions were prepared by the international steering committee and by **Jean-Louis Couture**, the seminar coordinator. The questions, in adapted form, are listed in **Box no. 1**. After discussion, the groups gave the coordinator their conclusions for inclusion in the summary report on each principle.

To round out the group work, resource people, who were expected to further explain the various themes, made presentations at the plenary session. This was followed by short discussion the highlights of which are presented further on.

Jean-Louis Couture first of all presented the seminar’s main questions, then gave an analysis of the questionnaires that the participants had filled in during registration. He

gave a multifacet image of the various countries of Africa, the Caribbean and the Indian Ocean and, at the same time, an idea of the participants' expectations.

SEMINAR METHODOLOGY: GUIDING QUESTIONS

Institutional and management principles refers to now well accepted assertions in a pressure-ridden world concerning the upstream and the downstream parts of the water systems, for the major international hydrographic basins, but also at the local basins scale and for the intra-basin irrigation systems. What is the stakeholders' institutional framework? What mandates do stakeholders have? What capacities do they have to carry out their roles? How far can they go in transferring responsibility to water users associations? Who settles conflicts on usage? What is the connection between the administrative bodies that operate at the basin scale and the lower water management forums?

The social principles are based essentially on the concept of equity, accommodation of vulnerable social groups that may be deprived of access to water or irrigated lands and, more generally, from participating in making decisions that affect them directly or indirectly. Have the new water utilisation programmes given enough attention to traditional rights and customs? Women are generally very much involved in developing irrigated agriculture; do they have recognised access to resources and are they represented in water management institutions? How do vulnerable groups get access to water?

The economic and financial principles are based, on the one hand, on the concept of scarce resources and optimal allocation and, on the other, on the problem of capital needed for water harnessing and distribution as well as the often difficult job of resource renewal. What steps can lead from the logic used when water is proposed by a government agency to the logic that seeks water savings through quota management, consumption-based billing and water markets? What do we know about how the water users will accept the various ways of paying for services received? What security or guarantees are there for the economic stakeholders? What will be the role of financial incentives and subsidies?

The environmental principles refer to at least four types of effects on irrigation development vs. natural environment and the local living conditions. The first incidence concerns the possible imbalance between available and extracted water resources. The second concerns direct changes in the physical, chemical and biological characteristics of farmed environments or wetlands downstream of the irrigation installations. The third concerns the upstream to downstream drop in water quality. The fourth is the development of vector-borne diseases which affect the population as a whole. Has attention been given to the environmental constraints? What indicators are available? Can a substantial part of the water resources be set aside for sustaining special ecosystems? Can water systems be managed to minimise risk to public health?

The information, education and communications principles certainly stand out as the weakest elements in sustainable water management. One obstacle is the complexity of the problems. Further, stakeholders often do not share the same outlook; they do not get the same information, nor have the capacity to understand the logic behind other people's actions. What are the main shortcomings? How is information produced and retrieved? What sort of training is needed? What general strategies should be established for the stakeholders as a whole, and individually?

Technological principles which often are in the limelight, were listed sixth in the EC guidelines. The brief, of course, is to make technological choices that respect the five preceding domains. The central issue is the ownership of techniques; are they relevant considering available resources, individual and collective funding capacities, access to credit, proper training, innovation processes, etc.? The question of flexibility is important in the debate because technical infrastructure can sometimes hinder possibilities to change production systems and the development of alternatives to the standard model.

Dr. **Alan Hall** gave a formal presentation of the EC guidelines. Prof. **Paul Mathieu** analysed decentralisation, institutional reforms and farmers' strategies in the ACP countries and showed to what extent the State and the stakeholders as a whole could become detached from the local level where different legitimate interests lock horns. Mrs. **Rhoda Kweka** explained the importance of a gender approach in agricultural water management.

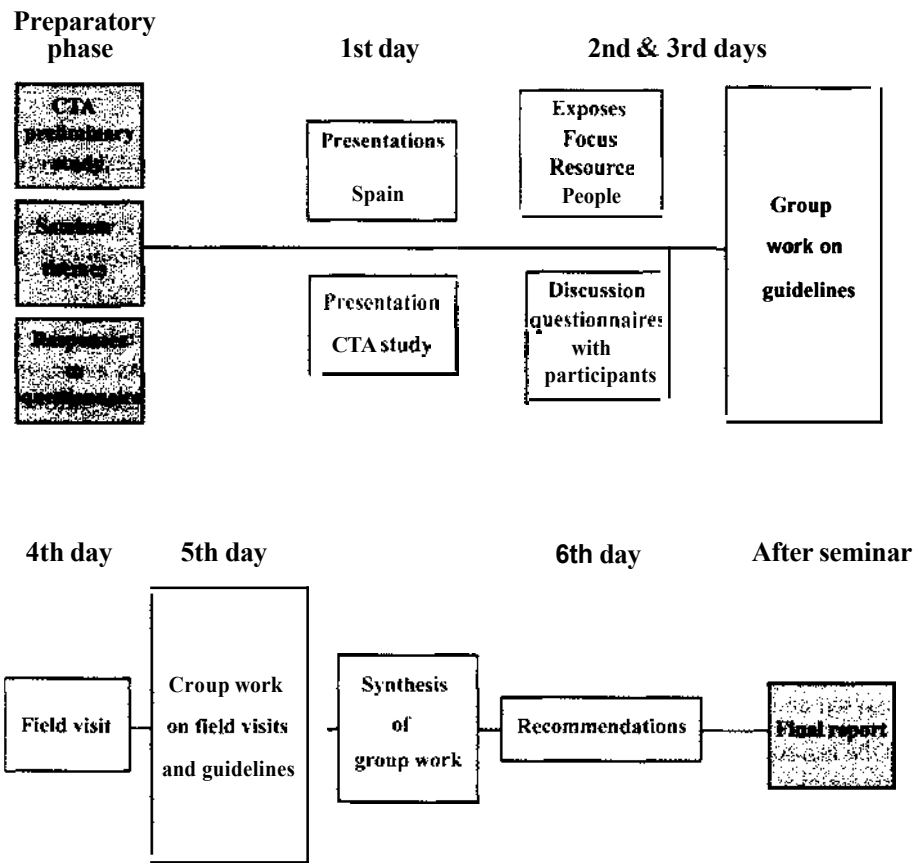
In his paper entitled "The Tuning of a Screw", Dr. **Leif Ohlsson**, showed that water, because of its scarcity, contributed to the rise of social conflict within countries and water systems. Dr **Yemi Katerere**, painted a general picture of the environmental aspects of agricultural water management while Dr. **Mohammed Reeza** presented the overall situation in the Caribbean.

Since the seminar was organised with support from the National Federation of Irrigators Communities of Spain, presided over by **Andrés del Campo**, an agronomy engineer, and since Cordoba is emblematic of the Arabo-Andalusian water cultures, the participants drew heavily on the Spanish experience in water management. To begin with, Andrés del Campo and **Juan Manuel Valero de Palma** described the history, characteristics and management objectives of the irrigation community of Spain. **Jose Maria Alcaide** completed the picture by describing the modernisation of water systems in Andalusia.

Halfway through the seminar, the participants went to the field to learn about the main principles used in the public management of major basins such as Guadalquivir, and community self-management of the farmers' irrigated schemes. Each working group analysed and described the most striking characteristics of three systems.

At the last session, the participants discussed a final motion on orienting future action programmes in ACP countries. They then left to visit the Holy Cathedral, (formerly a mosque) and the city of Cordoba for the last time, lingering in an atmosphere so propitious for thought, cultural exchange and tolerance.

Seminar Schedule





Main Conferences

1. **The Spanish Example** by Andrés del Campo, Juan Manuel Valero de Palma and Jose Maria Alcaide
2. **The European Union's Guidelines** by Alan Hall
3. **Decentralisation, institutional reforms and farmers' strategies** by Paul Mathieu
4. **Gender relations and irrigated land policies** by Mrs. Rhoda Kweka
5. **Water, scarcity of social resources, and risks of conflicts within countries – the turning of a screw** by Leif Ohlsson
6. **Water availability, the environment and social issues related to irrigation** by Yemi Katerere

The Spanish Example

Andrés del Campo, President of the National Federation of Irrigators Communities of Spain opened the seminar by placing emphasis on the exchange of experiences and the importance of irrigation – which has existed for over a thousand years – in rural development in Spain. Although he spoke of irrigation as a heritage received from earlier generations for transmission to future generation, he recognised that irrigators of today have better technical preparation and are constantly seeking to make their distribution systems more efficient.

Andrés del Campo stressed the immeasurable historical value of the Spanish irrigators communities. Coordination is most effective when it brings together farmers who have shared interests. Historically, the communities acquired their legal status and water management responsibilities according to customary law based on pre-Roman principles that later incorporated rules inherited from the Romans and then the Arabs. Water, collectively owned, is distributed via the community which creates local arbitration institutions for its users. The most famous example is the Valencia water court, which has been examining users' conflicts every Thursday morning for the last 1000 years. The

legal framework for water was modernised in the 19th c., and then again in 1985. Full respect was maintained for the old customs and communities although the State and later on the basin confederation, were able to propose a water infrastructures schemes at the national, regional, and then basin levels.

Nowadays, a community may receive water concessions, but water rights are connected to the land. The law forbids selling land without its attendant water rights. The irrigators "junta" has legal status, and functions as a public entity; it operates exclusively through an assembly composed on *comuneros* who have both rights and duties. They have the right to use the water resources, vote, receive information, and assume responsibilities. These legal rights predicate on the discharge of duties such as paying their share of the facility's running expenses.

Gravity-flow irrigation canals and pressure-flow systems are managed direct through three basic bodies: (1) the General Assembly, (the supreme body) which establishes the norms, (2) a Board of Governors (*junta de gobierno*) to carry out executive functions, (3) an Irrigation Jury (*jurado de riego*) to settle disputes among community members. The Irrigation Jury is unique to the Spanish system for joint water management and can be traced to the system's history. At the more regional level, water management of catchment basins is indirect since it is handled through hydrographic confederations composed of representatives of the State, the provincial authorities and the user communities. The water council and the management junta make and implement a hydrological plan for the basin. Applying these general principles of independence for irrigation communities at the community level and active cooperation between water users at the basin level has enabled irrigation in Spain to grow from one million hectares at the beginning of the 20th c., to a smart 3.4 million hectares now.

Juan Manuel Valero de Palma, Secretary General of the National Federation of Irrigation Communities of Spain, explained that each irrigated hectare received an average 7000 m³ of water per year: 59% of the area is irrigated by gravity, 24% by spraying, and 17% through localised irrigation. Surface waters irrigate 68% of the lands, 28% of the water comes from the phreatic zone (which, since 1986, has also been recognised as common property), and the remaining 4% is mixed. In any case, wherever an irrigation community exists and has defined its area of work, people living within the area have to belong to the community if they want access to irrigation waters. This self-administration model, based on norms and direct participation, inspired the Latin America system and avoids having the water administration meddle in the numerous petty conflicts that arise day in day out concerning the distribution of water.

Then Jose Maria Alcaide, speaking on behalf of the Andalusia Ministry of Agriculture and Fisheries, showed that supply – regulated through a global basin management system in Andalusia – could not meet agricultural demand and that it could not be increased without causing serious harm to the environment. And for socio-political reasons, large water transfers from the north of Spain to the arid south will not be

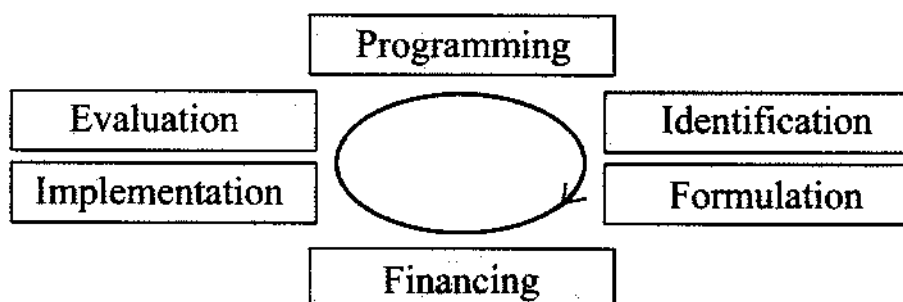
possible in either the short- or medium term. This means that demand will have to be better managed, and that an irrigation modernisation programme will be needed that replaces the traditional gravity system by a pressure-flow system which combines flow restrictors with consumption-based individual billing.

In the discussion, the Spanish attendees explained that the State granted a direct 50% subsidy for the irrigation communities' investments in water distribution and the communities contributed half of the major water regulation system investments for the hydrographic basin. The question of **who** would benefit from the water to be saved thanks to the modernisation process, was not clearly answered. In principle, water rights are attached to the land and, thus, cannot be sold to a third party. The water market cannot be opened unless a new law is adopted.

The orientations of the European Union

Alan Hall presented "Towards Sustainable Water Resources Management: the EC guidelines" prepared by the EC and the General Directorate for Development. The main aim is to improve the EU cooperation policy by formalising new concepts and harmonising approaches among member states and the international community.

Numerous international conferences have pointed to the major crisis looming ahead in the next decades either because of water scarcity or because of pollution-instigated degradation, and claim that water policies are fragmented and not very effective. The Dublin principle is well known: fresh water is a finite, vulnerable resource that is essential to life, development and environment. Everyone talks about integrated water management at all levels, from extraction to control to services, using a holistic approach based on coordination and integration. Water, thus, is a limited resource that is closely connected to socio-economic development. There is a certain analogy with the organisation of the computer world, but here the *hardware* would be the infrastructures, while the *software* would be the participating management, institutions, legislation, and the capacity to formulate and construct management systems, and, in between would be the *operating system* that serves to formulate the strategy plan for water policies.



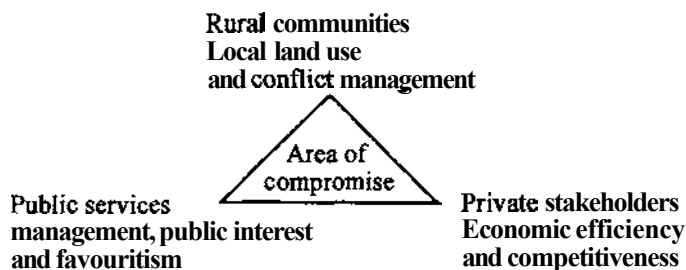
The guiding principles that were presented to the seminar were used to orient the working groups and have to be borne in mind in project management. The EC book can be used from the macro to the micro level, and make it possible to apply the guiding principles to all the steps in water management by using a problem-oriented approach and listing the key problems encountered in preparing responses.

Alan Hall ended his talk with the following recommendations. Irrigation systems do not need to be built everywhere, especially not where rainfed farming still has room for improvement. Attention must be given to the need for more efficient water use. It is important to develop institutional models on demand-driven management, promote stakeholder participation and be appealing to the private sector. The ensuing discussion brought out certain contradictions; some participants pointed out that their countries did not have adequate infrastructure or that State disengagement gave the feeling that the funding agencies were pulling out. One participant asked what relations the State, the farmers and the management services should have since the State's problems are very different from the farmers'.

Decentralisation, institutional reforms, farmers' strategies

Paul Mathieu, an economist at the *Institut d'Étude du Développement* at the *Université de Louvain*, first explained the changes in orientations that characterised water policies in the 1980s. The first tendency, over-investment in infrastructure and strong State involvement in governing development, was replaced by an emphatic tendency that favoured "everything for the users' associations", including nearly all the responsibilities. Ten years later, there is a new trend emerging through the concepts of "holistic", "global" and "integrated" strategy, combined with decentralisation (which goes beyond the question of irrigation) and privatisation (which relies more or less exclusively on tools specific to the users' water market).

At the local level, there are several factors that contribute to the viability of an irrigated plot. There are financial parameters: who will pay for the installations and maintenance? What is the ratio of between operating costs for the plot and agricultural income, or collective charges and individualised charges? There are also social parameters: conflict or cooperation, degree of social capital (rules and knowledge of the local Society). Last, the institutional parameters make it possible to organise coordination with a certain stability, clearly recognising that the stakes are high for the local players and that many decisions are compromises between various authorities.



There are various forms of decentralisation, *e.g.* simple decentralised relocation of State services, or decentralisation toward to local political entities which in any case are always interested in the financial benefits of irrigation. Or decentralisation may mean privatisation or devolution of rights giving local authorities, that are not accountable to either the State or the market, a strong say in organisational matters.

Paul Mathieu then gave a detailed presentation of the various groups of public, private and community stakeholders. The State is a complex body composed of central and local services that provide leadership for diverse economic, fiscal and administrative functions. The private sector is composed of operators directly concerned with irrigation, and other functions such as supply, processing and marketing. The community sector is composed primarily of traditional organisations, local traditional political authorities, and specialised organisations – officially defined as irrigators' unions – and decentralised local communities. All these groups interact or interfere with each other: when a user of the irrigation system does not fulfil his obligations, what happens among the various stakeholders and institutions? A set of mechanisms are activated that bear on services rendered, material or financial transfers, decisions and arbitrations, and markets that are more or less transparent.

Does this mean that everything should be examined inside out? No Society is perfect. The general interest is certainly to minimise opportunistic behaviour and maximise coordination so that irrigation may reflect equitable and efficient water access. What makes the search for solutions difficult is that stakeholders may claim to stand up for official objectives, as recorded in the technical specifications, and at the same time have non-official objectives that form a sort of hidden agenda. At last, in the game of interaction, the players must have real responsibilities to the grassroots level, and be held accountable. In conclusion Paul Mathieu said that whatever be the case, building up a viable institution takes a lot of time.

The discussion bore on the state of dire poverty that can hold back the local community's capacity to build up solid organisations and design management systems that are equitable, efficient and sustainable. To limit State disengagement, thoughts turned to the size of the small and large plots. At last, some States may be too weak to promote rational decentralisation.

Gender relations and land tenure policies for irrigated lands

Mrs. Rhoda Kweka, Irrigation Section of the Tanzanian Ministry of Agriculture, spoke to the nearly all-male seminar on the need for a gender approach in agricultural water management. Just look at the sex ratio among the participants. She explained the situation in Tanzania where 100,000 families live off of irrigated lands. Since 1991, Tanzania has had a water resources management policy based on the following four key principles: delivery of adequate shares of water resources, maximisation of benefits for all of Society, broadening stakeholder participation, and giving stakeholders the wherewithal to have their voice heard concerning various aspects of water management. But there is

no approach for women and smallholders in irrigated agriculture. Irrigation projects have perpetuated the old social control system wherein the clan leaders have authority over the land, which, moreover, is only bequeathed to male descendents. Since women are deemed incompetent, their only access to land is via their husband. Access to water is also difficult for women; in some cases, they are even denied rights to irrigation waters, as well as to other resources such as training and credit.

Irrigation projects stagnated because of the timid involvement of the poorest farmers and the women (who had to cope with the traditional authorities), as well as because of lack of education at the community level, lack of participation of various stakeholders in the decision-making process and lack of recognition of indigenous practices and knowledge by professionals and other key players.

The Tanzanian water policy is changing now, with backing from the World Bank and the River Basin Management and Smallholder Irrigation Improvement Project which includes classical objectives such as capacity-building at the national level, respect for the environment, the transfer of irrigation systems to the users, whose rights are recognised, but, on the other hand, who, in order to cover operating costs, are billed for the water they use. Furthermore, women are involved in the project. Each woman receives her own income-generating plot of land, which is separate from the male-run family lands.

An evaluation of a specific project can be used to measure the early effectiveness of this policy. Positive effects: water user associations have been established and include both men and women, men agree to have women “water masters” (to allocate water), single and married women now have access to the land and, in general, higher incomes. Negative effects: women have more chores, the land for food crops has been reduced as more cash crops are grown, the rise in the price of irrigated lands may make women’s access more difficult in the future.

Mrs. Kweka hoped that the present trend would continue and stressed that time would be needed to reach a consensus, and to develop institutions in which African women would be recognised as key players in decision-making on both water supply and use.

Water, social resources scarcity, and risks of conflicts within countries: the turning of a screw

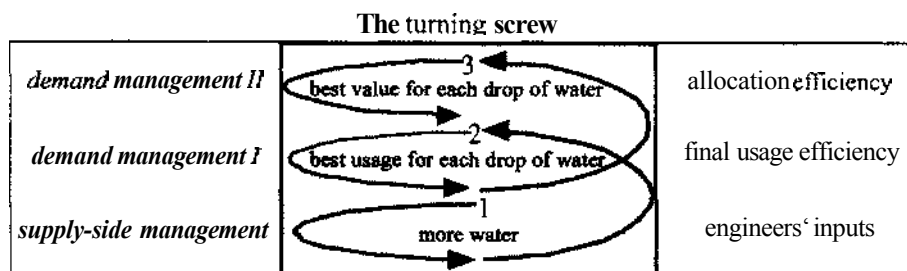
Leif Ohlsson, a sociologist at the Dept. of Social Sciences at Obrero University in Sweden gave a general theoretical overview of a research project now undenvay. The question of water scarcity takes us back to the history of societies which used different means to cope with the problem. There are various perceptions and ways to tell the story. The traditional tale identifies the problem of rivers that run dry, “hydrocide”. Then attention turns to changes that may occur at the international level to face the risk of “water wars” and environmental disasters. But there is a new story in which major risks of conflict are intranational, rather than international and require institutional changes needed to cope with water scarcity.

At the first level of adaptation, societies attempt supply-side management. Social resources employed at this stage consist mainly of large-scale engineering efforts. This is a simplified version of the heroic era of engineers who built big dams and pipelines.

At the second level, when supply-side management can no longer provide sufficient water because of larger populations and water requirements, societies turn to demand-management, with the primary criterion being end-use efficiency (“get more out of every drop”). The social resources that are used include institutional change, and new regulations and economic incentives to increase the price of water.

At the third level, societies are obliged to change objectives by replacing food self-sufficiency by food security, which is to be achieved by developing a capacity to produce the new economic resources needed to import staples and, hence, virtual water, the water that would have been needed to grow the food crops within the country. The social resources required focus on the opportunity to find work in cities and industry rather than in agriculture.

These three steps fit together like a turning screw: at each turn, different challenges appear.



Leif Ohlsson

At the first level, increased supply has countries and user groups within the countries vying against each other. The upstream sectors usually blackmail the downstream sectors. But at the international level, empirical evidence shows that the risk of conflict seems to lead to cooperation between countries (although tensions may continue) rather than “water wars”. At the local and regional levels, within the country, water scarcity may be caused by growing populations, or else the supply may be insufficient because rivers have dried up or groundwater tables have been depleted. Or it may be a structural deficit because in certain societies, the more powerful sectors confiscate a major part of the water to the detriment of the increasingly marginalised sectors.

At the second turning of the screw, water scarcity becomes relative, and predicates on the efficacy of new rules and economic incentives to consume less water. But institutional change is a very cumbersome, difficult process because of the well anchored interests of some segments of Society that have become very powerful, even

“unevictable”. Potential conflicts bring out the weaknesses of the State that wants to impose new rules, and the coalition of a small number of big water users who used to receive subsidies.

The third turning of the screw is dominated by the search to get maximum value out of each and every drop of water through industrial and urban uses where it is worth 20 to 70 times more than in agriculture. The social challenge is that agricultural expansion no longer ranks as an option, and the main question becomes livelihood; water apportionment, as a source of conflict, is replaced by issues connected to the integration of a growing part of the population in the modern sector, which leads to a societal divide.

Water availability, environment and social issues

Yemi Katerere, of the IUCN Regional Office for Southern Africa also focused on the situation created by competition for water resources, which cannot be treated as a problem to be solved merely by seeking new sources. The role of irrigation in food security at the worldwide level is obvious: over one-third of the world's harvest comes from **16%** of the world's croplands. Irrigation infrastructures are becoming increasingly expensive, and prices are highest in Africa where only 2 to 5% of the croplands are irrigated. Yet, estimates show that the 3–5 million hectares under irrigation are far from the 17 million hectares that potentially could be used for irrigated farming.

Irrigated agriculture in developing countries in general will be contributing more to overall food production and therefore will have greater water requirements. Other sectors are challenging its position as the main water user. Measures will be needed to help countries faced with demand that exceeds the potential supply of clean fresh water, but there seems to be some contradiction between objectives directed towards the need for more food, the search to solve the problem of water scarcity, and environmental problems connected to irrigation. In Africa, food production increases during the last 40 years did not follow the path of the Asian and Latin American green revolution. Growth has been through increased rainfed cropping, not through intensification. Productivity gains per hectare and per cubic meter of water have been slight. Yet irrigation is an important component of economic policies. It emphasises the development of markets, it serves as a reference for measuring productivity margins per farming system, and, it provides an overall idea of where agricultural development stands as a integral part of the country's economic development.

Each country, thus, has to make choices concerning the future of irrigation. The various situations can be classified according to two criteria: social welfare and environmental conservation. Assuming population figures stay level, a country that bases its strategy on rainfed cropping without any irrigation at all will maintain a certain environmental integrity but will have to cope with the vagaries of climate and economic uncertainties stemming from erratic water supplies. If there is an irrigation system, but it is poorly managed, groups of people will have to be resettled, lands and

waters will be degraded, the socio-economic situation will remain critical and, further, the effects on the environment will be disastrous. If there is an irrigated system that is managed neither well nor poorly, the economic success will not prevent environmental degradation and losses. The last case is that of the country that ensures social well-being and a protected ecosystem; this requires good governance.

Throughout the world for the last 20 years, social and environmental impact studies on irrigation have led to increasingly severe criticism, despite its contribution to food security. Examples include changes to the natural environment, the introduction of harmful species, a trend towards monocropping, forced relocation of populations. Actually there are two levels of impact: first, direct impact on crop productivity within the irrigated system, *e.g.* degradation of quantity and quality of irrigation waters, soil salinisation, and, second, indirect impact on agricultural productivity which affects the environment beyond the local irrigation system, *e.g.* loss of biodiversity, degradation of river waters, development of vector-borne diseases.

Yemi Katerere put forth some recommendations to overcome the above-mentioned problems. The first was to include irrigation policies in a wider national vision of development so as to include possible progress in rainfed agriculture. The second was to recognise that there are various categories of farmers who use irrigation, and that the treatment of private agricultural entrepreneurs – who are well integrated into the market – should be different from that of farmer communities eking out a mere subsistence or little concerned with market rates. The latter should continue receiving State support. The third recommendation concerned economic and social incentives for improving water use, *e.g.* transferring responsibility for management and billing decisions. Last, appropriate legislation and regulations are needed to improve administrative measures and water management/control. The discussion clearly pointed to the shortage of the tangible examples needed to understand all facets of the problems. It is important to learn about real, precise experiences that include viable irrigation systems in Africa and elsewhere throughout the world.



Exchanging Experiences

Synthesis of working groups conclusions

1. Institutional and legislative issues
2. Social issues
3. Economic and financial issues
4. Environment and quality of life
5. Information, education and communication
6. Technology
7. Small-scale irrigation

1. Institutional and legislative issues

Water management involves a large number of players whose approaches differ according to the magnitude of the questions that need to be answered. But regardless of territorial scale, insufficient coordination is a constant. At the international level, the functions of certain organisations are limited to issues and information-sharing. No mention is made of basin agencies or authorities that have an established role in the harmonisation and coherence of hydrographic basin management. At the national level, the various ministerial services in charge of water resources, the funding agencies, the specialised state irrigation agencies and various political representations (when there are any) seem to be competing with each other in a complex institutional game that has as many players as (unclear) rules. At the irrigated perimeter level, coordination is also a Chinese puzzle involving decentralised State services, political authorities, farmers' organisations, governmental organisations, the private sector, the farmers themselves, suppliers, processing services and marketing agents. Even the countries where the institutional structure seems to be clear suffer from ill defined roles and inadequate application of rules. Water laws need revision, and the water authorities need to be restructured with their missions well spelt out.

This implies capacity building for players at all levels, first at the national level to ensure information-sharing and to organise the far-reaching consultations on rules and regulations needed to revise the law, and, at the local level, to strengthen institutions and build up skills.

Transferring management to the local users' institutions requires land tenure guarantees and, thereupon, a real shift of responsibility for the pipelines and equipment to the users **who** must be able to handle the system, in particular from the economic angle. Transferring management must not be limited to a shift of responsibility for collecting fees. It is a process that should impart new professional skills to both the users associations and to the State agents whose role is supportive but needs to be redefined.

2. Social issues

The social organisation of access to resources in ACP countries is marked by great diversity. Social relations are interwoven references, codes and laws that come from the local or national political history: customs and mores, Moslem regulations, colonial codes, legislation of independent countries. In certain countries like Ethiopia, Tanzania and Madagascar, local customary law that has a long tradition in water resource appropriation still has strong powers over the irrigators' social organisation. But in most other countries, the State has designed the irrigation network and, for two or three decades, imposed social relations based on acceptance of the State model. At present, State disengagement – generally decided at the highest echelons for economic reasons – brings up the question of how to organise social relations around land and water and, more globally, the question of management models based on user associations. The model is applied in a wide range of situations; it is relatively well adapted for managing village perimeters but is less well understood when used in larger areas. The very fact that the land tenure guarantee policy is mentioned, without clearly describing the guarantee, prolongs or revives conflict over land, accompanied by a new type of exclusion that especially affects the most vulnerable social groups.

This is not women's day! In the traditional irrigation systems, the woman is considered as part of the family unit and must respect the type of property rights and decision-making habits of the head of the family, **who** is usually a man. Plans for State irrigation systems ignore women, although certain countries have irrigation system rehabilitation programmes that provide strong support for women's organisations.

ACP countries on the whole are marked by a project engineering culture that up to now has not given attention to national or local culture nor to the history of societies.

3. Economic and financial issues

Moving from a supply-based logic to a demand-based logic is only relevant if due attention is given to context and geographical area. For ACP countries as a whole, there

is a clear distinction between places that have too little water and places that have too much. How hydraulic systems work in general, with transfers to the groundwatertables, drainage, and reutilisation of water must not be forgotten. One participant put forth the idea that after a more or less difficult start-up period, various countries would reach a stage of maturity in their hydraulic development activities. But other participants seemed less optimistic, and pointed to the depletive extraction of certain non-renewable resources and the increased conflict over who owns available lands and waters.

At the hydraulic basin level, supply and demand should be regulated by an agency which proposes – and monitors – a programme based on demand expressed by irrigation system and other users. This would depend on four conditions: the users must be represented in the agency, minimum guarantees must be provided for available resources, the agency and the various water user organisations must be bound by a contract, and a reliable, accessible information system must be available.

At the irrigated system level, the management mechanisms that the farmers adopt must target demand-based regulation as expressed by the farmers. The rules must be applicable, in other words, be coherent with the system's upstream water supply capacity. They should serve as norms for drawing up contracts that include both rights and obligations for the contracting parties, *i.e.* the users and their management organisations (user and other associations). The users' financial contribution should be matched against their agricultural income, charges and products. Technologies for water mobilisation, distribution and use should be well adapted and fit in with local socio-economic conditions, including the information and measuring systems.

Farmers are willing to pay for water, but what does this entail? The cost of supplies? The economic value of water? External costs? The bureaucratic structure that is still around? Should the production conditions be included? Should rates be different for different types of holdings or be related to their place or success on the market? Should the fee systems, which are often seen as a land tax, be maintained? Should bills be drawn up on the basis of water consumed? Remember that this leads to the thorny questions of reliability of measuring techniques, overpricing because of measurement costs and disagreements about measurements. Should water prices be clearly broken down into costs for maintaining the system, (pro rata operating costs), costs for regulating the hydrographic basin and for environmental conservation? Finding a financial equilibrium in a local irrigation system requires rigorous discussion among the stakeholders who have to analyse the various scenarios. Account also has to be taken of the users' non-monetary participation, *e.g.* individual or collective work.

The question of renewing capital for hydraulic installations shows that amortisation is a very difficult concept, often misunderstood and considered suspicious because of its importance in times of strong economic and monetary uncertainty or even, vis-à-vis risks of embezzlement and corruption. The use of credit schemes seems more appropriate if public subsidy is aimed at an incentives system, because no state will completely eliminate its subsidies and financial incentives policy for broader objectives, *i.e.* that outstretch irrigation systems *per se*, such as the development and settlement of certain areas or support for a food self-sufficiency policy. Subsidies are needed, but

they should be connected to contracts that stipulate objectives relating to water resources organisation and savings, environmental protection and financial management. Last, subsidies granted to stakeholders should be transparent and open. In more general terms, the accounts for collectively managed water resources should be clear for all stakeholders, be they public, private or community players.

The question of guaranteed establishment on irrigated perimeters depends on the context. In State-built systems on State lands, the farmer exclusion process has given the farmers a feeling of insecurity. Although the States partly withdrew, the risk of exclusion did not disappear with it since the local associations that took over apply the same rules – maybe they are unable to draw up any others! The status of the farmers differs greatly. Some have mere usufruct, others rent or own the land. In any case, they need a certain security; they want to have official guarantees for their contracts, conditions of use, transmission of rights and representation on the local irrigators associations. Recognition of ownership deeds based on land surveys would be desirable but is probably connected to certain social obligations and environmental provisions. Real estate transactions should be market-driven, although there are two difficulties: a trend towards excessive accumulation of land and, on the contrary, the emergence of excessive subdivision of land (*minijindism*).

4. Environment and quality of life issues

Since Africa is far from reaching its potential in irrigated agriculture, the general feeling seems to be that water resources are still abundant and that when water is in short supply, the problem is probably a shortage of equipment to capture water that is difficult to exploit. In certain cases, the power play between basin-sharing States restricts upstream possession of an abundant resource, e.g. the Nile. This said, there is reason to believe that absolute or relative scarcity of water will be a problem that Africa will have to face by the year 2025.

Hydroagricultural installations are accused of a long and relatively well known list of ills: land degradation, deforestation, erosion, water logging, development of undesirable plant species, various sorts of pollution, transformation of wet environments, (in particular coastal regions and estuaries), diseases that afflict a considerable part of the population. Making a list is one thing; timely evaluation of these phenomena is another, and preparing and applying adequate responses is a third. What can the resistance be of an environment that has been subjected to so many shocks at the same time? Proposals can be made to allocate water for environmental purposes, as was done in the rehabilitation scheme for a lacustral environment in Waza Logone, Cameroon.

5. Information, education and communication

As was clearly brought out in the preceding conferences and workshops, information at the hydrographic basin and irrigation systems level is notoriously inadequate; there is

a shortage of everything needed to introduce a strategy, carry out routine management or evaluate what is being done. National administrations all collect certain data but their objectives are different, and the data lack continuity, and often...reliability. Even if data are collected, the problem of processing remains, and, at the end of the day, data distribution is limited. In sum, there are enormous unfulfilled needs, *e.g.* renovation of information systems, establishment of inter-service coordination. Further, access to information gives rise to questions of legal rights and possibly also to economic and financial questions.

Alongside information deficits lies the all-important problem of insufficient training for stakeholders which, in turn, affects demand for reliable, judicious information on basin management systems and irrigation systems. Emphasis is quite naturally placed on the farmers' four specific needs, irrigation methods, the need to share information on the state of water resources (which concerns all the stakeholders), and the establishment of a strategy for allocating water at the basin agency level. Certain training is, quite obviously, keyed to the needs of particular stakeholders, but the various stakeholders in water management have a very unclear idea of the position of other stakeholders whom they readily hold responsible for general problems. This shows the importance of understanding the motivation of the stakeholders and their logic vis-à-vis water resources and utilisations, in other words, the importance of two-way communications using a new approach. Information should flow freely among stakeholders and not merely from the top of the administrative pyramid to the bottom where orders are to be executed.

6. Technology

After tackling so many difficult issues in the first five work groups, quite logically there was no pat answer to the problem of adapting irrigation technologies, a problem which prompted opposing viewpoints. Gravity irrigation was condemned by participants who felt it consumed too much water, while others felt it was better adapted to the stakeholders' resources than pressure-flow irrigation, which was considered, at least in the large perimeters, beyond the country's financial and human resources. A distinction is still being made between the small and large perimeters with the assumption being that the former can more easily cope with technical changes and reorganisation of water allotment. Imported technologies are counterweighed against endogenous technologies. Could they be combined? Despite the desire to have the users appropriate technologies, little attention is given to what the users say about their needs, references and wishes. Further, when adapting technologies, drainage is often neglected.

7. Small-scale irrigation

At the initiative of the participants, a seventh workshop was held to discuss small-scale community-managed irrigation systems. The working group also discussed the main principles described above. The group considered the diversity of origin – traditional or State – and pointed out that local stakeholders lacked information and did not com-

municate with each other. Farmers should share their experiences at the national, regional and local levels and, if appropriate, through a dedicated network supported by technical assistance services of international organisations.



The Three Andalusian Field Visits

The field visits not only illustrated the general principles that were discussed in the working groups and in the Spanish introductory papers, they also enabled the participants to understand the roles of stakeholders in two working situations: traditional gravity-flow irrigation, and pressure-flow irrigation.

The Guadalmellato canal waters the Cordoba plain (6,500 hectares cultivated) and traverses the whole city. Before 1920, the region was irrigated by small canals descending from the mountain in a system that dates back to the Arab period. In the city, the fountains are fed from sources that are tapped and managed according to family water rights. The large number of wells are evidence of substantial water extraction from the groundwater tables. In 1920, a farmers' association took the initiative to build a dam on an affluent of the Guadalquivir and a 50-km long canal, thus being able to irrigate 10,000 hectares. In 1990 a second dam was built. This time the initiative came from the Guadalquivir hydraulic confederation, as part of its water flow regulation plan. The management of water flow into the canal is in the hands of an autonomous community which organises water allotment and charges a fixed sum of 200 euros per year per hectare. The community has to cope with increasing urban pressure which has caused the irrigated area to be reduced by one-third. The subsequent decrease in income makes it increasingly difficult for the remaining users to manage the system. Coordination between the basin confederation and the irrigators community seems to work well, while relations between the community and the city are conflictual. Illegal constructions are not controlled; quite the contrary – they are “regularised” and the city does not pay anything to the irrigators community.

As far as Guadalquivir River regulations go, the Fuente Palmera irrigated perimeter is a newcomer (1983). It is located on the high semi-arid agropastoral (cereals and olives) lands. The project covers 5200 ha that are irrigated from a large pumping station. It is managed autonomously by the irrigators community. The State contributed a 50% subsidy for the initial investment, but now the community functions on its own, without any direct supervision. The pressure-flow pipelines have the same characteristics as those in the old network since the system is structured into 82 separate hydraulic blocs (average of 60 ha, and up to 40 members). The irrigators of each bloc organise themselves and elect a president and spokesmen.

Their general assembly is sovereign. It elects a management committee composed of a chairman and 11 bureau members (**governors**) selected from among the 82 bloc chairmen, and a local jury to settle conflicts outside the jurisdiction of the management commission. The irrigation payment system is very transparent; there are four headings of which three are set sums and one is variable. The fixed per hectare charges amount to 180 euros: 60 euros for running the community, (mainly paying the 9 system operators), 60 euros for the community's participation in the basin authority and 60 euros for reimbursing the community's 25-year soft loan to pay for 50% of the initial investment. Variable charges include 40 euros per 1000 cubic meters of water consumed (*i.e.* 0.04 cents per cubic meter). Consumption used to be estimated and depended on the crops grown, but in 1998 the association installed individual meters. This decision, prompted by crop diversification, was taken collectively. In the beginning, cotton and maize were the main crops. Now the farmers have orange, peach and quince orchards, and even some olive trees watered by trickle irrigation. The success of the project seems to be connected to the strong social support it receives. Young farmers took over the project when the older farmers withdrew because of the scope of the organisational, financial and technological problems.

The Genil-Cabrera perimeter is a bigger (45,000 ha), more recent project. The system is fully automated. Water is pumped from the Guadalquivir River to feed the reservoir. A 20-km canal carries pressure-flow waters to the various farmers' associations. Their autonomy is much like that of Fuente Palmera.



General Recommendations

SHORT SUMMARY OF CTA SEMINAR ON AGRICULTURAL WATER MANAGEMENT

APPROVED BY THE PARTICIPANTS ON 25 SEPTEMBER 1999

1. Numerous stakeholders have been identified in the field of sustainable water management, particularly in irrigation. The multiplicity of (state) bodies dealing with water-related management issues causes problems and, because of this, there is a need to coordinate decision-making as well information collection and synthesis.

2. The present situation: past lessons and available conceptual considerations help us envisage “split-responsibility” between the State and the beneficiaries or final users of irrigation development.

3. The considerable change in the water development sector during the last two decades makes it necessary to revisit the role of the stakeholders. This transformation is a long process, not an event, and implies:

- the participation of the entire spectrum of stakeholders;
- the redefinition of roles, responsibilities and rights of all the stakeholders;
- the emergence and development of new services;
- the establishment of support programmes to launch change and facilitate their implementation;
- the monitoring and evaluation of social, economic and environmental impact.

4. Current developments in sustainable water management and the establishment of irrigation systems are impeded by:

- insufficient clarity about “who is responsible for what and under what conditions”;
- stakeholders’, mainly the farmers’ lack of preparation for their new roles;

- changes in the traditional roles and functions of statal and parastatal institutions;
- reluctance of “newly emerging economic players” to take on new roles and functions;
- resistance to change.

5. For overall water resources management and allocation, and questions of respect for the environment, the current situation is not very satisfactory since data are scattered amongst institutions, and are often contradictory, and too many institutions are involved in decision-making. There is an urgent need to find remedies to this “function-splitting”, be it via basin-oriented institutions or via other appropriate means of information exchange and joint decision-making.

6. The following cross-cutting topics should be considered:

- ownership of and guaranteed access to land and water;
- expression of demand;
- qualification and performance (professionalisation);
- internal regulations on the use of equipment, water, and the payment of fees;
- respect for the environment;
- involvement of women in decision-making.

7. The information and training package that is offered on a massive, indiscriminate manner to all people working in the irrigation sector does not meet the needs of the targeted professionalisation.

Training and information should be crafted to provide and strengthen the professional skills of the stakeholders with a view to improving the sectoral and global performance in the field of irrigation and water management.

To better satisfy demand requires a well-focused training and information dissemination policy stemming from transparent, democratic processes.



Conclusion

The seminar as a whole, with its conferences, workshops and visits, showed that irrigation paradigms were changing. A semantic shift takes us from the “irrigated perimeter” to the “irrigation system”. Building a networked system is not an end in and of itself, central State authority will not guarantee the success of development installations, the words “project beneficiary” are tending to fade out and an “authoritarian regime” is no longer acceptable. The irrigation system is a complex hydraulic gridwork whose history is more or less long. Its path is taking a new course as the State withdraws, and changes to the system require reorganisation. Through an interplay of adaptations and transformations in the rules of management, the irrigation system is recomposing itself in a changing Society. Forms of the system may be very varied, but isn’t system diversity essential to the development of viable irrigated agriculture?

The Cordoba experience was very enriching, and calls for follow up considering the actions which the participants will be introducing in their home countries, undoubtedly drawing inspiration not only from the EU guidelines but also from the felt needs for exchanges, comparisons and more profound reflection.